

Ruminant Nutrition: Dairy: Forages, Fiber, Grazing

M376 Effect of chestnut tannins supplement on milk production traits of dairy sheep on pasture. A. Nudda^{*1}, G. Battacone¹, A. Fenu¹, M. Decandia², M. Sitzia², M. Acciaro², and G. Pulina¹, ¹*Dipartimento di Scienze Zootecniche, University of Sassari, Sassari, Italy*, ²*Agricultural Research Agency of Sardinia - AGRIS Sardegna, Sassari, Italy*.

The use of tannins in grazing ruminants reduces OM digestibility in the rumen and increases protein escape. This is particularly desirable when animals graze on grass with a high content of soluble protein, because tannins can reduce the production of ammonia in the rumen and increase the protein available for intestinal digestion. The present study aimed to investigate the milk productive response of dairy ewes, grazing on pasture composed by 70% of *Medicago polymorpha* (27.5% dry matter, DM; 44.3% NDF, 29.5% ADF, 18.3% CP, on a DM basis) and 30% of *Lolium rigidum* (39.6% DM; 58.3% NDF, 31.2% ADF, 9.4% CP, on a DM basis), to the supplementation of concentrate (300 g/d; 87.1% DM; 29.4% NDF, 16.9% ADF, 17.6% CP, on a DM basis) containing 3 levels of commercial chestnut hydrolyzable tannin (0, 6 and 12%, on a DM basis; T0, T6 and T12, respectively). Thirty-six 2- to 4-yr-old Sarda ewes (12 per experimental group), in mid lactation (90–120 DIM), and grazing on pasture were used in this one-month trial. Daily milk production was recorded and daily milk samples were collected for analysis of fat, protein, lactose, SCC and urea. Data were analyzed by ANOVA including tannin level and sampling as fixed factors and their interaction. Tannin level did not influence milk yield and milk fat and protein concentration. Lactose was higher in T12 than in T0, being T6 intermediate. The urea content was not modified by the addition of tannin to the diet. The SCC was lowered by the inclusion of tannin in the diet. These results showed that the dose of tannins used did not modify the productive performance of dairy sheep on pasture. Research supported by the Ministero dell'Istruzione dell'Università e della Ricerca (Project PRIN 2008).

Key Words: dairy sheep, tannins, milk

M377 The estimation of rumen fungi growth on maize stubble treated with steam and sodium hydroxide by using of quantitative competitive polymerase chain reaction. M. Chaji^{*} and T. Mohammadabadi, *Department of Animal Science, Ramin (Khuzestan) Agricultural and Natural Resources University, Ahwaz (Molassani), Khuzestan, Iran*.

This experiment was conducted to evaluate the effect sodium hydroxide (NaOH) and steam on growth of rumen anaerobic fungi on maize stubble (MS) using quantitative competitive polymerase chain reaction (QC-PCR) assay. Rumen fungi were isolated from pre-incubated wheat straw in the rumen of fistulated sheep and then grown by Joblin (1981) method. These isolates were used (1:9) as a source of fungi inoculums in serum bottles containing fungi culture medium, 1 g maize stubble (as untreated or treated with 45 g/kg DM NaOH, steam at 130°C and 120 min, and or NaOH+steam; UMS, T1MS, T2MS and T3MS, respectively) and 1 mL antibiotic solution at 39°C (3 times sub culturing). Total genomic DNA was isolated from pure culture samples using guanidine thiocyanate-silica gel method. A universal PCR primer pair GAF (F): 5'-GAG GAA GTA AAA GTC GTT AAC AAG GTT TG-3' and GAF (R): 5'-GAA ATT CAC AAA GGG TAG GAT GAT TT-3' was used to amplify a specific region of 18S rDNA from rumen anaerobic fungi. Standard control DNA was constructed to use in the QC-PCR and was shown to amplify under the same reaction condition and the same amplification efficiency as the target DNA. The relative intensities of PCR products

that were used to compare fungal biomass, was quantified by Image J 1.29x and the data was analyzed using the GLM procedure of SAS for a completely randomized design. The result showed that growth of rumen anaerobic fungi in the medium containing MS treated with NaOH and steam (+0.24, +0.19, respectively) was greater than untreated MS (-0.61) and the highest fungi growth was for medium containing MS treated with NaOH+steam (+0.63) ($P < 0.05$). Therefore it appears that rumen anaerobic fungi growth and in vitro maize stubble degradation increased by NaOH and steam treatments.

Key Words: maize stubble, rumen fungi, steam

M378 The in vitro fermentation of sesame straw processed with alkali by rumen isolated bacteria. T. Mohammadabadi^{*} and M. Chaji, *Department of Animal Science, Ramin (Khuzestan) Agriculture and Natural Resources University, Ahwaz (Molassani), Khuzestan, Iran*.

The aim of this study was to determine rumen bacteria fibrolytic activity by using disappearance of DM and NDF in rumen isolated bacteria culture containing sesame straw (SS) as untreated and or treated with sodium hydroxide (NaOH). The experimental samples were including; untreated SS and SS treated with 30, 40 and 50 g/kg DM NaOH; USS, N1SS, N2SS and N3SS, respectively. Rumen fluid collected from 4 fistulated sheep, centrifuged (1000 rpm, 10 min), and supernatant was used to grow bacteria in medium containing fungicides (benomyle: 500 ppm/mL medium and metalaxyle: 10 mg/ml medium) under anaerobic conditions at 39°C for 24 h. These isolates were then used as a source of inoculum for culturing bacteria in a serum bottle containing 45 mL of culture medium and 1 g of experimental sample under anaerobic conditions (using 3 times subculture) for 12, 24, 48, 72 and 96 h. The residual substrates of each bottle were then filtered and used to determine disappearance of DM and NDF. Data of DM and NDF disappearance were analyzed as a completely randomized design using the general linear model procedure of SAS (1990). The result showed disappearance of DM after 96 h incubation by rumen isolated bacteria will be 67.3, 78.3, 86.3 and 92.1 g/100 g for untreated SS and treated with 30, 40 and 50 g/kg DM NaOH, respectively ($P < 0.05$). The highest increase of NDF disappearance after 96 h incubation was for SS treated with 50 g/kg DM NaOH (452.3 mg/g DM) that followed by SS treated with 40 and 30 g/kg DM NaOH (420.2 and 383.3 mg/g DM, respectively) ($P < 0.05$). Therefore, it appears that the growth and fibrolytic activity of rumen isolated bacteria on sesame straw is influenced by sodium hydroxide content.

Key Words: sesame straw, sodium hydroxide, rumen bacteria

M379 Synergism between cellulolytic and non-cellulolytic rumen bacteria on different fibrous substrates: Study in semi-defined cultures. J. Chiquette^{*} and K. Lauzon, *Agriculture Canada, Sherbrooke, Quebec, Canada*.

The objective was to investigate the occurrence of synergistic fibrolysis when cellulolytic bacteria are cocultured with non-cellulolytics in a semi-defined medium in vitro. Cellulolytic bacteria were *Fibrobacter succinogenes* GC5 and *Ruminococcus flavefaciens* NJ and the non-cellulolytics were *Prevotella bryantii* 25A and *Prevotella ruminicola* 19189. Timothy hay and alfalfa hay were used as substrates to measure NDF disappearance with time (3 and 7 d). Each bacterial population was quantified by real-time PCR when in monoculture or when cocultured on the different substrates. Cellulolytic bacteria were grown at 37°C

for 72 h in basal medium containing 1% (w/v) Avicel (NJ) or 0.3% cellulose filter paper (GC5). Non-cellulolytic bacteria were grown in basal medium containing 0.5% (w/v) cellobiose as a sole carbon source until the end of the log phase (12h). The OD-adjusted inocula were added in monocultures (0.2 mL) or in cocultures (0.2 mL each for cellulolytics and non-cellulolytics) to tubes containing 10 mL of basal medium with 100 mg of each substrate. After 7 d of incubation, a greater disappearance of timothy NDF was observed when *R. flavefaciens* was cocultured with *P. ruminicola* (18.2%) or *P. bryantii* (18.1%) compared with the monoculture of *R. flavefaciens* (16.4%) ($P \leq 0.05$). Similarly, when *F. succinogenes* was cocultured on timothy hay with *P. ruminicola*, NDF disappearance was greater (26.9%) compared with the monoculture of *F. succinogenes* (24.3%) ($P \leq 0.05$). *P. ruminicola* was in greater number when cocultured with NJ or GC5 on timothy hay ($P \leq 0.05$). *P. bryantii* tended to be in greater number ($P \leq 0.15$) when cocultured with *R. flavefaciens*. There was no synergistic fibrolysis between the 2 bacterial groups on alfalfa hay. These results demonstrated that synergistic fibrolysis was substrate dependent and was accompanied by increased populations of the non-cellulolytic bacteria.

Key Words: synergism, fibrolysis, rumen

M380 Effects of chemical treatments on in situ ruminal degradation of canola straw in Holstein cows. M. Ghiasvand, M. Dehghan-Banadaky*, and K. Rezayazdi, *Department of Animal Sci., Campus of Agriculture, University of Tehran, Karaj, Tehran, Iran.*

This study was conducted to evaluate the effects of different chemical treatments on canola straw including: T1 urea (3% of DM); T2 urea and molasses (urea 3% and molasses 2% of DM); T3 ammonium hydroxide (3% of DM); T4 sodium hydroxide (5% of DM); T5 sodium hydroxide and hydrogen peroxide (NaOH 5% and H₂O₂ 2% of DM); and T6 water (2.5 L/ Kg DM). All treatments received 2.5 L water/ kg DM of canola straw. Chopped straw treated in double plastic bags at room temperature for 21 d then samples of each treatment collected and used for in situ nylon bags procedure. Three nonlactating, ruminally cannulated Holstein cows were used for the in situ experiment. Samples incubated in rumen for 0, 3, 6, 12, 24, 48, 72 and 96 h. Bags residual analyzed for dry matter (DM) and neutral detergent fiber (NDF) to calculate ruminal disappearance of nutrients. Data were fitted to the nonlinear regression equation: $D(t) = a + b(1 - e^{-ct})$ where D is percentage disappearance of DM or NDF at time t, a the soluble fraction and b the less rapidly degradable fraction which disappears at the constant fractional rate c per time t. Fraction of a for DM and NDF in T4,5 were greater than other treatments. Ruminal degradation rate (c) of DM and NDF were significantly faster in treated compared with untreated straw, but T4 and 5 increased degradation rates and degradability compared to other treatments. Although T4 and T5 had similar actions, T4 is prefer because of less chemical material usage and cost.

Key Words: canola straw, chemical treatments, ruminal degradation

M381 Effect of rice bran extracts on fermentation, protein, dry matter and organic matter digestibility in rumen in vitro. D. Srichana*¹ and S. Kondo², ¹*Department of Agricultural Technology, Faculty of Science & Technology, Thammasat University, Pathumtani, Thailand,* ²*Faculty of Medicine, Thammasat University, Pathumtani, Thailand.*

Rice bran consists of γ -oryzanol which has ferulic acid, a phenolic compound as a component. Phenolic compounds have been known to change rumen fermentation. Hence this study was conducted to investigate the effect of rice bran extracts on rumen fermentation end products

and protein, dry matter and organic digestibility in batch culture. The experiment was performed at 39°C for 24 h. Culture flasks containing 3 g of dairy cow diet were added with 120 mL mixture of rumen fluid and buffer (1:3). The extraction of Sangyot rice bran (SYE) and Hom Mali rice bran (MLE) using 95% ethanol had been carried out. Seven treatments of the 2 extracts were prepared at concentrations of 0.05, 0.5, 5 mg/ml and the control (without the extract). They were subsequently arranged in CRD and added to the culture flasks in triplicate. The results showed that ammonia concentration was decreased ($P < 0.05$) by SYE 5 mg/ml (6.23 mM) and it was increased ($P < 0.05$) by MLE 5 mg/L (11.54 mM) when compared with the control (9.38 mM). The obtained results were parallel with the results of protein digestibility which was decreased ($P < 0.05$) by SYE 5 mg/mL (39.89%) and increased ($P < 0.05$) by MLE 5 mg/mL (49.11%) when compared with the control (48.04%). Dry matter and organic matter digestibility was decreased ($P < 0.05$) by SYE 5 mg/mL (51.95 and 50.23%, respectively) when compared with the control (61.11 and 60.33%, respectively). The rest and the control were not significantly different ($P > 0.05$). The highest OD was MLE 5 mg/mL (2.77) followed by the OD of SYE 5 mg/mL (2.56). Both were higher ($P < 0.05$) than the OD of the control (2.27). The lowest concentrations of acetic acid and propionic acid (49.99 and 24.12 mM, respectively) were detected when treated with SYE 5 mg/mL. Butyric acid concentrations of all the treatments were not significantly different ($P > 0.05$) ranging from 10.62 to 14.09 mM. In conclusion, SYE 5 mg/ml decreased the digestibility of protein, dry matter and organic matter whereas MLE 5 mg/L enhances the highest growth of rumen microbes. None of the extracts were able to increase propionic acid concentration in batch culture.

Key Words: rice bran extract, rumen, batch culture

M382 The effect of sewage irrigation on mineral composition and in vitro digestibility of forage sorghum. E. Yosef*¹, J. Miron¹, E. Zukermann², M. Nikbachat¹, and D. Ben-Ghedalia¹, ¹*ARO Israel, Bet-Dagan Israel,* ²*Extension Service-Ministry of Agriculture, Bet-Dagan, Israel.*

Sorghum is common summer forage cultivated in Israel, and due to lack of summer rainfalls it needs irrigation. Use of sewage water irrigation increased in Israel due to regional droughts and the necessity to eliminate the excess urban waste water. The purpose of this study was to evaluate the effect of secondary-treated sewage water irrigation on the composition and in vitro digestibility of forage sorghum strain FS5 grown for summer and sequential autumn harvests. The irrigation treatments were sewage (S) vs. flood (F) water at a level of 1890 m³/ha during summer growth and a level of 2400 m³/ha during sequential autumn growth. Each treatment consisted of 5 replicate plots and sampled by manual harvesting at the soft dough stage of maturity. The conductivity of S and F water was 1.41 and 0.81 ds/m, respectively. The plant morphology, crop yields and NDF content were not affected by type of water irrigation; however, yields and plant protein content were significantly lower in autumn cut than in summer cut for both treatments. The S treatment had no significant effect on DM digestibility in vitro of both harvests (62.9% vs. 61.5% for 1st cut and 60.7% vs. 59.1% for 2nd cut). The NDF content of autumn cut was higher and dry matter and NDF digestibility lower as compared with summer plants. However, in summer harvest, S treatment decreased significantly NDF digestibility as compared with F treatment (43.1% vs. 47.4%). Despite higher mineral concentrations in S water as compared with F water: Na (x 5.4), S (x 2.6), K (x 14), P (x 473), Al (x 5.6), B (x 2.4), Mn (x 24.3), Cu (x 31.9), the mineral content of sorghum plants from both treatments was similar. In autumn cut plants, B and Na contents were by 98% and 109% higher

than in summer cut. In summer plants the nitrate contents were 4 fold higher than in the autumn plants. In this study the minerals content of secondary-treated sewage water were below the critical level that might damage sorghum quality.

Key Words: sorghum forage, digestibility, minerals

M383 Kinetics of degradation assessment and prediction of the fraction of indigestible neutral detergent fiber by-products. J. G. L. Regadas Filho¹, E. S. Pereira^{*2}, P. G. Pimentel², T. S. OLiveira¹, M. R. G. F. Costa², and I. S. G. Maia², ¹Universidade Federal de Viçosa, MG, Brazil, ²Universidade Federal do Ceará, Fortaleza, Brazil.

The experiment was conducted to estimate the kinetics parameters of ruminal degradation of neutral detergent fiber (NDF) of by-products of cashew (*Anacardium occidentale*; pulp and cashew nut), passion fruit (*Passiflora edulis*), melon (*Cucumis melo*), pineapple (*Ananas comosus* L. Merr), west indian cherry (*Malpighia emarginata*), grape (*Vitis vinifera* L.), annatto (*Bixa orellana* L.) and coconut (*Cocos nucifera*) submitted to the gravimetric technique of nylon bag, and evaluate the prediction equation of indigestible fraction of neutral detergent fiber (iNDF) adopted by the Cornell Net Carbohydrate and Protein System (CNCPS). The feed samples were ground, placed in nylon bags with dimensions of 7 × 14 cm and porosity of 50 micron and incubated in duplicate in the rumen of a heifer, at 0, 3, 6, 9, 12, 16, 24, 36, 48, 72, 96 and 144 h. The incubation residues were evaluated for NDF content and interpreted by a non-linear logistic model. The evaluation process of predicting the indigestible fraction of NDF was carried out through adjustment models of linear regression between values predicted and observed values. There was wide variation in the degradation parameters of NDF from by-products. The rate of degradation of NDF ranged from 0.0267 h⁻¹ and 0.0318 h⁻¹ for grape and pulp cashew to 0.0884 h⁻¹ and 0.0971 h⁻¹ for passion fruit and west Indian cherry, respectively. The potentially digestible fraction of NDF (pdNDF) ranged from 4.17 and 14.13% for the melon and grape to 81.91 and 90.67% for cashew nut and coconut respectively. The equation used by CNCPS was able to predict the iNDF of the by-products, however, due to the high value of the mean square prediction error (291.40), such estimative shown inaccurate, being preferred the estimation by biological means.

Key Words: CNCPS, feeds, validation

M384 Plant bioactive screening of vegetation browsed/grazed by goats on Mexican semi-arid rangelands. H. M. Cuchillo^{*1}, D. C. Puga¹, O. A. Navarro², and F. R. Perez-Gil¹, ¹Departamento de Nutrición Animal, INCMNSZ, Mexico, Distrito Federal, México, ²Facultad de Química, UNAM, Mexico, Distrito Federal, México.

It is well recognized that plants consumed by ruminants, to cope their nutritional needs, contain a wide range of non-nutrient phytochemicals. Many plant bioactive metabolites are linked to antinutritive properties; however some of them are recognized as beneficial compounds which their significance remain unclear. Thus, we evaluated antioxidant activity (AA), total polyphenols (TP), flavonoids (FV) and hydroxycinnamic acids (HA) of plants browsed/grazed by goats during summer 2008. Direct observation of 2 core animals throughout grazing/browsing time during 3 d was done. Vegetation recollection was performed simulating the goats bites. The assessment included *Aristida adscensionis*, *Bouteloua curtipendula*, *B. repens*, *Chloris virgata*, *Leptochloa dubia*, *Lippia queretarensis*, *Pennisetum ciliare*, *Rhynchelytrum roseum*, *Urochloa fasciculata*, *Acacia farnesiana*, *A. schaffneri*, *Mimosa biuncifera*, *Prosopis laevigata*, *Celtis pallida*, *Jatropha dioica*, *Psilactis brevilingulata*, *Verbascina serrata*, *Zalazania augusta*, *Opuntia affasiacantha*,

O. amyctaea, *O. hytiacantha*, *O. imbricata*, *O. robusta*, *O. streptacanta*, and *O. tomentosa*. Consecutive methanolic extractions in triplicate were realized whether from whole plants, stems, leaves, cladodes, fruits, flowers or a mixture of them. A screening of AA was completed with TLC method against DPPH⁺ whereas TP was made with Folin-Ciocalteu reagent. FV and HA were determined by HPLC. Results showed that all the extracts displayed AA, though the pronounced effects have a positive relation with TP content. TP, HA and FV were found in higher means on fruits and flowers while the lowest were achieved by stems, cladodes and leaves. TP ranged from 0.077 for *O. hytiacantha* cladodes to 38.20 g of gallic acid/100g for *A. farnesiana* fruits. Besides, fruits of *P. laevigata* reported the top value of caffeic acid while *B. repens* achieved the greatest cinnamic acid mean. Epigallocatechin accounted the highest concentrations in *O. hytiacantha* prickly pears. Further investigations to clarify the possible implications of plant bioactives on animal husbandry and productivity are necessary.

Key Words: grazing, antioxidant activity, plant bioactives

M385 The effects of high pressure steam treatment on some chemical and physical characteristics of sugarcane pith. M. Chaji^{*1}, A. A. Naserian², R. Valizadeh², and T. Mohammadabadi¹, ¹Ramin Agricultural and Natural Resources University, Ahwaz, Khuzestan, Iran, ²Ferdowsi University of Mashhad, Mashhad, Khorasan Razavi, Iran.

The nutritional characteristics of the steam treated sugarcane pith were determined by physico-chemical properties. High-pressure steam-treated sugarcane pith was prepared at 19 bar for 3 min (70% moisture) in a Monel pressure vessel (Emamkhomeini Co., Khuzestan-Iran). Functional specific gravity (FSG) was measured by pycnometric method; a hydration solution prepared from rumen liquor was used. Water holding capacity (WHC) of feedstuffs was measured using filtration method; the samples were filtered through Whatman No. 1 filter paper. The wet sample was weighed after letting water decant for 10 min. WHC was the quantity of water retained by the sample and expressed as mg/ml sample dry matter. A 100 mL glass graduated cylinder was filled with sample and swirled for 15 s., bulk density (BD) was equal to the weight of sample (mg) over the volume occupied (ml). Steam treatment resulted in a significant decrease in NDF, 77 vs. 55%; hemicellulose to cellulose ratio, 0.54 vs. 0.10, and increase degradation of hemicellulose. Using the steam pressure improved the physical properties of sugarcane pith by increasing the BD, 0.20 vs. 0.31 mg/ml and FSG, 0.3 vs. 0.57 g/ml and decreasing WHC, 2.5 vs. 2.1 mL/g. Steam-pressure treatment may improve the nutritional value of sugarcane by-product for ruminants, and also the physical properties might explain some behaviors of the feedstuffs in rumen which are not recognizable by the chemical approach.

Key Words: functional specific gravity, water holding capacity, bulk density

M386 Effects of chemical treatment on the digestibility of corn stover in diets with modified distillers grains with solubles. J. L. Anderson^{*1}, J. R. Russell¹, D. D. Loy¹, N. A. Pyatt², M. J. Cecava², and P. H. Doane², ¹Iowa State University, Ames, ²Archer Daniels Midland, Decatur, IL.

Two sheep metabolism trials were conducted to investigate the effects of chemical treatment on the DM digestibility of corn stover in diets with modified distillers grains with solubles (MDGS). Chopped corn stover was either untreated (C) or treated with anhydrous ammonia at 3% (NH3) or calcium oxide at 5% (CaO; DM basis) at either a low (27%; LM) or high (36%; HM) moisture concentration and ensiled in 115-l barrels for 6 mo at ambient conditions. Post-ensiling, each stover was

ground through a 2.54-cm screen. In Exp 1, wether lambs (42 kg) were used in a 6 × 6 Latin-square design to evaluate stover silages at 30% (DM basis) in diets with 65% MDGS and 5% of a corn-based supplement. In Exp 2, wether lambs (43 kg) were used in a 7 × 7 Latin-square design to evaluate the effects of stover inclusion level in MDGS diets. The control consisted of 10% corn silage (CS), 40% MDGS, and 50% of a corn-based supplement (DM basis). Treatments consisted of the HM-C or HM-CaO stover silages fed at 10, 20, and 35% of diet DM with the balance of the diet as MDGS (40, 50, and 60%) and a corn-based supplement (50, 30, and 5%) of the DM. Both trials had a 10-d adjustment phase when all diets were limit-fed at 1.5x maintenance for the least digestible diet and a 5-d collection phase when amounts fed were adjusted fororts collected during the adjustment period. Apparent DM digestion (g/d and %; $P < 0.05$) for LM-C, HM-C, LM-NH3, HM-NH3, LM-CaO, and HM-CaO diets were 473, 67.5; 478, 66.1; 572, 70.1; 551, 71.5; 548, 72.3; and 595, 74.3, respectively. In Exp 2, apparent DM digestion (g/d and %; $P < 0.05$) were 760, 83.1; 686, 80.9; 629, 78.4; 593, 74.5; 682, 78.5; 461, 64.1; and 544, 69.1 for the CS, 10% HM-C, 10% HM-CaO, 20% HM-C, 20% HM-CaO, 35% HM-C, and 35% HM-CaO diets, respectively. Treatment with 5% CaO at a high moisture concentration is more effective than anhydrous 3% NH3 in the improvement of corn stover digestibility.

Key Words: corn stover, alkali treatment, digestibility

M387 Partial replacement of corn silage and alfalfa silage with Italian ryegrass silage in diets of high producing dairy cows. J. T. Woolever* and D. K. Combs, *University of Wisconsin-Madison*.

Two experiments were conducted to evaluate milk yield and milk composition when high quality Italian ryegrass silage was used as a source of digestible fiber and digestible energy in rations of high producing dairy cows. In experiment I, 6 pens of 8 animals were randomly assigned to a control diet ($n = 3$) or a treatment diet ($n = 3$) in a 6-week crossover design (3 weeks/treatment). In experiment II, 10 pens of 8 animals were assigned to the same control diet ($n = 5$) or the same treatment diet ($n = 5$) in a randomized complete block design. In both experiments, control diet consisted of alfalfa silage (25% of diet DM), corn silage (25% of diet DM), high moisture corn (30% of diet DM) and concentrate. Treatment diet included alfalfa silage (16% of diet DM), corn silage (17% of diet DM), ryegrass silage (18% of diet DM), high moisture corn (30% of diet DM) and concentrate. Diets were formulated to be iso-nitrogenous and iso-caloric, but the treatment diet contained less nonfiber carbohydrate (NFC) (46.5% vs. 48.5%) and more NDF (26.9% vs. 24.8%) as a % of DM. Milk yield and milk components were collected over the course of both experiments. In experiment I, cumulative milk yield was unaffected by diet (7,196 kg control vs. 7,003 kg treatment, $P > 0.40$). Pens of cows consuming the ryegrass diet had higher milk fat levels in experiment I (3.75% vs. 3.60%, $P < 0.05$). Cumulative 4% fat corrected milk yield was similar for control and treatment groups (7,321 kg vs. 7,301 kg). Other milk components did not statistically differ between periods or diets. Cumulative milk yield was similar between treatment groups during experiment II (118,842 kg vs. 118,724 kg, $P > 0.98$). Milk composition and 4% fat corrected milk yield did not differ due to treatment in experiment II. Rations including ryegrass silage can produce similar levels of milk and fat corrected milk compared with more traditional high NFC diets containing high levels of corn and alfalfa silages. Including grass in dairy rations appears to be a feasible method to reduce the NFC level of early lactation diets and increase levels of dietary fiber.

Key Words: Italian ryegrass, grass silage, NDF digestibility, NDFD

M388 Effect of a live yeast, *Saccharomyces cerevisiae* I-1077 on in situ ruminal degradation of alfalfa hay and fiber-associated microbes. F. Chaucheyras Durand^{1,2}, A. Ameilbonne^{1,2}, N. D. Walker*¹, P. Mosoni², and E. Forano², ¹*Lallemand Animal Nutrition, Blagnac, France*, ²*INRA, Saint-Genes Champanelle, France*.

In ruminants the digestion of plant material is performed by a complex symbiotic relationship of rumen microbiota. However, the chemical composition and the physical structure of the plant material limit the efficacy of degradation. Also, fibrolytic microbial activities may be depressed under certain dietary conditions, as with ruminal acidosis. Our aim was to investigate effects of a live yeast, *S. cerevisiae* I-1077, on in situ ruminal degradation of alfalfa hay under non-acidotic conditions. We also measured the population levels of bacteria and fungi associated to feed particles by qPCR. Three rumen cannulated cows were fed with grass silage and meadow hay. A first period of 4 weeks without yeast (-SC) was followed by a second 4 week-period (+SC) during which the cows received daily 10^{10} cfu of *S. cerevisiae* I-1077. Nylon bags containing 5g of chopped alfalfa hay were incubated in the rumen for 2, 6, 12 and 24 h. Bags were removed from the rumen, washed, dried and residual NDF determined. *F. succinogenes*, *B. fibrisolvans* and anaerobic fungi were quantified by PCR. The live yeast induced a significant increase in alfalfa DMd and NDFd (Table 1). The rate of degradation was particularly stimulated. The early colonisation of alfalfa particles by anaerobic fungi appeared to be improved; the populations of *B. fibrisolvans* were greatly promoted whatever the incubation time of the bags, whereas *F. succinogenes* populations, which were dominant, were not influenced by yeast supplementation. In conclusion, the daily distribution of *S. cerevisiae* I-1077 significantly improves alfalfa hay degradation in the rumen and affects feed particle associated microbial populations.

Table 1. Effects of *S. cerevisiae* I-1077 on alfalfa hay degradation and particle associated microorganisms

	2		6		12		24	
	-SC	+SC	-SC	+SC	-SC	+SC	-SC	+SC
DMD (%)	13.17	26.98*	17.45	32.6*	29.15	40.7*	41.53	50.84*
NDFD (g/kg NDF)	83.74	211.21*	107.25	237.14*	183.12	261.41*	336.11	363.48
Anaerobic fungi ¹	3.52	3.56	2.29	3.29	3.73	5.82	11.61	10.87
<i>B. fibrisolvans</i> ²	4.46	4.88*	5.61	6.66*	5.64	6.66*	6.33	7.45*
<i>F. succinogenes</i> ²	7.32	7.42	8.05	8.04	8.07	8.29	8.28	7.96*

* P -value < 0.05 .

¹ μ g/gDM.

²log10 of 16S rDNA copy numbers/g DM.

Key Words: yeast, fiber

M389 Evaluating the effect of an active dry yeast on fiber digestion in vitro and in situ. N. D. Walker* and M. E. Quintino Cintora, *Lallemand Animal Nutrition, Montreal, QC, Canada*.

The aim was to measure the effect of adding live yeast CNCM I-1077 (LSC) on fiber digestion kinetics by rumen microorganisms in vitro and in situ. For the in vitro studies, rumen contents were removed from 3 fistulated lactating dairy cows fed 50% forage:50% concentrate, DM basis, pooled and strained (SRF). SRF was mixed with anaerobic buffer (1:4) and added to 4 jars (2 control, 2 treatment) containing filter bags with a known weight of substrate and incubated in a Daisy fermentor. LSC was added at 1×10^6 cfu/mL incubation. Substrates tested were corn silage (CS), wheat silage (WS), alfalfa silage (AS), grass silage

(GS), alfalfa hay (AH), hay (H) and straw (S). Bags (3) were removed at 0,3,6,12 and 24h and analyzed for %NDFd. Incubations were repeated on 2 different days. In vitro data showed that yeast supplementation significantly increased %NDFd for CS ($P < 0.01$), WS ($P < 0.05$), AS ($P < 0.05$), GS ($P < 0.05$) and AH ($P < 0.05$). At 12h, %NDFd was significantly increased for S ($P < 0.05$), however no significant effect was observed on H. In a second part of the study, nylon bags containing the same samples of CS, WS, AS, AH and H, were placed in the rumen of the donor animals and incubated for 0, 3, 6, 12, 24, 48 and 96h and analyzed for %DM and %NDF losses. At the same time, rumen contents were removed from each animal and used to set up corresponding Daisy fermentors. Due to limitations with the number of fermentor jars, only CS, WS and AS were tested. Animals were then fed LSC (1×10^{10} cfu/day) for 14 d before the measurements were repeated. Applying Mertens and Loften NDF kinetics model to the in situ data demonstrated that LSC significantly ($P < 0.05$) reduced the lag time for all except AS. The extent of fermentable NDF was increased ($P < 0.05$) for all except WS. The fractional rate was increased for AH ($P < 0.05$), WS ($P < 0.01$) and AS ($P < 0.01$) with LSC supplementation, with the rate being doubled for WS and AS. No correlation existed between the in vitro and in situ results at 24 h, however if LSC had increased the rate in vitro it also increased it in situ. All the data shows that supplementation with LSC can have a positive effect on fiber digestion both in vitro and in situ.

Key Words: yeast, fiber

M390 Influence of Rumensin200 and tallow on the rumen parameters and fiber digestion of dairy cows. H. Castillo, M. Rivas*, D. Dominguez, L. Durán, M. Arana, G. Villalobos, and J. A. Ortega, *Universidad Autonoma de Chihuahua, Chihuahua, Chihuahua, Mexico.*

The modification of rumen physical-chemical parameters such as pH and oxidation-reduction potential (ORP) by addition of Rumensin200 and tallow to the TMR of dry and lactating cows was investigated. For this experiment, 4 ruminally fistulated Holstein cows were fed rations based on a 90:10 (dry) and 40:60 (lactating) forage to concentrate ratios. Four treatments were randomly assigned in a 4×4 Latin square experimental design as follows: TMR (T1), TMR + 2/3.3 g Rumensin 200(dry/lactating), (T2), TMR + 3.2% DM tallow (T3) and TMR + 2/3.3 g Rumensin 200+ 3.3% DM tallow (T4). The cows were fed ad libitum (0800 and 1500 h) in individual stalls and milked twice daily (0400 and 1300 h). Each of 4 experimental periods had 12 d of conditioning, followed by sampling on d 13 and 15. Samples of ruminal content were taken at 0, 1, 2, 4, 8, 12, 18 and 24 h after morning feeding for DM and NDF digestibility evaluation with standard protocols. Oxidation-reduction potential and pH were measured in rumen with a multiparameter electrode. Statistic analysis of data was done using PROC mixed in SAS. Ruminal pH fluctuated considerably during day and showed a quadratic trend for all treatments ($P < 0.05$), producing wide value ranges as follows: T1 = 6.22–7.02, T2 = 6.27–7.02, T3 = 6.22–6.93, and T4 = 6.03–6.95. However, there were not significant differences among treatments and between dry and lactating stages ($P > 0.05$). The oxidation-reduction potential changed significantly between physiological stages and over time ($P < 0.05$), while exhibiting little variation among treatments. Dry matter digestibility and NDF were not different among treatments ($P > 0.05$). This experiment suggested that the addition of Rumensin200 and tallow lowered the ORP to more negative values and showed a significant difference of this parameter between dry and lactating stages.

Key Words: Rumensin, ORP, pH

M391 Nutrient demand interacts with orchardgrass maturity to affect dry matter intake and yields of milk and milk fat. K. L. Kammes* and M. S. Allen, *Michigan State University, East Lansing.*

The effect of dry matter intake in the preliminary period (pDMI) on responses to diets containing orchardgrass silage harvested at 2 maturities were evaluated. Fifteen ruminally cannulated Holstein cows were used in a crossover design experiment with a 14-d preliminary period and 2 18-d treatment periods. During the preliminary period, pDMI of individual cows ranged from 22.9 to 33.4 kg/d and 3.5% fat-corrected milk yield ranged from 30.8 to 58.3 kg/d. Treatments were diets containing orchardgrass silage harvested from one field at either 44.9% (EARLY) or 54.4% NDF (LATE) as the sole forage. Both diets contained 22% forage NDF and 27% total NDF. Main effects of maturity and their interaction with pDMI were tested by ANOVA. There was no main effect of treatment for DMI, however, DMI response to grass maturity tended to depend on pDMI ($P = 0.11$). While cows with high pDMI consumed more EARLY compared with LATE, the reverse was observed for cows with low pDMI. Intakes of organic matter (OM), starch, NDF, and nitrogen were greater for LATE compared with EARLY ($P < 0.05$). LATE increased yields of milk, milk protein, lactose, and solids not fat compared with EARLY. Interactions were detected between grass maturity and pDMI for fat-corrected milk and milk fat yield and concentration with a greater benefit for EARLY compared with LATE as pDMI increased. Rumen pool of indigestible NDF (iNDF) was greater for LATE compared with EARLY (3.63 vs. 2.53 kg, $P < 0.001$), which resulted in greater rumen pools of DM, OM, and NDF. Greater rumen pool size of iNDF for LATE was because of greater iNDF fraction of the forage NDF and a longer ruminal turnover time ($P < 0.05$) compared with EARLY. Rates of passage and digestion of potentially digestible NDF were similar for both treatments ($P > 0.10$). Dry matter intake was likely increasingly limited by rumen fill for LATE compared with EARLY as nutrient demand increased. Greater starch intake for LATE compared with EARLY is consistent with greater yield of milk and decreased yield of milk fat.

Key Words: grass maturity, intake, milk production

M392 High total nonstructural carbohydrates timothy enhanced performance of mid-lactation dairy cows. A. F. Brito*¹, G. F. Tremblay³, A. Bertrand³, Y. Castonguay³, G. Bélanger³, R. Michaud³, and R. Berthiaume⁴, ¹University of New Hampshire, Durham, ²Université Laval, Québec, QC, Canada, ³Agriculture and Agri-Food Canada, Québec, QC, Canada, ⁴Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada.

We have previously reported that alfalfa cut at sundown [high total nonstructural carbohydrates (TNC)] and harvested as baleage increased milk yield and microbial protein synthesis in late-lactation cows fed only forage. The current study examines the effects of feeding a timothy-based high-TNC TMR on performance of mid-lactation cows. Diets contained (% of DM): 1) 40% PM-cut timothy baleage and 25% PM-cut timothy silage (High-TNC diet) or 2) 40% AM-cut timothy baleage and 25% AM-cut timothy silage (Low-TNC diet). Both TMR contained a common concentrate (35% on DM basis). The High- and Low-TNC TMR contained respectively (% of DM): 16.8 vs. 16.9 CP, 43.3 vs. 44.1 NDF, and 14.2 vs. 13.3 TNC. Six multiparous (MC) and 10 primiparous cows (PC) averaging 135 DIM were blocked by DIM, milk yield, and parity and randomly assigned to treatments in a crossover design. No significant diet (TNC) \times parity interaction was observed. DMI ($P = 0.02$) and yields of milk fat ($P = 0.01$), milk protein ($P = 0.04$), and milk lactose ($P = 0.05$) were all higher in cows fed the High- vs. the Low-TNC diet. Compared with the Low-TNC diet, the High-TNC diet

increased both milk yield ($P = 0.07$) and 4% FCM ($P = 0.03$). Overall, the high-TNC diet enhanced performance of mid-lactation cows fed 35% of dietary concentrate.

Table 1. Performance of cows fed High- vs. Low-TNC diets

Item	PC			MC			P	
	High-TNC	Low-TNC	SED	High-TNC	Low-TNC	SED	TNC	Parity
DMI, kg/d	18.0	17.2	0.33	20.7	20.0	0.42	0.02	0.02
Milk yield, kg/d	21.4	21.0	0.55	25.7	24.3	0.71	0.07	0.04
4% FCM, kg/d	20.9	20.5	0.41	25.3	23.9	0.53	0.03	0.04
Fat, %	3.85	3.87	0.05	3.88	3.88	0.07	0.74	0.91
Fat, kg/d	0.82	0.81	0.02	1.00	0.95	0.02	0.01	0.05
Protein, %	3.28	3.26	0.02	3.25	3.23	0.03	0.43	0.68
Protein, kg/d	0.70	0.68	0.02	0.83	0.79	0.02	0.04	0.04
Lactose, %	4.50	4.50	0.02	4.38	4.31	0.03	0.13	0.19
Lactose, kg/d	0.96	0.94	0.03	1.13	1.06	0.03	0.05	0.12

Key Words: timothy, dairy cows, TNC

M393 Modification of the Penn State Particle Separator with 3.18- or 4.76-mm perforated steel sieves to measure physically effective fiber. K. W. Cotanch*, J. D. Darrah, C. S. Ballard, and R. J. Grant, William H. Miner Agricultural Research Institute, Chazy, NY.

The Penn State Particle Separator (PSPS) 3-sieve system was modified in attempts to better predict physical effectiveness factor (pef) of total mixed rations (TMR), corn silage, and haycrop silage with as-is samples on-farm. The PSPS 1.18-mm wire mesh sieve was replaced with either 3.18-mm (40% open area) or 4.76-mm (32% open area) perforated steel sieve. These sieves are identical to those used in the Z-Box system. Samples were sieved according to standard PSPS protocol using 19-mm, 8-mm, and either the 3.18-mm or 4.76-mm sieve. Samples were sieved in 3 replicates by 2 technicians. Samples were: 25 TMR varying in dry matter, forage-to-concentrate ratio, and forage type (dry hay or silage), 12 corn silages, and 12 haycrop silages. Physical effective factor of as-is sample determined with modified PSPS was compared with pef determined with the standard method of dry vertical sieving with RoTap (proportion of DM ≥ 1.18 mm). Within forage type, mean bias of pef determined using RoTap and PSPS sieve was calculated. The PSPS sieve with the smallest mean bias (expressed as units of pef) and narrowest 95% confidence interval encompassing zero was deemed to most accurately assess pef. Use of 3.18-mm perforated steel sieve in the PSPS reliably predicts pef of as-is corn silage samples, while the 4.76-mm sieve accurately predicts pef of haycrop silage. The 3.18-mm sieve is slightly more accurate than the 4.76-mm sieve at predicting pef of TMR samples. Modification of the PSPS with perforated steel sieves accurately predicts pef of as-is samples.

Table 1. Mean bias and confidence interval of pef determined using RoTap and PSPS sieve

Forage type	n	Sieve	Mean	Upper	Lower
		(mm)	bias \pm SD	95% CI	95% CI
Corn silage	12	3.18	0.020 \pm 0.012	0.028	0.013
		4.76	-0.045 \pm 0.020	-0.032	-0.058
Haycrop silage	12	3.18	0.138 \pm 0.061	0.176	0.099
		4.76	-0.004 \pm 0.082	0.048	-0.056
TMR	25	3.18	0.042 \pm 0.076	0.073	0.011
		4.76	-0.047 \pm 0.065	-0.020	-0.074

Key Words: Penn State Particle Separator, physical effective factor

M394 Effect of the level of forage and monensin on trans-18:1 isomers and CLA in milk. R. Mohammed*, J. J. Kennelly¹, and J. K. G. Kramer², ¹University of Alberta, Edmonton, Alberta, Canada, ²Guelph Food Research Centre, Guelph, Ontario, Canada.

Milk fat cis9, trans(t)11-conjugated linoleic acid (CLA) is well known for its anti-cancer effects in animal models. This study reports the effect of the level of forage (F), monensin (M) and its interaction (F \times M) on t-18:1 isomers and CLA in milk. Forty Holstein cows in mid-lactation were assigned to 4 diets in a 2 \times 2 factorial arrangement of treatments. Treatments were 2 levels of forage (60% or high forage, HF and 40% or low forage, LF) and 2 levels of monensin per kg DM (0 ppm or M- and 16 ppm or M+). All diets were supplemented with sunflower seed (3.6% DM). Milk samples were collected at the end of 2nd and 4th week during treatment and again at the end of 2nd and 4th week after monensin-withdrawal. During treatment, milk t10-18:1 (% total FAME) was 0.70^b, 0.79^b, 0.71^b, and 1.2^a, for HFM+, HFM-, LFM+ and LFM- respectively (SEM = 0.09; P -values for F = 0.03, M = < 0.01 and F \times M = 0.04). Milk t11-18:1 content was 1.2, 1.3, 1.2 and 1.7 for HFM+, HFM-, LFM+ and LFM- respectively (SEM = 0.13; P -values for F = 0.07, M = 0.02 and F \times M = 0.08) and CLA content was 0.61, 0.77, 0.70 and 0.98 for HFM+, HFM-, LFM+ and LFM-, respectively (SEM = 0.06; P -values for F = 0.02, M < 0.01 and F \times M = 0.34) during treatment. After monensin withdrawal, the main effects and interaction for milk t10-18:1 was not different. Milk t11-18:1 content was 0.94, 1.1, 1.2 and 1.3 for HFM+, HFM-, LFM+ and LFM- respectively (SEM = 0.09; P -values for F = 0.02, M = 0.14 and F \times M = 0.85) and CLA content was 0.50, 0.64, 0.63 and 0.67 for HFM+, HFM-, LFM+ and LFM-, respectively (SEM = 0.04; P -values for F = 0.05, M = 0.02 and F \times M = 0.15) after monensin-withdrawal. Conclusions: This study demonstrates the role of low forage diet in enhancing milk CLA and t11-18:1. Monensin supplementation at 16 ppm did not favor greater t11-18:1 and CLA. However, its presence reduced the shift to t10-18:1, particularly for the LF diet. Monensin effects on milk fat t10- and t11-18:1 did not persist in the monensin-withdrawal period.

Key Words: forage level, monensin, CLA

M395 Comparison between the Penn State Particle Separator and the Z-Box to estimate the peNDF content of dairy cow rations. A. S. Atzori*, P. Carta, and A. Cannas, Dipartimento di Scienze Zootecniche, University of Sassari, Sassari, Sardinia, Italy.

Optimal particle size distribution in TMR requires field monitoring. Two field sieving devices to assess physical effective NDF content (peNDF) of dairy cattle rations, the Penn State Particle Separator (PSPS), made by 3 sieves, and the Z-Box (ZB), made by 1 sieve, were compared with a reference method. Samples from 2 different diets for lactating cows (34.1 \pm 1 and 39.1 \pm 1% of NDF on DM basis for rations 1 and 2, respectively) were collected from the beginning, middle and end of feeding alleys. The ration peNDF (25.3 \pm 1 and 28.1 \pm 1% of DM) was determined by dry sieving the diets with the laboratory reference method of Mertens (1997). Rations peNDF were hence obtained by sieving the as fed diets using the PSPS (1.5 L sample) and the ZB (0.25 L sample) following the indications of the producers. TMR distribution homogeneity was evaluated measuring the differences in peNDF in the 3 points of the feeding alley. Results were compared with a monofactorial ANOVA. The PSPS and ZB differed in peNDF estimations within diet ($P < 0.01$). The PSPS estimates of peNDF (27.4 \pm 1 and 33.6 \pm 1% of DM, for rations 1 and 2, respectively) were higher than the laboratory values, but the differences were significant ($P < 0.05$) only for ration 2, the most fibrous. The ZB estimates of peNDF (20.6 \pm 1 and 24.6 \pm 1% of DM for ration 1 and 2, respectively) were only numerically ($P >$

0.1) lower than the laboratory values. For both devices, increasing the quantity of sieved sample (1.0, 2.0, 3.0 L for PSPS; 0.15, 0.35, 0.45 L for ZB) resulted in increased peNDF concentration. Regarding TMR distribution homogeneity, both PSPS and ZB were able to detect the small differences in peNDF content (<8%) that occurred within feeding alley. The PSPS was also able to detect, due to the use of 3 sieves, large differences (>50%) in homogeneity within feeding alley for large particles (>8 and 19 mm). In conclusion, the 2 field sieving methods tested gave different values of peNDF compared with the reference method. Their accuracy was also affected by dietary NDF concentration.

Key Words: peNDF, PSPS, Z-Box

M396 Effects of methionine analogues on rumen fibrolytic activities and fibrolytic microorganisms. E. Devillard^{*1}, C. Martin², D. Morgavi², E. Forano², and P. Mosoni², ¹*Adisseo SAS, 03600 Commentry, France*, ²*INRA de Theix, 63122 St Genes Champanelle, France*.

Milk performance can be improved by balancing rations with methionine (Met) analogs, HMB and HMBi [2-hydroxy-4-(methylthio)-butanoic acid and its isopropyl ester, respectively]. It has been suggested that all the HMB and part of the HMBi act in the rumen through improving organic matter digestibility and fiber degradation, partially explaining improvements in milk performance. The aim of the present study was to investigate the effects of HMB and HMBi on rumen activities and rumen microbial populations, with a special emphasis on fibrolytic activities and fibrolytic microorganisms. Six rumen-cannulated Holstein cows fed a wheat/hay (50/50) diet were used in 3 × 3 Latin square design with 2 animals per block. Treatments were supplementation or not with HMB or HMBi (14 g equivalent Met per day). Each period of treatment consisted in 3-week adaptation followed by 8 weeks of experimentation. Under our experimental conditions, supplementation with HMB and HMBi had no effect on rumen carboxymethylcellulase and xylanase activities, in sacco degradability of maize grain and maize silage, ammonia and total volatile fatty acid concentrations. However, a decrease in acetate/propionate ratio was observed with both Met analogs ($P < 0.05$) due to a numerical increase in propionate concentration. The concentrations of total protozoa (counted by microscopy), total bacteria and 2 fibrolytic bacteria *Fibrobacter succinogenes* and *Ruminococcus albus* (quantified by qPCR), were not affected by the supplementations. Conversely, the concentration of the fibrolytic bacterium *Ruminococcus flavefaciens* increased by 1.7 fold in the presence of both Met analogs ($P = 0.03$). In addition, *R. flavefaciens* was also found to better colonize maize silage and maize grain with HMBi (2 fold, $P = 0.01$). In conclusion, both Met analogs stimulate *R. flavefaciens* population but only HMBi increases *R. flavefaciens* attachment to feeds. The modes of action of the 2 sources of Met on fibrolytic populations still require further investigation.

Key Words: rumen, methionine, fibrolytic microorganisms

M397 Effect of soybean hulls levels on ruminal parameters of dairy cows grazing elephant grass. J. C. Martinez^{*1,3}, T. V. Voltolini⁴, A. V. Pirez², and F. A. P. Santos², ¹*São Paulo State University, Jaboticabal, São Paulo, Brazil*, ²*São Paulo University, Piracicaba, São Paulo, Brazil*, ³*University of California, Davis*, ⁴*Embrapa Semi-árido, Petrolina, Pernambuco, Brazil*.

The trial evaluated soybean hulls (SH) inclusion on concentrate supplements offered to lactating cows grazing Elephant Grass during the rainy season. Trial was conducted at Animal Sciences Department, USP/ESALQ, Piracicaba/SP-Brazil. Twelve multiparous Holstein (509 kg LW, 90 DIM at trial beginning) were used on a replicated 4 × 4 Latin Square design. Data were analyzed by MANOVA and GLM procedures

of SAS (2002). Animals were kept on a 4.6ha pasture area divided in 25 0.2ha paddocks fertilized with 80 kg N ha/month. All concentrates had 19% crude protein (CP) and were soybean and ground corn based. SH substituted 20, 50 and 75% of corn on experimental treatments. The microbial N was analyzed by HPLC, and VFA by photometry. Treatments did not affect ruminal VFA (123.5 mM), ammonia (26.9 mg/dL) concentrations, ruminal pH (6.33), and microbial N flux (183.0 g N/day) (Table 1). Results indicate that SH can be utilized as a replacement for corn on lactating cows rations with no effects on rumen fermentation parameters.

Table 1. Ruminal parameters of dairy cows supplied with different levels of soybean hulls

	Treatments				Mean	Pr(t)
	Corn	25%SH	50%SH	75%SH		
C2, mM/mL	71.6	76.4	69	71.2	71.3	.87
C3, mM/mL	37.2	31.8	27.4	31.7	32	0.09
C4, mM/mL	16	15.8	13.4	13.8	14.8	0.32
Iso-C4, mM/mL	1.23	1.33	1.26	1.09	1.23	0.08
C5, mM/mL	1.7	1.62	1.47	1.57	1.59	0.24
Total VFA, mM/mL	130.6	126.7	115.1	121.6	123.5	0.42
NH3, mg/dL	28.5	25.2	27.1	26.7	27	0.12
pH	6.41	6.25	6.31	6.36	6.33	0.27
Microbial N, g of N/day	184	183	183	180	183	0.14

Within rows, means followed by different superscripts are significantly different ($P < 0.05$).

Key Words: volatile fatty acids, ruminal metabolism, tropical pastures

M398 Effects of crude protein levels in the supplementation of dairy cows grazing elephant grass on milk yield and composition. M. A. C. Danes^{*}, F. A. P. Santos, L. J. Chagas, J. R. R. Dorea, and A. M. Pedrosa, *University of Sao Paulo, Piracicaba, Brazil*.

The experiment was conducted to evaluate the effects of crude protein (CP) levels in grazing dairy cow rations on milk yield and composition. Thirty-one Holstein and crossbred (Holstein × Jersey) cows averaging 120 d in milk (DIM) were fed 3 levels of crude protein in the concentrate supplement for 72 d. Cows were blocked by breed, parity, DIM and milk yield into 11 incomplete groups of 3 cows and randomly assigned to dietary treatments. Concentrates contained fine ground corn, minerals, vitamins and 3 CP levels (8.7, 13.4 and 18.1% DM) were achieved by replacing corn with soybean meal. Grazing management was intensive, with high levels of nitrogen fertilizer and high stocking rate. Cows were allotted to a new paddock every day, after the afternoon milking, and received the concentrate individually twice a day before each milking, at a 1 kg concentrate/3 kg milk ratio. Milk yield was registered weekly, and milk, concentrates and pasture samples were taken weekly. The data were analyzed as an incomplete randomized blocks design. The average crude protein content of the Elephant grass was 18.5% DM. Increasing the CP level of the concentrate had no effect on milk yield, which was 19.5, 19.4 and 19.1 kg/d for 8.7, 13.4 and 18.1% CP concentrate respectively. There was no difference in protein, fat, and casein content of milk among treatments. Milk fat, protein and casein content average values were 3.5%, 3.3% and 2.6%, respectively. Milk urea nitrogen (MUN) increased linearly ($P < 0.01$) from 8.4 to 10.3 and 13.1 mg/dL as the CP level of the supplement increased from 8.7 to 13.4 and 18.1%. Under the conditions of this study, yields of milk and milk protein were not increased by feeding protein supplement for dairy cows grazing highly

fertilized tropical grasses. The linear increase in MUN resulted from an excessive nitrogen (RDP) supply in the diet.

Key Words: grazing dairy cows, protein supplementation, tropical pasture

M399 Effect of soybean hulls levels on performance of dairy cows grazing elephant grass. J. C. Martinez^{1,3}, T. V. Voltolini⁴, and F. A. P. Santos², ¹São Paulo State University, Jaboticabal, São Paulo, Brazil, ²São Paulo State University, Piracicaba, São Paulo, Brazil, ³University of California, Davis, ⁴Embrapa Semi-árido, Petrolina, Pernambuco, Brazil.

The trial evaluated soybean hulls (SH) inclusion on concentrate supplements offered to lactating cows grazing Elephant grass during the rainy season. Trial was conducted at Animal Sciences Department, USP/ESALQ, Piracicaba/SP-Brazil. Twelve multiparous Holstein (509kg LW, 90 DIM at trial beginning) were used on a replicated 4 × 4 Latin Square design. Data were analyzed by GLM procedures of SAS (2002). Animals were kept on a 4.6-ha pasture area divided in 25 0,2ha paddocks fertilized with 80 kg N ha/month. All concentrates had 19% crude protein (CP) and were soybean and ground corn based. SH substituted 20, 50 and 75% of corn on experimental treatments. Cows received concentrate according to milk production on a 1:3 basis, fixed at trial beginning, twice daily after each milking. No differences were observed among treatments ($P > 0.05$) for milk production. Treatments did not affect milk fat, protein, lactose, total solids and urea concentrations ($P > 0.05$) (Table 1). As complement, the live weight (LW) (516 kg), body condition score (BCS) (2.2), plasma urea (31.8 mg/dL) and nonesterified fatty acids (NEFA) (358.2 mEq/L) concentrations were not affected by treatments ($P > 0.05$). Results indicate that SH can be utilized as a replacement for corn on lactating cows rations with no effects on milk production and composition, LBW and blood composition.

Table 1. Milk yield and composition of dairy cows feed with different levels of soybean hulls

	Treatments				Mean	Pr>(t)
	Corn	25%SH	50%SH	75%SH		
Milk, kg/day	17.8	17.7	17.4	17.3	17.7	0.50
FCM, kg/day	16.5	16.8	16.6	16.3	16.5	0.92
Fat, %	3.06	3.21	3.22	3.2	3.14	0.80
Fat, kg/day	0.54	0.56	0.56	0.55	0.55	0.93
Protein, %	2.81	2.92	2.78	2.78	2.82	0.70
Protein, kg/day	0.50	0.52	0.48	0.48	0.50	0.54
Urea, mg/dL	15.71	15.94	14.95	14.54	15.78	0.23

Within rows, means followed by different superscripts are significantly different ($P < 0.05$).

Key Words: supplementation, tropical pastures, milk yield and composition

M400 Evaluation of starch digestibility and physico-chemical properties of Monsanto corn hybrids. D. Ngonyamo-Majee^{*1}, P. Feng², J. Hinen¹, G. Hartnell¹, B. Kutzner¹, M. Brandt¹, and M. Stephens¹, ¹Monsanto Company, St. Louis, MO, ²Monsanto Company, Ankeny, IA.

The negative correlation between corn vitreousness vs. starch availability and milk production potential has been widely reported in US and Europe. Two studies were conducted in 2006 and 2007 to deter-

mine the variability of Monsanto corn germplasm on kernel physico-chemical properties and their influence on ruminal starch degradability (RSTARCHD). Samples (30 hybrids in 2006 and 44 hybrids in 2007) for both studies were sourced from various Monsanto locations where the particular hybrid background is recommended. The decision to cover diverse germplasm background and different locations ensured we develop a more robust near infrared reflectance (NIR) calibration. The hybrids were all harvested at R6 stage (black layer). The samples were split into 2 sets. One set was used for whole kernel analyses; vitreousness (visual procedure), 1000-kernel weight, density (water displacement procedure) and NIT predictions of starch and protein. The other set was ground through a 6 mm Wiley grinder and processed for determination of in vitro ruminal starch degradability using the Daisy II procedure. Results from these studies showed wide genetic variability on RSTARCHD and physico-chemical traits. Negative correlations were observed between RSTARCHD and kernel protein ($r = -0.79$), density ($r = -0.30$), and vitreousness ($r = -0.42$). A positive correlation was observed with extractable starch ($r = 0.76$). The data generated NIR calibration with RSTARCHD ranging from 50.3 to 66.3% (mean 56.6 ± 3.33%). The calibration statistics were within acceptable range ($R^2 = 0.83$; standard error of calibration = 1.36 and standard error of cross validation = 1.67). We are continuing to expand the calibration with more diverse germplasm and locations.

Key Words: corn starch, rumen degradability, vitreousness

M401 Growth performance of Bluchi female lambs fed by diets containing different levels of date palm leaves. R. Valizade, A. Salahi^{*}, and M. Mahmodi, ¹Ferdowsi University, Mashhad, Iran.

The objective of present study was to evaluate the effect of diets containing date palm leaves (DPL) fed to Baluchi female lambs in a completely randomized design on growth performance. The study was carried out with 24 female Iranian Baluchi lambs of 4–5 mo of age and average body weight (BW) of 20.48 ± 4.9 kg, and lambs were allocated to 4 dietary treatments in a feedlot condition. All lambs were given a TMR composed of 39% forage (Alfalfa hay (15%), and wheat straw or DPL) and 61% concentrate (corn grain 45%, soybean meal 15%, limestone 0.4%, premix 0.4%, and salt 0.2%). The dietary treatment were 1) wheat straw (24%), 2) wheat straw (16%), DPL (8%), 3) wheat straw (8%), DPL (16%), 4) DPL (24%). The experiment was conducted for 76 d and data were analyzed using the PROC MIXED procedure (repeated measurement) of SAS (version 9.1; SAS Institute Inc., Cary, NC). Average daily feed intake by the lambs in different treatment were 857, 918, 986, and 1035 g/d, respectively. The difference between all means was significant ($P < 0.05$). Lambs fed by 1 dietary treatment were lower average daily body weight gain (g/day) than other groups. Average daily gains of lambs on dietary treatments of 1, 2, 3 and 4 were 106, 143, 156, and 165 g/d, respectively. The best feed conversion ratio was also recorded for the lambs on diet containing 24% DPL (6.16 kg feed consumed per kg of weight gain). The obtained data at Feed intake on metabolic weight (69.3, 69.1, 75.6 and 74.5 g/kg W^{0.75}) differed significantly. Ruminal pH (6.64, 6.55, 6.56 and 6.53); ruminal NH₃ (13.12, 12.4, 11.12 and 10.38 mg/100mL); blood urea nitrogen (19.27, 20.74, 20.36 and 20.09 mg/dl); blood glucose (71.62, 60.31, 67.2 and 62.6 mg/dl) were into the normal ranges. It was concluded that inclusion of DPL can be beneficial mainly for smallholder farmers during periods of low rainfall and forage scarcity.

Key Words: date palm leaves, Bluchi female lambs, growth performance

M402 Effect of date palm leaves substitution with wheat straw on health and rumen parameter of Saanen dairy goats. A. Salahi*, R. Valizade, A. Naserian, and A. Tahmasbi, *Ferdowsi University, Mashhad, Iran.*

This experiment was conducted to determine the effect of date palm leaves (DPL) feeding on the blood parameter of Saanen dairy goat. Nine lactating dairy goats were randomly assigned to treatment in a 3×3 Latin squares design. All goats were given a TMR composed of 40% forage and 60% concentrate (corn grain 26%, cotton seed meal 15%, sugar beet pulp 15.5, wheat bran 2%, limestone 0.5%, premix 0.5%, salt 0.5%). The dietary treatment were 1) alfalfa hay (20%), wheat straw (20%) 2) alfalfa hay (20%), DPL (20%) and 3) alfalfa hay (20%), treated (4% urea) and ensiled DPL (20% DM basis). The experiment lasted for 63 d (3 periods of 21 d which 15 d for diet adaptation and last 7 d for data collection). Goats were individually fed twice daily at 07:00 and 15:00. Data were analyzed using General Linear Models procedure of SAS 9.1 for ANOVA to evaluate difference among experimental groups, mean compared with Duncan test. Average dry matter intake by the goats in different treatment were 2055, 2055, and 1794 g/d, respectively. The difference between these means was significant ($P < 0.05$). Ruminant pH (6.43, 6.41, 6.24); ruminal NH₃ (23.8, 22.9, 19.00 mg/100 mL); blood urea nitrogen (20.2, 20.2, 18.9 mg/dL); blood glucose (39.1, 38.5, 40.1 mg/dL); blood Cholesterol (79.7, 79.7, 79.1 mg/dL) were into the normal ranges. Although no differences were detected between these figures, the obtained data on blood triglyceride (6.9, 12.2, 9.9 mg/dL) differed significantly. The studied parameters in this experiment support inclusion of DPL into the diets for dairy goats in a dry area with poor vegetation and rainfall.

Key Words: date palm leaves, Saanen dairy goat, blood parameter

M403 Milk production and composition of Saanen dairy goat fed by ration containing date palm leaves. A. Salahi*, R. Valizade, A. Naserian, and A. Tahmasbi, *Ferdowsi University, Mashhad, Iran.*

Date palm leaves (DPL) is one of the most abundant agricultural by-products in south of Iran were fed to 9 Saanen dairy goat in a 3×3 Latin square design. All goats were given a TMR composed of 40% forage and 60% concentrate (corn grain 26%, cotton seed meal 15%, sugar beet pulp 15.5, wheat bran 2%, limestone 0.5%, premix 0.5%, salt 0.5%). The dietary treatment were 1) alfalfa hay (20%), wheat straw (20%) 2) alfalfa hay (20%), DPL (20%) and 3) alfalfa hay (20%), treated (4% urea) and ensiled DPL (20% DM basis). The experiment lasted for 63 d (3 periods of 21 d which 15 d for diet adaptation and last 7 d for data collection). Data were analyzed using General Linear Models procedure of SAS 9.1 for ANOVA to evaluate difference among experimental groups, mean compared with Duncan test. Average dry matter intake by the goats in different treatment were 2055, 2055, and 1794 g/d, respectively. The difference between the means was significant ($P < 0.05$). Average milk production by the goats in different treatments were 1375, 1389 and 1381 g/d, respectively. The difference among these means as well as other milk constituents (fat, protein, and lactose) was not significant. Although no differences were detected between these figures, the obtained data on BUN (11, 11, 15.5 mg/dL) differed significantly. Total solid of the milk produced by goats in different treatments were 10.34, 10.63, and 10.8%, respectively. Total cell counts of the milk samples were 241, 314, and 537 cell per mL, respectively. The difference among these means also was not significant. It was concluded that DPL can be fed to such animals without any adverse effects.

Key Words: date palm leaves, Saanen dairy goat, milk parameter

M404 Effects of an alfalfa feeding strategy in the first week postpartum on feed intake and ketogenic status in transition cows. M. Larsen* and N. B. Kristensen, *Faculty of Agricultural Science, Aarhus University, Tjele, Denmark.*

Feeding additional forage fiber to fresh cows is believed to secure good rumen function. Thirteen multiparous Holstein cows were used in a randomized block design to study the effects of an alfalfa feeding strategy to postpartum transition dairy cows on dry matter intake (DMI) and ketogenic status. At calving, cows were randomly assigned to 1 of 2 ad libitum fed total mixed diets: a control lactation diet (CTRL) or an alfalfa haylage lactation diet (ALFA) for the first week postpartum. From wk 2 to 4 postpartum, all cows were fed CTRL. The CTRL was composed of (dry matter basis) 35% corn silage, 25% grass-clover silage, 20% rolled barley and 20% concentrate mix. The ALFA diet was composed of 50% CTRL diet and 50% alfalfa haylage. Forage NDF was 19.1% in CTRL and 30.1% in ALFA. Blood was sampled at 14 d prepartum and at 4, 15, and 29 d in milk (DIM). The statistical model included block, treatment, DIM and treatment \times DIM, where DIM within cow was considered as a repeated measure. In the first week postpartum, DMI was unaffected by treatment ($P = 0.41$) and averaged 10.5 and 11.5 ± 0.8 kg/d with ALFA and CTRL, respectively. A carry over effect of ALFA was observed during wk 2 to 4 postpartum, where DMI was lower ($P < 0.01$) for cows previously fed ALFA as compared with CTRL (14.4 and 16.4 ± 0.4 kg/d, respectively). The orts percent was higher ($P < 0.01$) with ALFA in the first week postpartum, but did not differ ($P = 0.40$) in wk 2 to 4 postpartum. Milk yield was unaffected by treatment ($P = 0.30$). Blood plasma glucose concentration decreased more ($P = 0.04$) from prepartum to 4 DIM with ALFA as compared with CTRL. Concomitantly, plasma concentrations of acetoacetate+acetone and β -OH-butyrate as well as their ratio tended to increase more ($P = 0.06$ to $P = 0.11$) from prepartum to 4 DIM with ALFA as compared with CTRL. In conclusion, the tested alfalfa haylage feeding strategy did not induce greater DMI in postpartum transition cows. The results showed that high forage feeding strategies for fresh cows increase the risk for hyperketonemia.

Key Words: transition, feed intake, forage fiber

M405 Milk production efficiency improves with addition of an exogenous fibrolytic enzyme to a total mixed ration. L. Holtshausen*¹, Y.-H. Chung¹, H. Gerardo-Cuervo², M. Oba², and K. A. Beauchemin¹, ¹*Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada,* ²*University of Alberta, Edmonton, Canada.*

Ruminant response to feed enzymes remains variable despite it being well researched in the last couple of decades. This study aimed to determine whether addition of Econase RDE (AB Enzymes, Germany) to a TMR improves productivity of early-lactation dairy cows. Sixty Holstein dairy cows (46 ± 10 DIM) were blocked by parity and randomly assigned to one of 3 treatments for a 10-wk period: 1) Control diet (CTL; no enzyme), 2) Low enzyme (LE; CTL with 0.5 mL Econase RDE/kg TMR DM) and 3) High enzyme (HE; CTL with 1.0 mL Econase RDE/kg TMR DM). Endoglucanase and xylanase activity for Econase RDE was 722 and 2604 nmol/mg enzyme product, respectively. The CTL diet had 21% alfalfa silage, 21% barley silage, 11% alfalfa hay and 47% concentrate (DM basis). Twenty-four hour in situ DM, NDF and ADF degradation of alfalfa and barley silage, with and without enzyme, were determined using 6 cannulated cows. Cows on the CTL diet had a higher DMI ($P < 0.01$) than cows on the HE diet and tended ($P = 0.09$) to have a higher DMI than cows on the LE diet. Fat corrected milk yield and milk composition did not differ. Cows on the HE diet had a greater FCM production efficiency than CTL cows ($P < 0.01$), with that of LE

cows being intermediate and not different from CTL cows ($P = 0.31$). Enzyme addition did not improve in situ DM or NDF degradation of alfalfa or barley silage, but there was a tendency ($P = 0.10$) for greater ADF degradation of alfalfa silage. Greater FCM production efficiency with dietary addition of exogenous fibrolytic enzymes might in part be a result of greater ADF degradation of some feedstuffs, particularly alfalfa.

Table 1. Performance of early-lactation dairy cows and in situ degradation of feedstuffs with the addition of an exogenous fibrolytic enzyme

Item	CTL	LE	HE	SE	P (trt)
DMI, kg/d	24.5	22.9	22.2	0.58	0.02
3.5% FCM yield, kg/d	36.5	36.1	36.3	0.66	0.90
Milk fat, %	3.29	3.19	3.26	0.057	0.44
Milk protein, %	2.95	3.01	3.03	0.027	0.14
FCM Efficiency, kg FCM/kg DMI	1.50	1.58	1.67	0.041	0.02

24h Degradation	Barley		Alfalfa		CTL	Enz
	CTL	Enz	CTL	Enz		
DM	46.1	47.7	68.8	70.0	1.14	0.20
NDF	19.4	20.9	26.7	28.7	1.77	0.34
ADF	31.9	32.2	36.6 ^a	40.7 ^b	1.63	0.21

^{a,b} $P = 0.10$.

Key Words: feed enzymes, production efficiency, dairy cow

M406 Effect of different sources of pectin feedstuffs on chewing activities in early lactating Holstein cows. M. Kordi*, A. Naserian, R. Valizade, and A. Tahmasbi, *Ferdowsi University, Mashhad, Iran*,

Eight primiparous early lactating Holstein cows (60 ± 23 d postpartum, weighing 530 ± 60 kg) were assigned into a duplicated 4×4 Latin square design for evaluation of different pectin feedstuffs on intake and chewing activities of lactating dairy cows with 4 3-wk periods. Cows were allocated into 4 diets with 1)10% barley grain, 2)10% sugar beet pulp, 3)10% wheat bran and 4) 10% dried citrus pulp. Each experimental period was 21 d including 14 d adaptation period and 7 d collecting samples. Chewing behavior observations were visually recorded every 5 min for 24 h. The time spent for each animal observation was not more than 5 s. Eating, ruminating, and total chewing times were determined and expressed as minutes per day. Time (expressed in minutes) expended in each activity was calculated by the number of observations recorded multiplied by 5. Total chewing time was considered as the sum of eating and ruminating times. Eating, ruminating, and total chewing times were also expressed as minutes per kg of DM and NDF intakes. Chewing activities data are shown in Table 1). There were no differences ($P > 0.05$) in the daily intake of DM (kg/d). Eating behavior as minutes per Kg of DMI were not affected by treatments ($P > 0.05$) but there were significant differences in eating behavior as minutes per kg of NDFI ($P < 0.05$). Similarly there were significant differences on ruminating and total chewing activities between treatment diets ($P < 0.05$). These data suggest that, the addition of sources of pectin feedstuffs at 10% levels (dry matter basis) of the dairy cow ration instead of cereal grain; will decrease the cost of milk production without any negative effect on chewing activities.

Table 1. Effects of treatments on chewing activities of lactating dairy cows.

Item	Treatment				SEM
	T1	T2	T3	T4	
DMI (kg/day)	19.34	19.63	19.74	18.7	0.34
Eating					
min/d	380.63	390.63	373.13	378.13	11.205
min/kg DMI	19.75	19.89	18.92	20.58	0.73
min/kg NDFI	63.1 ^{ab}	59.04 ^{ab}	56.31 ^b	64.34 ^a	2.30
Ruminating					
min/d	510.63 ^a	460 ^b	452.5 ^{ab}	490 ^b	16.12
min/kg DMI	26.36 ^a	23.46 ^b	22.97 ^b	26.28 ^a	0.803
min/kg NDFI	84.23 ^a	69.61 ^b	68.36 ^b	83.44 ^a	2.45
Chewing					
min/d	891.25 ^a	850.63 ^{ab}	824.38 ^b	857.5 ^{ab}	15.1
min/kg DMI	46.11 ^a	43.35 ^{ab}	41.82 ^b	46.32 ^a	1.05
min/kg NDFI	147.32 ^a	128.65 ^b	124.48 ^b	147.04 ^a	3.26

Key Words: chewing activities, lactating Holstein cow, pectin feedstuffs

M407 Effect of different sources of pectin feedstuffs on blood metabolites in early lactating Holstein cows. M. Kordi*, A. Naserian, R. Valizade, and A. Tahmasbi, *Ferdowsi University, Mashhad, Iran*.

This experiment was conducted to determine the effect of different sources of pectin feedstuffs on blood metabolites in early lactating Holstein cows. Eight primiparous early lactating Holstein cows (60 ± 23 d postpartum, weighing 530 ± 60 kg) were assigned into a duplicated 4×4 Latin square design with 4 3-wk periods. Cows were allocated into 4 diets with 1)10% barley grain, 2)10% sugar beet pulp, 3)10% wheat bran and 4) 10% dried citrus pulp. Each experimental period was 21 d including 14 d adaptation period and 7 d collecting samples. Blood samples were collected from the jugular vein 2h after the morning feeding. Blood serum was collected after centrifuged at $1,500 \times g$ for 20 min, frozen at -40°C , and later analyzed for glucose, urea N, cholesterol, triglyceride, alkaline phosphate and albumin. Blood metabolites data and DMI are shown in Table 1. There were no differences ($P > 0.05$) on daily intake of DM (kg/d) (Table 1). Similarly, no treatments effects were observed blood metabolites (Table 1). These data suggest that, the addition of sources of pectin feedstuffs at 10% levels (dry matter basis) of the dairy cow ration instead of cereal grain; will decrease the cost of milk production without any negative effect on DMI and blood metabolites.

Table 1. Blood metabolites of dairy cows

Item	Treatment				SEM
	T1	T2	T3	T4	
DMI (kg/day)	19.34	19.63	19.74	18.69	0.348
Glucose (mg/dL)	55.8	53.8	54.1	53.5	22.902
Blood urea nitrogen (mg/dL)	24.37	25.62	25.87	26.25	0.786
Cholesterol (mg/dL)	186.25	186.88	193.88	185.63	8.142
Triglyceride (mg/dL)	9.25	10.625	10.625	12.87	2.69
Alkaline phosphate (U/L)	68.25	75.5	69.25	71.87	4.212
Albumin (g/dL)	4.23	4.25	4.28	4.22	0.047

Key Words: barley, lactating Holstein cow, pectin feedstuff

M408 Effects of forage family (alfalfa vs. orchardgrass) on apparent ruminal synthesis of niacin and vitamin B6 in lactating dairy cows. M. Seck^{*1,3}, J. A. Voelker Linton², M. S. Allen², P. Y. Chouinard³, and C. L. Girard¹, ¹Agriculture and Agri-Food Canada, Sherbrooke, Quebec, Canada, ²Department of Animal Science, Michigan State University, East Lansing, ³Departement de sciences animales, Université Laval, Quebec, Quebec, Canada.

Effects of forage family on apparent ruminal synthesis and post-ruminal supply of niacin (B3) and vitamin B6 were evaluated using 8 ruminally and duodenally cannulated lactating Holstein cows. The experiment was a crossover design with 2 15-d treatment periods and a preliminary period in which dry matter intake (pDMI) of a diet intermediate in composition between the treatment diets was measured. Treatment diets were formulated to contain 23% forage NDF and contained as sole forage, alfalfa (AL, 43% NDF) or orchardgrass (OG, 48% NDF) silages. Intakes of B3 and B6 were greater ($P \leq 0.01$) for AL than OG (B3: 2337 vs. 847 ± 87 mg/d; B6: 75 vs. 55 ± 4 mg/d) but AL decreased ($P \leq 0.03$) duodenal flows of B3 and B6 compared with OG (B3: 1702 vs. 2508 ± 175 mg/d; B6: 46 vs. 82 ± 11 mg/d for B6). Ruminal synthesis of B3 and B6 was greater ($P \leq 0.01$) for OG compared with AL (B3: 1661 vs. -635 ± 139; B6: 27 vs. -28 ± 9 mg/d). Intakes of B3 and B6 increased with pDMI for AL but not for OG (pDMI × T, $P \leq 0.01$) but duodenal flow of B3 tended to increase with pDMI to a greater extent for OG than for AL (pDMI × T, $P = 0.09$). With increasing pDMI, B3 degradation in the rumen increased for AL but synthesis increased for OG (pDMI × T, $P \leq 0.01$). No interactions between pDMI and treatments were observed for B6 duodenal flow or ruminal synthesis ($P > 0.6$). B3 intake was correlated negatively with ruminal synthesis ($r = -0.9$, $P < 0.01$) and flow ($r = -0.52$, $P = 0.04$) while B6 intake and synthesis were correlated negatively ($r = -0.48$, $P = 0.06$). Mean ruminal pH was correlated negatively with ruminal synthesis ($r = -0.76$, $P \leq 0.01$) and flow ($r = -0.68$, $P \leq 0.01$) of B3 (not B6). Microbial nitrogen flow (g/d) was correlated positively with ruminal synthesis ($r = 0.48$, $P = 0.06$) and flow ($r = 0.6$, $P \leq 0.01$) of B6 (not B3). Forages from different families (alfalfa vs. orchardgrass) altered ruminal fermentation which affected ruminal synthesis and supply of vitamins B3 and B6 to dairy cows.

Key Words: dairy cow, niacin, pyridoxine

M409 Effect of the volatile fraction from silage and forage:concentrate ratio on ruminal degradation of fresh chopped or ensiled sugarcane. J. L. P. Daniel^{*1}, L. G. Nussio¹, R. C. Amaral¹, S. G. Toledo Filho¹, J. R. Lima¹, E. Cabezas¹, and O. C. M. Queiroz², ¹University of São Paulo, "Luiz de Queiroz" College of Agriculture, Piracicaba, SP, Brazil, ²University of Florida, Gainesville.

The objective of this study was to determine whether volatile fermentation end products from silage and forage:concentrate ratio affect the in situ ruminal degradation of fresh chopped or ensiled sugarcane. We hypothesized that ethanol present in the volatile fraction from silage could increase ruminal degradation, and high-concentrate diet could decrease it. Sugarcane was mechanically harvested at 21.5 degrees brix and ensiled in 200 L plastic buckets (experimental silos) without adding any additive. Samples obtained before and after 90 d of storage, were dried at 60°C in a forced air oven, ground at 5 mm, and used to prepare Dacron bags, in triplicate, keeping the ratio 10–20 mg of sample per cm² of the bag. Six Nelore beef steers were randomly assigned in a replicated 3 × 3 Latin square design with 14-d periods. Steers were fed ad libitum once daily at 0800 h. Dietary treatments were balanced to be isonitrogen content: 75D – 75% sugarcane silage without volatile fraction (dried at 60°C and re-hydrated) and 25% concentrate, 75W – 75% wet sugarcane silage and 25% concentrate, and 40W – 40% wet

sugarcane silage and 60% concentrate (DM basis). On d 11 of each period, at feeding time, all bags were positioned into the ventral sac of the rumen during 24 h. Rumen pH was measured each 2 h during 24 h on d 13. Dry matter degradation (DEG24) was determined as the difference between sample and residue weights. Fresh and ensiled sugarcane were compared. DEG24 of fresh sugarcane (55%) was higher ($P < 0.01$) than that of ensiled sugarcane (39%). It was not detected effect ($P = 0.13$) on DEG24 across dietary treatments (averages: 75D = 48%, 75W = 47%, 40W = 45% of DM). Rumen pH was lower ($P < 0.01$) for the high-concentrate diet (75D: 6.65, 75W: 6.71, 40W: 6.33), however, all diets kept favorable rumen environment for digestion. The volatile fraction present in sugarcane silage did not improve the ruminal degradation of DM.

Key Words: volatile organic compounds, ethanol, rumen pH

M410 Performance of lactating crossbred cows on tropical pasture fed by supplements with soybean meal and Optigen or urea. D. C. Abreu^{*1}, R. P. Lana¹, A. S. Oliveira¹, F. A. Barbosa², F. L. Andrade¹, P. T. Silva¹, and F. A. C. Neto³, ¹Universidade Federal de Viçosa, Viçosa, MG, Brasil, ²Universidade de Brasília, Brasília, DF, Brasil, ³Colorado State University, Fort Collins.

Sources of nonprotein nitrogen (NPN) are attractive because of their low cost relative to vegetable proteins. Urea is the most commonly used NPN source but is rapidly hydrolysed to ammonia within the rumen and may therefore be used inefficiently by the rumen microbes. This study investigated the performance and nutrient utilization response of crossbred lactating dairy cows to the substitution of soybeans by 2 sources of non-protein nitrogen. Twenty one crossbred Holstein-Zebu cows (second or third parity; BW = 499 ± 60,63 kg; DIM = 167 d) grazing *Brachiaria decumbes* pastures were distributed in a 3 × 7 incomplete Latin squares design. Three periods, with 21 d each (samples collected on last 7 d of with period). Within herd, cows were fed by pasture source (ad libitum) and concentrated supplement isonitrogenous with 24% of crude protein, on DM basis (Table 1). The control diet contained a conventional N source (soybean meal; SBM) and others NPN as urea and Optigen. Daily milk production was condensed to weekly averages. Data was analyzed by repeated measures using PROC-MIXED of SAS. There was no effect ($P > 0.05$) of difference source of protein (SBM vs. NPN); interaction of source of NPN and level of NPN; source of NPN (urea vs. Optigen) and level of NPN. For crossbred Holstein-Zebu cows on tropical pasture, the urea or Optigen can be supplemented and add until 6% of DM of concentrated, without difference in the performance of lactating crossbred cows.

Table 1. Composition of ingredients of supplement (% DM basis)

Ingredients, %	Source of NPN						
	control diet	Urea, %			Optigen, %		
		2	4	6	2	4	6
Corn grain	58.50	69.00	79.50	90.00	69.00	79.50	90.00
Soybean meal (SBM)	37.50	25.00	12.50		25.00	12.50	
Urea		2.00	4.00	6.00			
Optigen					2.00	4.00	6.00
Mineral/supplement mix	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Key Words: nonprotein nitrogen, Optigen, crossbred dairy cows

M411 Modeling degradation characteristics and nutrient availability of anthocyanidin accumulating Lc-Alfalfa and alfalfa selected for a low initial rate of degradation in dairy cows. A. Jonker^{*1,2}, M. Gruber², Y. Wang³, and P. Yu¹, ¹Department of Animal and Poultry Science, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, SK, Canada, ²Saskatoon Research Centre, Agriculture and Agri-Food Canada, Saskatoon, SK, Canada, ³Lethbridge Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada.

Protein efficiency of dairy cattle eating alfalfa might be improved by introducing a gene that stimulates the accumulation of anthocyanidin in alfalfa forage. The objective of this study was to determine nutrient availability in the rumen and small intestine of newly developed anthocyanidin accumulating Lc-alfalfa populations by a modeling approach. Three winter hardy alfalfa varieties Rangelander, Rambler and Beaver were crossed with 3 transgenic T0 Lc-alfalfa populations 88–19, 88–09 and 88–01, respectively. The 3 phenotypic purple Lc-progeny used in this study were compared with AC Grazeland (selected for a low initial rate of degradation; LIRD). Alfalfa samples were collected at a vegetative pre-bud stage during the growing season of 2008 (AAFC, Saskatoon, SK, Canada). Data from wet chemical analysis and an *in situ* trial was used as input for the Dutch 2007 DVE/OEB protein system and VEM energy system to determine nutrient availability from tested alfalfa populations for dairy cows. The results were analyzed in a CRD using the contrast statement in Proc Mixed of SAS. The Lc-alfalfa populations had an average anthocyanidin concentration of 163.4 µg/g DM. The Lc-alfalfa had a lower ($P < 0.05$) undegradable NDF fraction and tendency for a higher ($P < 0.10$) rumen degradable CP and rumen degradable CHO and rumen degraded protein balance compared with LIRD-alfalfa. Total intestinal digestible protein (70.0 vs. 61.9 g/kg DM) tended to be higher ($P < 0.10$) and net energy for lactation was higher ($P < 0.05$; 1.50 vs. 1.42 Mcal/kg) in Lc-alfalfa compared with LIRD-alfalfa. In conclusion, Lc-alfalfa accumulated anthocyanidin and had a higher nutrient availability for the animal for milk production than LIRD-alfalfa.

Key Words: anthocyanidin-accumulating alfalfa, protein and energy models, dairy cattle

M412 Influence of reconstituted and silage sorghum grain on site and extent digestion in finishing cattle. U. A. González^{1,3}, M. González¹, A. Plascencia², and L. Corona^{*3}, ¹Universidad Autónoma del Estado de México, Toluca, Estado de México, México, ²Universidad Autónoma de Baja California, Mexicali, BC, México, ³Universidad Nacional Autónoma de México, Cd. Universitaria, DF, México.

Five calves (average BW: 190 ± 30 kg) with cannulas in the rumen and proximal duodenum were used in a 5 × 5 Latin square design to evaluate the influence of reconstituted and ensiling sorghum grain on nutrient digestion with the following treatments: 1) DCC (dry cracked corn); 2) RCS (reconstituted cracked sorghum); 3) DWS (dried whole sorghum); 4) RWS (reconstituted whole sorghum); and 5) DCS (dry cracked sorghum). The diets contained 73% of grain (% DM). Ruminal digestion of OM was greater ($P < 0.01$) for DWS and RWS (60 ± 1%) compared with others treatments. The higher ($P < 0.005$) ruminal starch digestion was for DWS and RWS (64 and 65% respectively), while N digestion was greater ($P < 0.0004$) for RWS (48%) compared with RCS (40%). Post-ruminal digestion of OM was higher ($P < 0.0001$) for RCS (71%) and starch digestion was greater ($P < 0.05$) for RCS (82%) compared with the other treatments. Total tract digestion of OM was greater ($P < 0.05$) for RCS and RWS (87 and 83%) compared with DCC, RWS and RCS (78 ± 1%); total starch digestion was greater ($P < 0.05$) for RCS (93%) respect to DCC, RWS and DCS (87 ± 1%), and lower for DWS (83%). The ruminal pH was higher ($P < 0.0453$) for

DWS compared with RCE and RWS. DCC had the lowest ($P < 0.0084$) ruminal proportion of acetic acid respect to RCS and DCS. Propionic acid production was higher ($P < 0.0235$) for DCC on RCS and DCS. Butyric acid production showed the lowest proportion ($P < 0.021$) for DWS respect RCS and RWS. The ratio acetate: propionate was lower ($P < 0.0085$) for DCC respect the rest of the treatments. The energy values calculated by replacement for RCS, DWS, RWS and DCS corresponded to 4.58, 3.77, 4.14 and 3.71 ED Mcal/kg, respectively. We concluded that the method of processing before restore cracked (RCS) and reconstituted sorghum (RWS) improve their nutritional value due to increase post-ruminal digestion of starch and N.

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Key Words: cattle, digestion, reconstituted sorghum

M413 Effect of germinated and ensiling sorghum grain on digestion and ruminal fermentation by feedlot cattle. F. Rodríguez¹, S. E. Buntinx¹, M. E. Ortega², and L. Corona^{*1}, ¹Universidad Nacional Autónoma de México, Cd. Universitaria, DF, México, ²Colegio de Posgraduados, Montecillo, Edo. de México, México.

Five steers (average BW: 400 kg) with cannulas in the rumen and proximal duodenum were used in a 5 × 5 Latin square design to evaluate the influence of sorghum grain germinated and ensiling on nutrient digestion and ruminal fermentation. Treatments consisted of a basal finished diet containing 73% sorghum grain (% DM basis) as: 1) DCS (dry cracked sorghum-0h reconstituted); 2) RWS (reconstituted whole sorghum-24h); 3) GS2 (germinated sorghum 2d-48h); 4) GS4 (germinated sorghum 4d-96h); and 5) GS6 (germinated sorghum 6d-144h). The grain germinated and ensiling was reconstituted to 30% moisture, germinated for 2, 4, 6 d and ensiling for 21d. Post-ruminal digestion of OM was lower (5% , $P < 0.01$) for GS2 than for GS6 and for starch was higher (29.5% , $P < 0.10$) for germinated treatments respect to DCS. Germinated tended to increase (linear effect, $P < 0.10$) post-ruminal starch digestion. Total tract digestion was higher for SG6 respect to SG2 for OM (7.22% , $P < 0.05$), starch (3.76 , $P < 0.10$) and nitrogen (4.06% , $P < 0.05$). DE Mcal/kg was higher ($P < 0.05$) for SG6 (3.72) than for SG2 (3.50). The ruminal pH was lower ($P < 0.10$) for DCS (6.24) respect to GS2, GS4 and GS6 (6.6 , 6.5 , 6.4 respectively). Germinated treatments increased ($P < 0.1$) molar proportion of acetate (6.73%) and decreased ($P < 0.05$) molar proportion of butyrate. Germinated tended to increase (linear effect, $P < 0.10$) molar proportion of acetate. Germinated increased post-ruminal starch digestion and SG6 had the higher total tract digestion for OM, starch, N and DE value.

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Key Words: cattle, germinated, reconstituted sorghum

M414 Performance of beef heifers finished at pasture in tropical conditions and supplemented with sunflower crushed seeds, in dry season. S. L. N. Cerilo^{*}, R. H. de Tonissi e Buschinelli de Goes, H. L. Lima, K. A. de Souza, A. F. Marquez, T. da Cunha Cornélio, K. A. Guimarães Nogueira, D. de Faria Pereira, E. R. de Oliveira, and A. M. de Araújo Gabriel, Universidade Federal da Grande Dourados, Dourados, MS, Brasil.

To evaluate the partial substitution of soybean meal for sunflower crushed seeds in the performance of Nellore Heifers, at pastures of *B. humidicula* during the dry season, we used 24 animals, with initial body weight (BW) of 310 kg, with body condition score (BC) of 2.25, divided into paddocks of 3000 m², in a completely randomized design. Supplements evaluated were supplied collectively at 0.8% BW/animal/day consisting of corn, soybean meal and mineral, with 20% CP; the soybean

meal was replaced in the proportions of 0, 20, 40, and 60% for sunflower crushed seeds. The estimated ether extract of the supplements were 2.5, 4.7, 7.0, 9.2%, respectively. The animals were weighed every 21 d and monitored for BC (1–5). The average daily gain of animals showed a quadratic response ($ADG = 0.2416 + 0.012x - 0.0002x^2$, $r^2 = 0.99$), and the replacement levels of 20 and 40% showed higher daily gains, 0.411 and 0.440 kg/day, while the levels of 0 and 60% had average of 0.242 and 0.320 kg/day. The inclusion of sunflower crushed seeds improved daily gain ($P < 0.10$) (average of 0.390 kg/day), this corresponds to an increase by 60% compared with supplementation with only corn and soybean meal. The efficiency of the use of concentrates (kg gain/kg of supplement) was greater for supplements containing sunflower crushed seeds, 12.26, 13.42 and 9.87% for the replacement levels of 20, 40 and 60% of soybean meal; the supplement without sunflower crushed seeds was efficient to 7.31%, these values can be related to the inclusion of sunflower crushed seeds into the concentrate, changing the energy density. The animal's BC improved with the sunflower crushed seeds, where the animals supplemented had the best initial (2.2, 2.5 and 2.2) and final (4.0, 4.0 and 3.7) body condition, for substitution levels of 20, 40 and 60%. The animals supplemented with corn and soybean, were initial and final body conditions of 2.1 and 3.6. Partial substitution of soybean meal with sunflower crushed seeds improves daily gain and body condition of animals on finishing systems on pasture.

Key Words: supplement, concentrated efficiency, daily gain

M415 Ingestive behavior of grazing Nellore steers supplemented with increased levels of energetic concentrate. J. R. R. Dorea, F. A. P. Santos, A. L. Marra, L. R. D. Agostinho Neto, D. C. Balestrin, M. A. C. Danes*, V. N. Gouvea, and A. M. Pedroso, *University of Sao Paulo, Piracicaba, Brazil*.

The objective of this trial was to evaluate the ingestive behavior of grazing Nellore steers receiving increased levels of energetic concentrate during rainy season. Eight rumen cannulated Nellore steers averaging 380 kg of initial body weight, were randomly assigned to 1 of 2 complete 4x4 Latin squares. Each of the 4 experimental periods lasted 18 d, with 17 d for adaptation and 1 d for data collection. The grass pasture was *Brachiaria brizantha*, cv. Marandu. Pastures were rotationally grazed using a height-based management, on which 25 cm was the entrance height into the paddocks, that were left when a 15 cm post grazing residue was reach. The treatments were 3 levels of energetic supplementation (0.3, 0.6 and 0.9% BW, DM basis), based on fine ground corn and monensin (20 ppm/animal/d), plus a control treatment, with no supplementation. The concentrate was individually fed once daily, in the morning, and the animals had free access to a mineral premix. Ingestive behavior was determined by visual observation of individual animals, during 24 h, 5 min intervals, totaling 288 observations. Parameters evaluated were grazing, rumination and resting periods. The data was tested with *t*-test at 5% probability. There was a linear decrease ($P < 0.05$) in grazing time as the level of the supplementation increased. There was no difference among treatments for ruminating and resting periods. The energetic supplementation of animals grazing a high quality pasture can increase even more the substitution effect, what can result in decreased grazing time.

Table 1. Ingestive behavior of beef steers under increased level of energetic supplementation during rainy season

	Levels of concentrate (%BW)				P-value Treatment	Contrast		SEM ¹
	0	0.3	0.6	0.9		L	Q	
Grazing time ²	441	385	372	363	*	*	ns	9.82
Ruminating time ²	395	399	358	378	ns	ns	ns	9.38
Resting time ²	441	515	548	551	ns	ns	ns	16.37

¹Standard error of the mean.

²Minutes; ns = not significant, * = $P < 0.05$.

Key Words: beef cattle, ingestive behavior, supplementation

M416 The effect of rumen protozoa of water buffalo and cow on fiber digestion in vitro. S. Jabbari*, M. Eslami, M. Chaji, T. Mohammadabadi, and M. Bojarpour, *Department of Animal Science, Ramin (Khuzestan) Agriculture and Natural Resources University, Ahwaz (Molassani), Khuzestan, Iran*.

The objective of this study was to compare the in vitro digestibility of wheat straw by rumen protozoal populations of water buffalo and Holstein cows. There is no information about the fibrolytic activity of rumen protozoa of water buffalo of Khuzestan in Iran. In vitro digestibility of dry matter (DM) and neutral detergent fiber (NDF) was measured by procedure of Tilley and Terry (1963). Rumen fluid was obtained from 2 buffalo and cows, which fed 30:70 concentrate: forage (corn grain, barley grain and wheat bran: sugarcane silage, corn silage, alfalfa hay and wheat straw). To preparing rumen protozoa, rumen fluid was added to antibiotic solution (streptomycin sulfate, penicillin G and chloramphenicol, 0.1 mg/ml each) and fungicides (benomyl: 500 ppm/ml medium and metalaxyle: 10 mg/ml medium), then was mixed with McDougall buffer in a ratio 1:4. After gasifying with CO₂, tubes were incubated at 39°C. After 48 h the fermentation, 6 mL of HCl solution (20%) and 5 mL pepsin solution were added and the incubated for 48 h simulating post-ruminal degradation. After incubation, the residual substrates of each tube were filtered and used to determine disappearance of DM and NDF. Data of DM and NDF disappearance were analyzed as a completely randomized design using the general linear model procedure of SAS. The results of this experiment indicated that the DM digestibility of wheat straw by rumen protozoal population of buffalo was higher than that by rumen protozoa population of cows (25.2 and 21.13 g/100 g, respectively) ($P < 0.05$). Neutral detergent fiber digestibility of wheat straw was 16.7 and 10.3 g/100 g for protozoal population of buffalo and cows, respectively ($P < 0.05$). The DM and NDF digestibility by rumen protozoa from buffalo was 1.19 and 1.62 folds of the rumen protozoa from cows, respectively. Therefore, rumen protozoa of Khuzestan water buffalo have higher fiber breakdown compared with cows under the same diet.

Key Words: fiber digestion, buffalo, rumen protozoa

M417 The degradation of alfalfa treated with enzyme and or sodium hydroxide by rumen anaerobic fungi. T. Mohammadabadi* and M. Chaji, *Department of Animal Science, Ramin (Khuzestan) Agriculture and Natural Resources University, Ahwaz (Molassani), Khuzestan, Iran*.

This experiment was conducted to investigate the effect of rumen fungi on degradation of alfalfa treated with enzyme (30 g/kg DM) or sodium hydroxide (45 g/kg DM) by using disappearance of dry matter (DM) and neutral detergent fiber (NDF) and chitin content in pure culture of

rumen anaerobic fungi for 12 d. Treatments were: untreated alfalfa and treated with sodium hydroxide (NaOH) (45 g/ kg DM), enzyme (30 g/kg DM) and or NaOH +enzyme. Rumen fluid was collected from 2 fistulated Holstein steers and centrifuged (1000 rpm, 10 min), then supernatant was used to grow fungi in medium containing antibiotic solution (streptomycin sulfate, penicillin G and chloramphenicol, 0.1 mg/ml each) under anaerobic conditions at 39°C for 24 h, by Joblin (1981) method. These isolates were used (1:9), as a source of inoculum for culturing fungi in a serum bottle containing 45 mL of culture medium and 1g of experimental sample under anaerobic conditions (using 3 times subculture) for 12, 24, 48, 72 and 96 h. The residual substrates of each bottle were then filtered and used to determine the DM and NDF concentrations. The chitin content of each medium was determined as described by Chen and Johnson (1983). The result showed disappearance of dry matter after 12 d incubation by rumen fungi will be 43.2, 58.3, 60.3 and 63.3 g/100 g DM for untreated alfalfa and treated with NaOH, enzyme and or NaOH+enzyme, respectively. Sodium hydroxide and enzyme caused to increase disappearance of NDF and chitin content, and the highest increase was for medium containing alfalfa treated with NaOH+enzyme (168.6 mg/g DM and 5.96 g/kg DM, respectively) ($P < 0.05$). Therefore, it appears that the degradation of alfalfa by rumen fungi is influenced by NaOH and enzyme treatments.

Key Words: rumen fungi, sodium hydroxide, enzyme

M418 Exchanging tropical fiber sources on intake and ingestive behavior of feedlot rations in beef cattle. R. S. Goulart*, V. P. Santos, G. B. Muraro, J. L. P. Daniel, R. C. Amaral, S. G. Toledo Filho, E. H. Cabezas, L. G. Nussio, and A. V. Pires, *University of São Paulo–ESALQ, Piracicaba, SP, Brazil.*

Forage and nonforage tropical fiber sources were evaluated in a 5×5 Latin square trial using Nelore steers within five 19-d periods (10-d adaptation followed by 9-d data collection). The 5 diets were composed of fiber sources: 20% NDF from corn silage (CS) (50.2% NDF); and 4 diets containing 10% NDF from corn silage added with 10% NDF from each of the following sources: sugarcane (SC) (46.8% NDF), sugarcane bagasse (SCB) (81.0% NDF), soybean hulls (SH) (75.1% NDF) and high oil – cottonseed meal (HOCM) (49.2% NDF). Steers were fed once daily in the morning and allowed ad libitum access to feed in tie stall pen. Data from the Latin squares were analyzed using Mixed procedures of SAS. Greater DM intake (9.26 kg/d) was observed for the diet which contained 20% NDF as CS ($P < 0.05$) compared with diets containing SC (8.85 kg/d) or SCB (6.86 kg/d). No differences in DM intake was observed between HOCM diets (9.62 kg/d) and CS diets. However, steers fed SH diet (8.44 kg/d) consumed less ($P < 0.05$) than CS. Steers fed SC or SCB diets showed greater capacity ($P < 0.01$) in stimulating rumination (50.0 and 62.3 min/kg DM, respectively) when compared with CS (42.5 min/kg DM), SH (26.7 min/kg MD) or HOCM diets (38.9 min/kg DM) for the same inclusion of NDF (% DM). This variation in feeding behavior affected the amount of acid produced in rumen fermentation of each treatment. Greater pH ruminal was observed for SC (6.21) and SCB (6.30) ($P < 0.01$) compared with CS (6.08) and SH (6.04). Thus, dietary NDF concentration alone from tropical roughage sources were not correlated to ruminal pH. Even though, it might provide a useful tool for exchanging roughages in diets, these results suggested that this fraction should not be considered exclusively as a predictor for estimate DM intake and ingestive behavior. Further studies involving physical and chemical traits from tropical roughage sources are on the way.

Key Words: roughage source, dry matter intake, Nelore steers

M419 Effect of levels of fiber and corn grain processing in diets for finishing Zebu cattle. R. Carareto*, F. A. P. Santos, G. B. Mourão, A. M. Pedroso, C. Sitta, W. Angolini, and B. Correa, *University of São Paulo, Piracicaba, São Paulo, Brazil.*

The objective of this trial was to compare 3 levels of grass hay and 2 types of corn grain processing in high concentrate diets for finishing feedlot cattle. Ninety-two Nelore bulls with an average initial SBW of 400 kg were used in a 63-d feeding trial after a 21 d period for adaptation to high concentrate diets. Animals were blocked by SBW and randomly allotted to 16 pens. Experimental diets were isonitrogenous and contained (%DM) 10% to 0% hay, 53.6 to 63.6% corn grain, 35% wet corn gluten feed, 1.4% of mineral mix with monensin.

Treatments were: 1) fine ground corn and 10% hay, 2) fine ground corn and 5% hay, 3) fine ground corn and 0% hay, 4) cracked corn and 0% hay. Data were analyzed based on a randomized complete blocks design, with pens as the experimental units, using the Proc. Mixed of SAS (1999) version 9.2 for Windows. Dry matter intake (DMI) and ADG were lower for treatments without hay ($P < 0.05$) (Table 1). Feed efficiency (DMI/ADG) was not affect by treatments ($P > 0.05$) (Table 1). Although the DMI and ADG were lower, the finishing Nelore bulls performance was not affected by treatments.

Table 1. Dry matter intake (DMI), average daily gain (ADG) and feed efficiency (DMI/ADG) of finishing Nelore bulls fed 4 different diets

Variables	T1	T2	T3	T4	Standard Error	Pr>F
ADG (kg /day)	1.55	1.51	1.30	1.36	0.0800	0.032
DMI (kg DM/day)	10.32	10.26	8.79	9.00	0.3729	0.0002
DMI/ADG	6.65	6.80	6.75	6.67	0.2365	0.9827

Key Words: Nelore, finishing, feedlot

M420 Influence of daily ingestion of alfalfa treated with quebracho tannins on in vitro fermentative activity of some browse species. H. Ammar^{1,2}, S. López², A. Z. M. Salem^{*3,4}, and J. S. González², ¹*Ecole Supérieure d'Agriculture de Mograne, Dept. Production Agricole, 1121-Zaghwan, Tunisia*, ²*Instituto de Ganadería de Montaña (CSIC-Universidad de León), 24346 León, Spain*, ³*Universidad Autónoma del Estado de México, Centro Universitario UAEM-Temasaltepec, Estado de México, C.P. 51300, México*, ⁴*Alexandria University, Department of Animal Production, Faculty of Agriculture (El-Shatby), Egypt.*

Leaves from 4 shrub species (*Erica australis*, *Cistus laurifolius*, *Quercus pyrenaica*, and *Rosa canina*) collected from the mountain of Leon (northwestern Spain) were used to test the medium-term effects of the intake of quebracho condensed tannins on the fermentative activity in the rumen of sheep. Leaves from all shrubs were sampled at 3 different maturity stages (spring, summer and autumn). Eight Merino rumen cannulated sheep fed chopped alfalfa hay were used. Four sheep were given alfalfa hay treated with 50 g quebracho/kg DM for 60 d (group Q), whereas the other animals were always given untreated alfalfa hay and used as the control group (C). Differences in the fermentative activity were examined in vitro in batch cultures inoculated with rumen fluid obtained on d 60 from both groups of sheep. In vitro dry matter digestibility (IVD) and gas production kinetics from leaves and flowers of all shrub species were determined. Except for the flowers of *C. laurifolius*, IVD was higher ($P < 0.05$) when rumen fluid from Q sheep was used. Likewise, a significant effect of inoculum source on the dry matter disappearance after 144 h of incubation was observed for the flowers of *E. australis*. For the same substrate, the inoculation with rumen fluid from Q sheep resulted in a higher gas production at 24 h and faster fractional

gas production rates. The differences were generally statistically significant ($P < 0.05$) in most comparisons and the magnitude of this effect was greater when material with higher tannin contents was incubated (leaves of *E. australis* and *C. laurifolius*). In conclusion, rumen fluid from sheep fed a diet supplemented with condensed tannins showed a higher fermentative activity to degrade tannin-rich browse. This could be due to the appearance and proliferation of tannin-tolerant bacterial species or to the induction of changes in the existing bacteria to enhance their tolerance to these phenolic compounds.

Key Words: shrub, in vitro digestibility and gas production, sheep

M421 Productive characteristics and chemical composition of elephant grass (*Pennisetum purpureum* Schum, cv. Mineiro) submitted to chemical and organic fertilization. T. S. Oliveira^{*1}, J. C. Pereira¹, R. A. M. Vieira⁴, J. G. L. Regadas Filho¹, and E. F. Aguiar², ¹Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, ²Universidade Federal do Vale do Jequitinhonha e Mucuri, Diamantina, Minas Gerais, Brazil, ³Universidade Estadual de Montes Claros, Janaúba, Minas Gerais, Brazil, ⁴Universidade Estadual do Norte Fluminense Darcy Ribeiro, Campo dos Goytacazes, Rio de Janeiro, Brazil.

The objectives of this work were to study the effect of chemical (CF) and organic (OF) fertilization on the forage DM production and chemical composition characteristics of elephant grass and to estimate the total net energy for lactation (NEL) and the total digestible nutrients (TDN). Two elephant grass stocking piles were formed and 2 fertilization systems were used. The plant was evaluated in relation to height, age, DM ha⁻¹ production (DMP), DM content and leave: stem ratio. Except for the age, the other values were analyzed in relation to the plant height. Based on the plant age, DM ha day⁻¹ production and growth rate (GR) were calculated. As for elephant grass nutritive values (chopped forage), the experiment was carried out in a completely block (6 periods) randomized design and 3 replicates per forage (CF and OF) per block. Data of CP, NDF, ash, Ca, P, Mg and K were evaluated by F test, at 5% of probability. Based on the NDF contents, the NEL and TDN of the elephant grass from the 2 fertilization systems were estimated. The best plant performance at field was for the elephant grass submitted to organic fertilization, which was higher in water content, growth rate and forage DM ha day⁻¹ production. Also in the nutritive value aspect, the elephant grass submitted to OF showed higher chemical composition values, which were indicative of better nutritional quality. In this forage, higher contents of CP (17.26%), ash (26%) and P (36.88%) and smaller of NDF (3.96%) were observed in relation to the elephant grass submitted to CF. In the conversion of NPK fertilizer in forage DM, the elephant grass submitted to OF was 41.38% smaller than elephant grass submitted to CF. The elephant grass cultivated under organic fertilization was harvest with higher frequency and with better nutritional quality.

Key Words: elephant grass, chemical fertilization, organic fertilization

M422 Effects of condensed tannins supplementation in a lactating dairy TMR diet on ruminal fermentation in continuous culture, maintained at high and low pH. C. M. Dschaak^{*}, C. M. Williams, J.-S. Eun, and A. J. Young, Department of Animal, Dairy, and Veterinary Sciences, Utah State University, Logan.

We investigated whether supplementing a water-soluble Quebracho extract would be beneficial to improve the rumen ecosystem by examining effects of ruminal pH on ruminal fermentation. The Quebracho extract contained approximately 75% condensed tannins (CT; Chemtan Company Inc., Exeter, NH), and the CT was supplemented to a barley-

based high concentrate, lactating diet at 6% of dietary DM. A dual-flow continuous culture system consisting of 4 fermentors was used in a 4 × 4 Latin square with dietary treatment arranged as 2 × 2 factorial (high and low pH vs. without CT and with CT). High ruminal pH (HpH) was maintained with normal artificial saliva, while low ruminal pH (LpH) was achieved by diluting 60% of the normal artificial saliva with water. The ruminal pH averaged 6.2 and 5.9 to the HpH and the LpH, respectively. The diet used consisted of 33% alfalfa hay, 7% corn silage, 40% rolled barley grain, and 20% concentrate mixture. The 4 treatments were: 1) TMR with HpH and without CT; 2) TMR with HpH and with CT; 3) TMR with LpH and without CT; and 4) TMR with LpH and with CT. Filtered ruminal contents were allowed 5 d of adaptation to the treatments followed by 3 d of data collection. Culture pH decreased with CT supplementation in the HpH, however pH was not affected in the LpH. Methane production increased ($P < 0.01$) in the HpH, but decreased in the LpH due to CT supplementation. Ammonia-N concentration ($P < 0.01$) decreased with CT supplementation regardless of type of ruminal pH. Total VFA increased ($P = 0.02$) with CT supplementation in the HpH, but was not affected in the LpH. Molar proportion of acetate increased ($P = 0.02$) in the HpH, whereas CT supplementation did not affect acetate proportion in the LpH. Propionate proportion was not affected by CT supplementation in the HpH and the LpH. The supplementation of CT in the HpH resulted in positive impacts on microbial production, as was seen in increased VFA and decreased ammonia-N. However, CT supplementation in the LpH had no benefit on ruminal fermentation.

Key Words: condensed tannins, continuous culture, ruminal pH

M423 Milk fatty acid composition of grazing dairy cows supplemented with soy and fish oils. G. M. Martínez¹, G. A. Gagliostro^{*2}, D. A. Garcíarena¹, V. I. Cejas³, M. A. Rodríguez³, R. A. Castañeda³, and M. Balán⁴, ¹INTA EEA Salta, Salta, Argentina, ²INTA EEA Balcarce, Balcarce, Buenos Aires, Argentina, ³INTI Lácteos, San Martín, Buenos Aires, Argentina, ⁴Prodeco SRL, Chivilcoy, Buenos Aires, Argentina.

The effect of feeding soy oil (SO, 55.5% C18:2) or a residue of SO extraction (SOR, 61% oil, 55.9% C18:2) combined or not with fish oil (FO, 9.89% EPA, C20:5 n3 and 20.64% DHA, C22:6 n3) on milk fatty acid (FA) profile was studied on 32 grazing dairy cows (115 ± 28 DIM) in a 2x2 factorial arrangement. Oils were mixed with corn silage (CS) immediately before feeding. Treatments (DM basis) were: SO = 72.63% CS, 2.79% urea and 24.58% SO; SO-FO = 68.42% CS, 2.63% urea, 5.79% FO and 23.16% SO; SOR = 62.95% CS, 2.42% urea and 34.63% SOR and SOR-FO = 59.77% CS, 2.30% urea, 5.06% FO and 32.87% SOR. Concentrate (7.3 kg/cow/d) and pasture (8.4 kg/cow/d) were also consumed. Milk samples were obtained before (basal) and then once a week after oils feeding during 35 d. A factorial arrangement with repeated measures over time adjusted by covariable was used. Factor A compared SO vs SOR and factor B examined the effect of FO. Comparisons between basal and final milk FA were tested by the Student t-Test for paired observations. Concentration of C4:0, C6:0 and C8:0 resulted higher in SOR treatments. C14:0 (g/100g FA) was lower ($P < 0.03$) in SO (9.15) compared with SOR (10.17). Compared with basal (12.52 g/100g FA) SO-FO showed the most important reduction in C14:0 (-3.55 g/100g FA). The atherogenicity index of milk (2.29 to 2.59) was reduced (1.43) without differences between treatments. Basal concentrations of 10t C18:1 (0.28 to 0.31 g/100g FA) were increased particularly with SO (4.55 g/100g FA) instead of SOR (3.9 g/100g FA). SO-FO showed the highest 10t C18:1 concentration (5.27 g/100g FA). Increase of 11t C18:1 (VA) over basal (2.56 g/100g FA) resulted higher in SO-FO (+3g/100g FA) followed by SOR-FO (2.91 and +2.84), SO (2.78 and +1.36) and SOR (2.54 and +1.06 g/100g FA). Concentrations

(g/100g FA) of 9c, 11t CLA averaged 3.23 (SO-FO), 2.95 (SOR-FO), 2.43 (SO) and 2.19 (SOR) resulting higher ($P = 0.01$) in FO treatments FO (3.14 vs 2.31) without interaction between FO and sources of supplementary C18:2. After supplementation, the CLA/11t C18:1 ratio decreased in all treatments. The SOR may successfully replace SO to modulate milk FA composition.

Key Words: soy oil residue, fish oil, conjugated linoleic acid

M424 Does the in situ ruminal degradation of feeds vary with the finishing ration fed to beef cattle? Y. L. Li^{1,2} and W. Z. Yang¹, ¹Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada, ²Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, China.

An in situ study was conducted to determine degradation of feeds in the rumen of beef cattle fed finishing diets that varied with the amounts of silage, barley grain and wheat DDGS. This study was part of the measurements in a metabolic study. Eight ruminally fistulated Angus heifers were assigned in a replicated 4×4 Latin square design with 4 diets that consisted of barley silage, barley concentrate, and wheat DDGS in ratios of 15:85:0, 10:65:25, 5:65:30 and 0:65:35, respectively, for control, low, med and high DDGS. Five grams of the barley silage (chopped), barley grain (temper-rolled) and wheat DDGS (as fed) fed to the cattle were incubated in situ in the rumen of 8 heifers for 0, 2, 4, 6, 12, 24 and 48 h in the first 2 periods of the study. The model $y = a + b(1 - e^{-ct})$ was fitted to determine degradation kinetics of DM, NDF and CP, where y is nutrient degraded, a is soluble fraction, b is slowly degradable fraction, c is degradation rate constant, t is incubation time. Effective degradability (ED) was determined by $ED = a + [bc/(c+k)]$, where $k = 0.06/h$. For barley silage, soluble fraction of DM decreased quadratically ($P = 0.01$). The slowly degradable fraction of DM tended to linearly ($P = 0.06$) decrease, and that of CP quadratically ($P = 0.05$) decreased with increasing amount of DDGS in the diets. For barley grain, the kinetic parameters of DM, NDF and CP were generally not affected by the diets except for the ED of NDF which was greater ($P = 0.01$) for med DG (48%) than for the other 3 diets. Finally, for wheat DDGS, the degradation kinetics and ED of DM, NDF and CP were overall not affected. The results suggest that the effects of finishing diet fed to cattle on in situ ruminal degradation kinetics vary with type of feed and nutrient measured; in situ ruminal degradation of wheat DDGS was the least affected by the diets fed to cattle among 3 feeds evaluated.

Key Words: In situ ruminal degradation, wheat DDGS, beef cattle

M425 Performance of grazing dairy cows supplemented with soy and fish oils. G. M. Martínez¹, G. A. Gagliostro², and D. A. Garcarena², ¹INTA EEA Salta, Salta, Argentina, ²INTA EEA Balcarce, Balcarce, Buenos Aires, Argentina.

Feeding soy oil (SO) or a residue of oil extraction (SOR) combined or not with fish oil (FO) may be an inexpensive way to increase vaccenic and conjugated linoleic acids in milk. Production responses of dairy cows fed SO (55.5% C18:2), SOR (61% oil; 55.9% C18:2) and FO were examined on 32 grazing dairy cows (115 ± 28 DIM) in a DCA with a 2×2 factorial arrangement over a 35 d period. Oils were mixed to corn silage (CS) defining 4 treatments: SO = 72.63% CS, 2.79% urea and 24.58% SO; SO-FO = 68.42% CS, 2.63% urea, 5.79% FO and 23.16% SO; SOR = 62.95% CS, 2.42% urea and 34.63% SOR and SOR-FO = 59.77% CS, 2.30% urea, 5.06% FO and 32.87% SOR. Concentrate (7.3 kg) and pasture (8.4 kg) were also consumed. Results were analyzed as a factorial arrangement with repeated measures adjusted by covariable. Factor A compared SO vs SOR and factor B examined the effect of

including FO. Within treatments, comparisons between pre- and final records were performed using the Student t-Test for pairwise observations. Intake of ration (kg DM/cow/d) was lower ($P < 0.01$) in SO-FO (2.14) and SOR-FO (2.30) compared with SO (2.66) and SOR (2.78). Pre-trial milk yield, milk fat and milk protein contents averaged 26.6 kg/v/d, 35.7 and 34.4 g/kg, respectively. After 35 of oil supplementation milk yield (SO-FO:-3,18, SO:-2.90, SOR-FO:-1.97 and SOR:-1,62 kg/cow/d) and milk fat content (SOR: -9.9, SOR-FO: -9.1, SO-FO: -9 and SO: -6,9 g/kg) decreased ($P < 0.01$), but milk protein content remained unaffected. FCM was also depressed. Milk yield (kg/cow/d) resulted higher ($P < 0.002$) in SOR treatments (23.9) compared with that including SO (22.9). Milk fat content (AxB, $P < 0.10$) was higher ($P < 0.05$) in SO (29.1g/kg) compared with SO-FO (26.1), SOR (26) and SOR-FO (2.61). FCM resulted higher ($P < 0.03$) for treatments without FO (19.75 vs 19.0 kg/cow/d). Yield of FCM (AxB, 0.07) was depressed by SO-FO (18.5 kg/cow/d) compared with SO (19.9), SOR (19.6) and SOR-FO (19.5). Milk fat secretion (g/cow/d) resulted higher in SO (698) compared with SO-FO (631) and SOR (622) without differences between SO and SOR-FO (640). A lower depression of milk yield and milk fat content was observed feeding the SOR supplement.

Key Words: soy oil, milk yield, milk composition

M426 Effect of production system on metabolic and endocrine responses of grass fed cows. L. D. Kaufmann¹, A. Munger¹, H. A. van Dorland², R. M. Bruckmaier², and F. Dohme¹, ¹Agroscope Liebefeld-Posieux, Research Station ALP, Posieux, Switzerland, ²University of Bern Vetsuisse Faculty, Veterinary Physiology, Bern, Switzerland.

We previously reported that energy expenditure was higher in dairy cows on pasture compared with those offered the same grass in a free-stall barn. Aiming to better understand these differences, the metabolic and endocrine profile and feed intake of the dairy cows fed grass of the same quality either on pasture (P) or in the barn (B) were investigated. Fourteen dairy cows (milk yield: 44 ± 2.7 kg/d) were randomly assigned to a crossover study. The 2 experimental periods lasted 2 wk each and consisted of an adaptation and a data collection period of 1 wk each. The P cows grazed on pasture whereas B cows had ad libitum access to grass from the same paddock, fed in a free-stall barn. All cows were supplemented with a cereal-based concentrate to meet their predicted nutrient requirements. Concentrate was offered in the barn at 0630 and 1630 h using weighing troughs. Grass intake and nutrient digestibility were estimated by the double alkane technique. Milk metabolites were analyzed and BW was recorded daily during the collection periods. On each day of the collection period, blood was taken at 0530 h from one cow of each treatment group. Samples were centrifuged and stored at -20°C until further analysis. As expected, grass quality was similar in both treatment groups (CP, 179 g/kg DM; NDF, 407 g/kg DM). Daily grass (15.6 kg DM) and concentrate intake (6.4 kg DM) did not differ ($P > 0.05$) and therefore no differences ($P > 0.05$) were observed in total DM, OM and NDF intake between treatments. Digestibility of OM (81.6%) and NDF (78.9%) were similar ($P > 0.05$) in both experimental groups. Milk acetone concentration (1.13 mg/kg) was unaffected ($P > 0.05$) while milk urea level tended ($P = 0.06$) to be lower in P cows (186 mg/kg) compared with B cows (208 mg/kg). Neither blood metabolites (albumin, BHBA, cholesterol, glucose, NEFA, total protein, triglycerides, and urea) nor IGF-1, T3, and T4 differed ($P > 0.05$) between treatments. In conclusion, the analyzed blood traits as well as the nutrient intake do not help explaining the observed differences in energy expenditure of grazing cows compared with cows fed the same grass in the barn.

Key Words: dairy cows, metabolic and endocrine profile, pasture

M427 Production of dairy cows fed varying levels of total mixed ration and pasture. A. Quilaguy-Ayure, G. A. Gagliostro*, D. A. Garciarena, L. Antonacci, and C. A. Cangiano, *INTA EEA Balcarce, Balcarce, Buenos Aires, Argentina.*

Nine dairy cows were offered combinations of total mixed ration (TMR) and pasture (P) in a triplicated 3 × 3 Latin square design with 3 partial mixed rations (PMR) targeted at (1) 75% TMR and 25% P, (2) 50% TMR and 50% P and (3) 25% TMR and 75% P. All cows were also fed the TMR-100% diet. TMR was composed (DM) by corn silage (36%), concentrate (49%), soybean meal (6.5%), soybean grain (6.5%) and feather meal (2%). Data were analyzed by a model that included treatment, square and period as fixed effects and cow within square as random effect. Differences between the TMR-100 and the other treatments were stated using the t-Test for paired observations. The actual proportions of TMR and P were (1) 79:21, (2) 58:42 and (3) 33:67. TMR intake (kg DM/cow/d) was 20.32, 13.44 and 7.06 for (1), (2) and (3) treatments, respectively ($P < 0.01$). Reducing the proportion of TMR increased ($P < 0.01$) pasture consumption (5.27, 9.77 and 14.49 kg DM/cow/d) and reduced ($P < 0.01$) total DM intake (25.59, 23.21 and 21.55 kg/cow/d for 1, 2 and 3, respectively). Total DM intake (kg/cow/d) for TMR-100 was higher (28.23, $P < 0.03$) compared with PMR treatments. Total DM intake (% of BW) was similar between TMR-100 (4.42%) and PMR-79 (4.26%), but higher ($P < 0.01$) to PMR-58 (3.82%) and PMR-33 (3.06%). Yields (kg/cow/d) of milk (31.2) or 4%FCM (26.8) did not differ between PMR. Milk production (kg/cow/d) in TMR-100 (32.1) was higher ($P < 0.01$) than PMR-58 (30.7) and 4%FCM did not differ between TRM and PMR treatments. Milk fat content (g/kg) was similar between TMR-100 (28.5) and TMR-79% (29.6) but lower ($P < 0.02$) to TMR-58% (31.3) and TMR-33% (32). Milk protein content (g/kg) resulted higher ($P < 0.02$) in TMR-100% (33.7) compared with TMR-79% (33.2). Milk fat secretion (0.954 kg/cow/d) did not differ. Milk protein yield (kg/cow/d) was similar between PMR diets (1.03) but lower ($P < 0.04$) to TMR-100% (1.07) for TMR-58 and TMR-33. Feed efficiency (kg milk/kg DM) had a tendency ($P < 0.08$) to increase from 1.13 to 1.42 with increased pasture levels in PMR diets. For cows producing between 32 to 30 kg of milk, decreasing the pasture TMR ratio in the diet did not show a clear production benefit.

Key Words: intake, pasture, partial mixed ration

M428 Effect of different pectin rich by products on feed intake, milk production and composition and ruminal pH of lactating dairy cows. M. Kordi*, A. Naserian, R. Valizade, and A. Tahmasbi, *Ferdowsi University, Mashhad, Iran.*

Eight primiparous early lactating Holstein cows (60 ± 23 d postpartum, weighing 530 ± 60 kg) were assigned into a duplicated 4 × 4 Latin square design for evaluated of different pectin rich by products on feed intake, milk production and composition and ruminal pH of lactating dairy cows with 4 3-wk periods. Cows were allocated into 4 diets whit 1)10% barley grain, 2)10% sugar beet pulp, 3)10% wheat bran and 4) 10% dried citrus pulp . Each experimental period was 21 d including 14 d adaptation period and 7 d collecting samples. Milk yield recorded daily and milk samples were taken from each milking times during the last 3 d of each period. Milk samples were subjected to analysis for CP, lactose, fat and SNF. The dry matter intake (DMI), NDFI, milk yield and composition and ruminal pH are presented in the Table 1. There were no differences ($P > 0.05$) in the daily intake of DM (kg/d), and milk yield and composition, among treatments (Table 1). Similarly, there were no significant differences in ruminal pH among treatment diets ($P > 0/05$). The NDF intake was significantly different among treatments ($P < 0.05$). These data suggest that, the addition of sources of pectin feed stuffs at

10% levels (dry matter basis) of the dairy cow ration instead of cereal grain; will decrease the cost of milk production without any negative effect on dairy cows performance.

Table 1. Dry matter intake, NDF intake, milk production and composition, and ruminal pH of dairy cows

Item	Treatment				SEM
	T1	T2	T3	T4	
DMI (kg /day)	19.34	19.63	19.74	18.69	0.122
NDF intake(kg/d)	6.05b	6.61a	6.63 a	5.8 8 b	0.110
Ruminal pH	6.25	6.36	6.3	6.26	0.071
Milk yield (kg /day)	28.68	28.3	28.81	27.37	0.201
Milk composition (%)					
Protein	3.1	3.03	3.16	3.12	0.046
Lactose	4.92	5.01	5.15	4.98	0.057
Fat	3.14	3.44	3.36	3.34	0.07
SNF	8.27	8.3	8.56	8.36	0.099

Key Words: barley, lactating dairy cow, pectin rich byproducts

M429 Modification of the Z-Box system for assessing particle distribution of forages and total mixed rations. K. W. Cotanch*¹, C. S. Ballard¹, J. W. Darrah¹, L. M. Klaiber¹, R. J. Grant¹, and K. Yagi², ¹W. H. Miner Agricultural Research Institute, Chazy, NY, ²Zen-Noh National Federation of Agricultural Co-operative Associations, Tokyo, Japan.

The Z-Box has been proven to be an accurate on-farm tool for determining the physical effectiveness factor (pef) of silage-based TMR, corn silage, and haycrop silage. It would be advantageous to consultants and dairy producers to modify the Z-Box to measure particle distributions in addition to pef. The objective of this study was to select perforated steel screens for the Z-Box to provide particle size distributions similar to the Penn State Particle Separator. Twenty-five kg samples of corn silage (CS, n = 12), haycrop silage (HCS, n = 12), and total mixed ration (TMR, n = 41) were sub-sampled and processed using the Penn State Particle Separator (PSPS) and Z-Box following the accepted methodology for both systems. Three replications of each sample were processed by 3 technicians. For the Z-Box, samples were processed sequentially working from the smallest to largest screen (3.18, 4.76, 6.35, 12.70, and 15.88-mm) following the standard Z-Box vertical-shaking method. The Z-Box method for assessing particle distribution was evaluated for accuracy within forage type by calculating the mean bias of particle distributions determined using PSPS and various Z-Box screens. The Z-Box screen with the narrowest 95% confidence interval (CI) encompassing zero most accurately assessed particle distribution. For TMR and HCS, 4.76- and 12.70-mm screens with the Z-Box resulted in the closest agreement with the PSPS method. For CS, the 4.76- and 15.88-mm screens assessed particle distribution most accurately.

Table 1. Mean bias of particles screened using PSPS and corresponding Z-Box sieves for forages and TMR

Sample	Z-Box Sieve < (mm)	PS		Upper 95% CI	Lower 95% CI
		Screen < (mm)	Mean bias ± SD		
CS	3.18	8	-12.92± 3.0	-11.01	-14.83
	4.76	8	-4.31± 2.26	-2.88	-5.75
	6.35	8	6.28± 1.80	7.42	5.13
	12.7	19	-11.92± 5.09	-8.69	-15.16
	15.88	19	0.66± 1.10	1.36	-0.04
HCS	3.18	8	-21.49± 6.19	-17.56	-25.42
	4.76	8	-6.04± 5.45	-2.58	-9.50
	6.35	8	11.76± 4.69	14.74	8.78
	12.7	19	0.29± 1.85	1.46	-0.88
TMR	3.18	8	-13.03± 3.11	-12.05	-14.01
	4.76	8	0.20± 3.06	1.17	-0.76
	12.7	19	-0.38± 4.53	1.05	-1.81

Key Words: particle distribution, forage, total mixed ration

M430 Zinc and heat treatments reduce ruminal protein degradation of grass leaf protein. K. L. Kammes*, B. D. Bals, B. E. Dale, and M. S. Allen, *Michigan State University, East Lansing.*

Leaf protein (LP) produced as a coproduct of cellulosic ethanol production can be utilized by ruminants. Effects of grass maturity, chemical and heat treatment, and conservation method on ruminal protein deg-

radation of LP extracted from orchardgrass (OG) were evaluated. Two maturities of OG were harvested from the same field in 2008 with crude protein (CP) concentrations of 17% (immature) and 13% (mature). Grasses (fresh, stored, or wilted) were chopped and protein rich juice was extracted with a screw press. The juice was chemically treated with concentrated hydrochloric acid (HCl, pH 3.3) with or without zinc (Zn, 2.085 g zinc chloride per liter) and treated with heat (100 or 140°C for 1 h) or without (21°C; control) followed by centrifugation to harvest precipitated LP. Crude protein concentrations of LP approximately doubled that of the original grass to 34.4 and 25.8% for immature and mature, respectively for all chemical and heat treatment combinations. In vitro protein degradation of LP was evaluated using enzymes extracted from rumens of lactating dairy cows. The HCl+Zn, 140°C treatment decreased CP degradation the greatest extent compared with HCl, control for fresh OG LP (4 vs. 20% degraded in 12 h). An interaction ($P < 0.10$) between maturity and Zn was observed with Zn decreasing CP degradation of immature OG more than mature OG after 4 h incubation. The HCl+Zn treatment decreased CP degradation more than HCl alone (3.0 vs. 9.9% after 4 h and 5.5 vs. 13.8% after 12 h; $P < 0.05$). Heat also decreased CP degradation with temperatures of 100 and 140°C resulting in similar degradation, which were lower than control (4.0 vs. 11.3 after 4 h and 7.3 vs. 14.4% after 12 h; $P < 0.05$). There was an effect of conservation method on HCl+Zn, 140°C treated OG LP with similar degradability for stored (7.7%) and wilted (9.8%), which were higher than fresh (1.7%; $P < 0.01$). Leaf protein from fresh OG treated with zinc and heat resulted in decreased ruminal CP degradation.

Key Words: leaf protein, protein degradation, bypass protein