284 Effect of diet composition and incubation time on feed indigestible NDF concentration in dairy cows. S. J. Krizsan* and P. Huhtanen, *Swedish University of Agricultural Sciences, Department of Agricultural Research for Northern Sweden, Umeå, Sweden.*

Indigestible NDF (iNDF) predicts forage OM digestibility accurately and precisely when determined by a 288-h ruminal in situ incubation, and it is an important parameter in mechanistic rumen models. The long incubation time required is a disadvantage. Further, intrinsic cell wall characteristics of feeds should be determined in ideal conditions for fiber digestion. The objective with this study was to determine effects of diet composition and rumen incubation time on iNDF over a wide range of feeds in dairy cows. In this study concentrations of iNDF were evaluated using 18 feeds and 4 cows in a split-split plot design. Ten feeds were concentrates and 8 were classified as forages. Treatments were in a 3 × 3 factorial arrangement, consisting of different diets and incubation times. Diet composition was primarily varied by changing concentrate inclusion between 17 (low), 42 (medium) and 62% (high) of diet DM. Grass silage was used as basal forage to all cows during the incubations. The feeds were incubated for 144, 216 and 288 h. Indigestible NDF was determined from 2 g sample weighed to polyester bags of Saatifil PES (Saatitech S.p.A., Veniano, Como, Italy) with pore size of 12 μm and a pore area equal to 6% of the total surface, providing a sample size to surface ratio of 10 mg/cm^2. Across all feeds concentration of iNDF ranged from 6 to 515 g/kg of DM. Feed iNDF concentration was not affected by cow ($P = 0.14$). The effect of diet composition on feed iNDF concentration was significant ($P < 0.01$). Concentrations of iNDF across feeds were 178, 186 and 197 g/kg of DM when cows were fed the low, medium and high diet, respectively. The effect of incubation time on feed iNDF concentration was significant ($P < 0.01$). Concentrations of iNDF across feeds were 199, 185 and 177 g/kg of DM for 144, 216 and 288 h, respectively. There were also significant ($P < 0.01$) interactions between incubation time and diet, incubation time and feed, and diet and feed. Indigestible NDF should preferentially be determined from 288-h ruminal in situ incubations in cows fed diets with low concentrate inclusion to be representative of the feed fraction that is unavailable to the animal.

Key Words: dairy cow, digestibility, fiber

285 Effect of corn snaplage on lactation performance of Holstein dairy cows. M. S. Akins*[1], M. Digman[2], and R. D. Shaver[1], *[1]Department of Dairy Science, University of Wisconsin-Madison, Madison, [2]U.S. Dairy Forage Research Center, Madison, WI.*

The objective of this study was to compare the effects of feeding TMR containing either corn snaplage (SNAP), corn snaplage with dry ground shelled corn (SPDC; 70% SNAP and 30% dry corn on DM basis), or high moisture shelled corn (HMSC) on lactation performance. Corn snaplage (67.6% DM; 61.0% starch DM basis) and HMSC (74.4% DM; 71.2% starch DM basis) were harvested from the same field of corn and stored in separate silo bags. Mean particle size of the SNAP, HMSC, and dry ground corn were 1764, 1335, and 825 microns, respectively. Sixty Holstein cows (30 primiparous and 30 multiparous) at 100 ± 23 DIM were housed in a pen with 30 electronic feeding gates to deliver the TMR teatments and measure DMI. Cows were blocked by parity (primiparous and multiparous), stratified by DIM, and randomly assigned to gates. Gates were randomly assigned to treatments with 10 for each treatment and 5 each for primiparous and multiparous cows. Primiparous or multiparous cows on each treatment could access all 5 gates. A 2-wk covariate adjustment period with all cows fed a 50:50 mix of the SNAP and SPDC treatments was followed by an 8-wk treatment period with cows fed there assigned treatment TMR. The TMR nutrient content (DM basis) for SNAP, SPDC, and HMC were 26.3, 27.5, and 23.9% starch, respectively and 22% NDF from forages for all treatments. Cows fed HMSC had greater ($P < 0.01$) DMI than SNAP and SPDC. Milk yield and fat corrected milk (FCM) yield were similar ($P > 0.10$) across treatments. Milk production efficiency was lower ($P < 0.01$) for cows fed HMSC than SNAP and SPDC, and cows fed SPDC tended ($P = 0.06$) to have greater efficiency than SNAP. Cows fed HMSC also had lower ($P = 0.01$) FCM/DMI than SNAP and SPDC. Milk fat percentage was greater ($P = 0.02$) for cows fed HMSC than SNAP with SPDC intermediate, however milk fat yield was not different ($P = 0.15$) across treatments. Milk protein percentage and yield were similar ($P > 0.10$) across treatments. Milk urea nitrogen was greater ($P < 0.01$) for cows fed SNAP than HMSC, and greater ($P < 0.01$) for HMSC than SPDC. Overall, cows fed SPDC had better lactation performance than SNAP or HMSC.

Key Words: corn snaplage, dairy cow, high moisture corn

286 Dry heat popping of sorghum grain to increase ruminal starch digestion in dairy cattle. A. R. Anstis[1], D. G. Barber[1], E. Raffrenato*[2,3], and D. P. Poppi[2], *[1]Agri-Science Queensland, Department of Employment, Economic Development and Innovation, Lawes, Queensland, Australia, [2]School of Agriculture and Food Sciences, The University of Queensland, Gatton, Queensland, Australia, [3]Department of Animal and Wildlife Sciences, University of Pretoria, Pretoria, Gauteng, South Africa.*

Sorghum grain is commonly fed to dairy cattle across Australia. However, starch digestibility of sorghum within the rumen is limited by its structure and the protein matrix surrounding the starch granules. Steam-flaking consistently improves digestibility. Dry popping using heat could also increase digestibility through gelatinization of the starch molecule and increased surface area for microbial digestion. The aim was to increase the rate and extent of ruminal starch digestion with dry popping compared with other processing methods. Sorghum grain was sourced from a local feed mill in Queensland, Australia, and the following treatments were imposed: disc-milled (DM), hammer-milled (HM), rolled (R), steam-rolled (SR), popped (P), popped and hammer-milled (PHM), popped and disc-milled (PDM), semi-popped and disc-milled (SPDM). The HM and DM treatments had a particle size of 2 and 1.2 mm, respectively. All other treatments were ground to 4 mm. The grain was fermented in vitro using rumen fluid from 2 fistulated steers that were fed 3 kg of rolled sorghum per day while grazing kikuyu pasture ad libitum. Data used for rate estimations were in vitro starch fermentation residues, fermented for 0, 3, 7, 12, 18, 24, 36 and 48 h. A first-order decay model was run to estimate rates of digestion, assuming no lag or indigestible starch present. Digestion rates were also derived using the 7 h starch digestibilities according to Roe (1994) and pair-compared with the rates estimated using the non-linear model. The non-linear model resulted in R^2 between 0.92 and 0.99 and rates of starch degradation between 0.0451 and 0.1157 h^{-1}. The PDM and PHM sorghums resulted in the highest rates ($P < 0.05$), followed by the SPDM, SR and P treatments. Similar results ($P = 0.65$) were obtained using the 7 h values, except for DM and HM, which were underestimated compared with the non-linear procedure. Across all intermediate time points, the PDM and

PHM sorghum resulted in the highest starch digestibilities. Dry popping of sorghum grain has a greater potential than steam rolling to increase ruminal starch degradability when the grain is disc or hammer-milled after being popped.

Key Words: sorghum, starch digestibility

287 Daily methane emission profile in Holstein heifers fed rice straw. G. D. Cruz*[1], P. H. Hai[2], S. Polyorach[3], N. Anantassok[3], P. Beelen[4], H. D. Rosa[5], and E. Kebreab[1], *[1]University of California, Davis, [2]Institute of Agricultural Science for Southern Vietnam, Hochiminh City, Vietnam, [3]Khon Kaen University, Khon Kaen, Thailand, [4]Federal University of Alagoas, Rio Largo, Brazil, [5]Sao Paulo State University, Botucatu, Brazil.*

In South East Asia, rice straw is the principal crop residue fed to livestock; it is estimated that 40% of total rice straw produced goes to animal feed. Rice straw is a high lignin, high silica and low digestibility feedstuff, therefore a method to increase its nutritional quality would benefit animal production. The objectives of the study were to 1) improve the utilization of rice straw by increasing dietary nitrogen or energy availability and consequently reduce methane emissions, 2) analyze the daily profile of methane measured in ventilated hood chambers (VHC) and 3) investigate intake variability of heifers in VHC compared with group pen. Nine Holsteins heifers were fed in a 3 × 3 Latin square design, with 3 dietary treatments and 3 periods. Animals were fed twice daily at 0900 and 1700 h. Treatments were: control (14.3 CP% and 2.35 Mcal ME/kg DM), high energy (14.2 CP% and 2.45 Mcal ME/kg DM) and high protein (16.5 CP% and 2.36 Mcal ME/kg DM). Each period consisted of 14 d of adaptation and 1 d in the VHC. During the adaptation period heifers were kept in a group pen equipped with Calan gate system to measure individual feed intake. Feed offered and refused in the VHC was weighted individually. Dry matter intake (DMI) of the day that animals were in the VHC was used as a covariate to analyze the total methane emitted. Increase in nitrogen or in energy in the diet did not have an effect on daily methane emission ($P \geq 0.35$), with heifers in control, higher energy and high protein treatments emitting a daily average of 396, 393 and 414 g/d, respectively. A 37% decrease in DMI between heifers in VHC and previous day in group pen was observed (6.4 vs. 10.2 kg/d, $P < 0.001$, respectively). Methane emission peaks occurred between 1 to 1.5 h after feeding, the morning peak averaged 20 g/h and the afternoon 24 g/h. Daily lowest values were observed early morning, 1 to 2 h before feeding with average values of 10g/h. Even though heifers were provided with the best management conditions during the VHC day, DMI was drastically reduced, which may have affected methane productions. Caution needs to be taken when making inference in methane production data when using VHC method and when few hours of observation are extrapolated to daily emission.

Key Words: dairy heifers, methane emission, rice straw

288 The effects of a two ration feeding regimen on intake, milk production, and rumen fermentation in dairy cows. L. W. Rottman, Y. Ying, P. A. Bartell, and K. J. Harvatine,* *Penn State University, University Park.*

In the dairy cow there is a circadian pattern of feed intake and milk synthesis, consequently a single total mixed ration fed once a day may not stabilize rumen fermentation and synchronize nutrient absorption and milk synthesis. The object of this study was to determine if feeding multiple TMRs that complement the pattern of feed intake over one day would stabilize ruminal fermentation and increase milk synthesis. Nine ruminally cannulated cows were arranged in a replicated 3 × 3 Latin square design with 23 d periods. Diets were control (33.2% NDF), a low forage diet (L; 29.5% NDF), and a high fiber diet (H; 34.8% NDF). The L and H diets were balanced to provide the same composition as the control diet when combined in a 3:7 ratio of L:H. The control (Con) treatment was fed control diet at 0900 h, the high/low treatment (HL) was fed H at 70% of total daily offering at 0900 h and L at 30% of total daily offering at 2200 h, and the low/high (LH) treatment was fed L at 30% of total daily offering at 0900 h and fed H at 70% of daily offering at 1300 h. All treatments were fed at 110% of daily intake. Data were analyzed with mixed model procedures using repeated measures for time course data. Preplanned contrasts compared Con to HL and HL to LH. DMI and digestible DMI were decreased by 1.9 and 0.8 kg/d by HL compared with Con ($P < 0.01$ and $P < 0.05$). Total tract DM and OM digestibility did not differ between Con and HL. Intake and total tract digestibility did not differ between HL and LH. There was no difference between Con and HL for milk yield and composition, but LH tended to reduce milk fat yield compared with HL ($P = 0.06$). There was no effect of treatment on milk *trans*-10 C18:1, *trans*-11 C18:1, and fatty acids less than 16 carbons. There also was no main effect of treatment on empty body weight gain, plasma insulin, glucose, and NEFA, and rumen VFA concentration. There was a significant effect of time on plasma insulin, glucose, and NEFA and rumen VFA concentration ($P < 0.001$), suggesting a circadian rhythm also regulates these variables. Feeding multiple rations over the day decreased intake without decreasing milk or body weight gain. Feeding multiple rations over the day reduced intake with no impact on milk yield or body weight gain, but had little impact on other production and rumen parameters.

Key Words: circadian, rumen fermentation, TMR

289 Validation of an acidosis model. H. M. Golder*[1,2], W. J. Wales[3], M. J. Auldist[3], A. R. Rabiee[1,2], E. Bramley[4], P. Celi[1], R. King[5], and L. J. Lean[1,2], *[1]University of Sydney, Camden, New South Wales, Australia, [2]SBScibus, Camden, New South Wales, Australia, [3]Future Farming Systems Research Division, Department of Primary Industries, Ellinbank, Victoria, Australia, [4]Murdoch University, School of Veterinary and Biomedical Sciences, Murdoch, Western Australia, Australia, [5]Dairy Australia, Southbank, Victoria, Australia.*

Twenty 4 rumen fistulated lactating Holstein cows were fed 8, 10, 12, 14 and 16 kg/hd/d of concentrate with either a control diet or partial mixed ration (PMR). These were used to validate an existing acidosis model based on ruminal pH, volatile fatty acid (VFA), ammonia and lactate measures. Controls were fed rolled wheat grain twice a day at milking, and had access to pasture and silage in the paddock. The PMR diet, containing the same amount of grain and silage as controls, was fed twice daily on a feedpad immediately after milking. The target grazed pasture intake for both groups was 8 kg DM/cow/d. Cows were adapted to the diets for 14 d before rumen sampling. Rumen fluid samples were collected 10 times over a 24 h period and rumen pH was immediately measured. Rumen samples were analyzed for VFA, ammonia and lactate concentrations. Milk and milk composition data were collected. The acidosis model was used to assign one of 3 acidosis categories to each rumen sample: acidotic, suboptimum rumen function or normal. Further, the eigenvector values from discriminant analysis were used to estimate the degree of acidosis for each sample on a 0 to 1 scale, with 1 being highly acidotic and 0 not acidotic. A repeated measures ANOVA was used for the analysis of eigenvector data (Table 1). The degree of acidosis linearly increased with increasing the amount of concentrate, and PMR feeding reduced acidosis. Control cattle fed 14 and 16 kg of concentrate were the most acidotic as indicated by the higher eigenvector values. These results validate the ability of the model to predict ruminal acidosis from rumen fermentation measures. The model may be used as an acidosis diagnostic tool and PMR feeding may reduce risk of acidosis.

Table 1. Least squares means ± SE and P-values for eigenvectors (0-1)

	LSM ± SE	*P*-value
Diet		0.06
Control	0.24 ± 0.022	<0.001
PMR	0.09 ± 0.022	<0.001
Rate (kg/d)		0.02
8	0.02 ± 0.036	0.63
10	0.04 ± 0.036	0.26
12	0.08 ± 0.036	0.02
14	0.19 ± 0.036	<0.001
16	0.50 ± 0.036	<0.001
Time		0.92
Diet*rate		<0.001
Diet*time		<0.001

Key Words: acidosis, partial mixed ration, metabolic model

290 Evaluation of two versions of a mechanistic, metabolic model including bacterial pools, to describe FA flux, pH and milk fat in cattle on various pasture supplementation feeding strategies. J. McNamara*[1], W. Wales[2], and M. Auldist[2], *[1]Washington State University, Pullman, [2]DPI Ellinbank, Ellinbank, Victoria, Australia.*

The objectives were to analyze data from a series of experiments with different proportions of grazed pasture and supplements using 2 versions of a mechanistic, metabolic model and to challenge the ability of the models to describe ruminal VFA flux, pH and resultant production variables, including milk fat production. The model was Molly (UC Davis, Baldwin) and an updated version of the Molly model with new VFA stoichiometry and bacterial pools to describe ruminal processes. Holstein dairy cattle were fed a range (approx. Sixteen to 21 kg DM/d) of grazed pasture plus wheat and silage supplementation (6 to 12 kg DM/d total supplement). Cows averaged 22.2 kg (SD 4.3) of ECM for 283 d Molly) is a mechanistic, dynamic model describing ruminal and body processes at an aggregated pathway level. An updated set of VFA stoichiometry, including lactate and valerate based on pools of amylytic and cellulytic bacteria, and protozoa, which all produced VFA from substrates differently, was integrated into Molly. The observed intake and chemical composition were direct inputs, and VFA production, ruminal pH, milk and milk composition were outputs. Inclusion of the bacterial pools allowed for the estimation of lactate and valerate production. Lactate uptake was highly correlated with lower milk fat (RSQ = −0.96, $P < 0.01$); a finding which although has been known for some time, we have not yet had a model which could predict it. Both versions of the model described VFA production, ruminal pH, milk and milk composition within 1 SD of the observed means; for example, rumen pH in a short-term, within day feeding trial was predicted with a root mean square prediction error of 3.7%, primarily composed of random error and a slight (30% of RMSPE) mean error, slope error was not different from zero and RMSPE was 32% of the SD. The newest version of the Molly model opens a new ability to ask more specific, complex research questions into the efficiency of dairy cattle in various situations.

Key Words: acidosis, metabolic model, milk fat

291 Multi-component versus one-component analysis: A different way of assessing the effect of TMR chemical composition on milk, fat, and protein yield individual lactation curves. **M. Caccamo*[1], R. F. Veerkamp[2], G. Licitra[1,3], R. Petriglieri[1], F. La Terra[1], A. Pozzebon[1], and J. D. Ferguson[4],** *[1]1CoRFiLaC, Regione Siciliana, Ragusa, Italy, [2]WageningenUR Livestock Research, Animal Breeding and Genomics Centre, Lelystad, the Netherlands, [3]Catania University, DISPA, Catania, Italy, [4]University of Pennsylvania, PA.*

The objective of this study was to examine the effect of chemical composition of TMRs tested quarterly from March 2006 through December 2008 on milk, fat, and protein yield curves for 27 herds in Ragusa, Sicily. Prior to this study, standard yield curves were generated on data from 241,153 test day records of 9,809 animals from 42 herds in Ragusa province collected from 1995 to 2008. A random regression sire-maternal grandsire model was used to develop variance components for yields. The model included parity, age at calving, year at calving, and stage of pregnancy as fixed effects. Random effects were herd × test date, sire and maternal grandsire additive genetic effect, and permanent environmental effect modeled using 3-order Legendre polynomials. Model fitting was carried out using ASREML. Subsequently, the model with fixed variance components was used to examine the influence of TMR CP, soluble nitrogen (Soluble N), acid detergent lignin (ADL), NDF, acid detergent fiber (ADF), starch, and ash on milk, fat, and protein yield curves. The data set contained 46,531 test-day milk yield records from 3,554 cows in the 27 herds recorded during the study period. Initially, an analysis was performed using one-dietary component (one-component) within each model as fixed effects associated with the test day record closest to month the TMR was sampled within each herd. An interaction was included with the nutrient component and DIM. The effect of the TMR chemical component(s) was modeled using a 9-order Legendre polynomial. Conditional Wald F statistic on fixed effects revealed significant effects ($P < 0.001$) for ADF, NDF, CP, and starch, and their interactions with DIM on milk, fat and protein yield. Based on these results, a multi-component analysis was performed where CP, NDF, and starch were simultaneously included in the model with DIM interactions. Although both analyses revealed diet composition influenced production responses depending on lactation stage, the multi-component analysis showed more pronounced effects of starch and NDF relative to CP for all traits throughout lactation.

Key Words: lactation curve, TMR, test day model

292 Intestinal digestibility of long chain fatty acids in lactating dairy cattle: A meta-analysis. J. C. Ploetz* and A. L. Lock, *Michigan State University, East Lansing.*

This analysis was performed to examine the intestinal digestibility of individual long chain fatty acids (FA) in lactating dairy cows. Available data were collated from 15 publications containing 61 treatments, which reported total and individual FA duodenal flows and calculations of intestinal digestibility. All studies involved lactating dairy cows and estimates of digestibility were based on measurements either between the duodenum and ileum or between the duodenum and feces. Analysis was performed using Comprehensive Meta Analysis v2 software that calculated the effect size using a random effects model. FA digestibility was calculated for C16:0, C18:0, C18:1 (*cis* and *trans* isomers), C18:2, and C18:3. Initially, intestinal FA digestibility was determined by pooling data regardless of site of collection. Percent digestibility (mean ± SE) were 75.9 ± 1.4, 73.3 ± 1.4, 80.7 ± 1.5, 77.9 ± 1.4, and 76.9 ± 1.6 for C16:0, C18:0, C18:1, C18:2, and C18:3, respectively. Digestibility of C18:0 was lower than for C18:1 ($P < 0.05$). Digestibility estimates for 18-carbon FA were subsequently separated according to site of collection (ileal vs. fecal). Ileal vs. fecal digestibility for C18:0 was 74.3 ± 2.0 vs. 68.7 ± 4.2. Digestibility of C18:1 was 80.1 ± 1.6 vs. 81.8 ± 0.6 for ileal vs. fecal. Comparing results for C18:0 and C18:1 calculated at the ileum indicate that the digestibility of these FA was not different ($P > 0.05$). Site of collection altered digestibility estimates for C18:2

(70.3 ± 2.8 vs. 79.7 ± 1.3; ileal vs. fecal, $P < 0.05$) and C18:3 (66.9 ± 4.5 vs. 79.4 ± 0.6, ileal vs. fecal, $P < 0.05$). In summary, digestibility estimates differed based on collection site (ileal vs. fecal) and degree of unsaturation of FA. These results suggest that unsaturated FA are biohydrogenated in the large intestine which would result in an over-prediction of unsaturated FA digestibility and an under-prediction of saturated FA digestibility when calculated from fecal collection. Since the amount of unsaturated FA reaching the large intestines is small, differences associated with digestibility estimates for unsaturated FA due to site of collection can be large. Relative differences in the digestibility of individual FA are minimal in lactating dairy cattle.

Key Words: fatty acid, digestibility, meta-analysis

293 Effect of replacing dietary soybean meal with canola meal on production of lactating dairy cows. G. A. Broderick*[1], A. P. Faciola[2], L. Nernberg[3], and D. Hickling[3], *[1]U.S. Dairy Forage Research Center, Madison, WI, [2]University of Wisconsin, Madison, [3]Canola Council of Canada, Winnipeg, MB, Canada.*

Previous research suggested that CP from canola meal (CM) was used more efficiently than CP from solvent soybean meal (SBM) by lactating dairy cows. We compared supplementation of either CM or SBM on both low CP (14.9% CP) and high CP (16.8% CP) diets and tested whether feeding rumen-protein Met plus Lys (RPML) was advantageous. Fifty lactating Holstein cows were blocked by DIM and parity into 10 squares in a replicated 5 × 5 Latin square trial. Five squares were fed: 1) low CP with SBM, 2) low CP with CM, 3) low CP with SBM + CM, 4) high CP with SBM, and 5) high CP with CM; the other 5 squares were fed the same diets except with added RPML (20 g/d of Met and 69 g/d of Lys). Diets contained (DM basis): 40% corn silage, 26% alfalfa silage, 13–23% corn grain, 2.4% mineral-vitamin premix and 31–33% NDF. Periods were 3-wk (total 15 wk); data from the last wk were analyzed using the Mixed procedure of SAS. LS-means and contrasts are reported in the table. There were no significant effects of RPML in this trial ($P \geq 0.11$). Increased CP (diets 4 and 5 vs. 1 and 2) increased fat yield and greatly elevated MUN. Relative to SBM, feeding CM increased DMI, and yield of milk and protein, and depressed MUN. At 14.9% CP, there was similar response in DMI and weight gain on CM and SBM + CM vs. SBM. In this trial, replacing SBM with CM resulted in improved production and N-efficiency at both 14.9 and 16.8% CP.

Table 1.

CP, %:	15	15	15	17	17		Contrasts[1]		
Protein:	SBM	CM	SBM +CM	SBM	CM	SE	[CP]	S vs C	S vs CS
Variable									
DMI, kg/d	24.8	25.3	25.3	25.2	25.5	0.4	0.29	0.04	0.04
BW gain, kg/d	0.28	0.54	0.47	0.50	0.41	0.09	0.78	0.33	0.04
Milk, kg/d	39.5	40.2	40.2	39.9	41.1	0.8	0.06	<0.01	0.08
Milk/DMI	1.59	1.59	1.59	1.59	1.62	0.02	0.24	0.15	0.97
Fat, kg/d	1.56	1.59	1.58	1.60	1.65	0.04	0.03	0.10	0.39
Protein, kg/d	1.19	1.21	1.21	1.21	1.24	0.02	0.10	0.04	0.28
SNF, kg/d	3.47	3.51	3.51	3.49	3.57	0.07	0.31	0.11	0.39
MUN, mg/dL	9.9	8.7	9.6	13.2	12.0	0.2	<0.01	<0.01	<0.01

[1][CP] = CP content; C = CM; S = SBM; CS = SBM + CM.

Key Words: canola meal, rumen-protected AA, soybean meal

294 Milk yield and composition of dairy cows fed diets combining pasture and total mixed ration. A. Mendoza[1,2], C. Cajarville[3], E. de la Quintana[1], M. E. Garmendia[1], E. Mutuberría[1], E. de Torres[4], and J. L. Repetto*[1], *[1]Facultad de Veterinaria, Departamento de Bovinos, Montevideo, Uruguay, [2]Instituto Nacional de Investigación Agropecuaria, Programa de Producción de Leche, Colonia, Uruguay, [3]Facultad de Veterinaria, Departamento de Nutrición Animal, Montevideo, Uruguay, [4]Facultad de Veterinaria, Campo Experimental Nº2, Libertad, Uruguay.*

To establish the effects of time of access to fresh pasture on milk yield and composition of cows fed a total mixed ration (TMR), 9 Holstein cows (mean BW = 572 kg; SD = 76) fed a TMR were assigned to three 3 × 3 Latin squares, with 20-d periods and sampling on the last 10 d of each period. Treatments evaluated were: 0 (TMR0), 4 (TMR4) or 8 (TMR8) hours of daily access to fresh pasture. Pasture (*Lolium multiflorum*; 22.1% CP, 24.0% ADF) was daily cut and offered ad libitum from 0800 h in individual stalls and TMR (16.8% CP, 16.4% ADF) was offered ad libitum during the remaining time. Cows were milked twice daily. Milk yield was measured during 5 consecutive days and individual milk samples were taken during 4 consecutive milkings of each period and analyzed for milk composition. Data were analyzed with a general linear model. There were no differences between TMR0 and TMR4 for any trait. However, compared with TMR0, an allowance of 8 h per day of access to fresh pasture decreased ($P < 0.05$) milk yield (32.7 vs. 34.4 kg/day; SEM = 1.5), 4% solids-corrected (32.5 vs. 34.8 kg/day; SEM = 1.0), protein (1.06 vs. 1.13 kg/day; SEM = 0.04) and total casein yield (0.80 vs. 0.86 kg/day; SEM = 0.03), and tended to decrease ($P < 0.10$) milk fat (1.29 vs. 1.40 kg/day; SEM = 0.05) and lactose yield (1.62 vs. 1.70 kg/day; SEM = 0.08). Milk fat (4.01%; SEM = 0.22), protein (3.31%; SEM = 0.13), total casein (2.50%; SEM = 0.11), lactose (4.94%; SEM = 0.06) percentage, total casein / protein ratio (0.756; SEM = 0.005) and MUN (19.9 mg/dl; SEM = 0.97) were not affected by treatments. It was concluded that time of access to fresh pasture influenced both milk and solids yield but not composition of TMR-fed dairy cows.

Key Words: milk composition, pasture, total mixed ration

295 Effects of dietary fiber source on lactation performance, nutrient digestion, and rumen microbial protein synthesis in early-lactating dairy cows. W. Zhu,* Y. Fu, B. Wang, Y. M. Wu, and J. X. Liu, *Institute of Dairy Science, MoE Key Laboratory of Molecular Animal Nutrition, College of Animal Sciences, Zhejiang University, Hangzhou, China.*

The objective of this study was to evaluate the effects of fiber source on lactating performance, rumen fermentation, nutrient digestion, and microbial protein synthesis in early-lactating dairy cows. Three multiparous (BW = 608 ± 20.0 kg, parity = 2 to 4) and 12 primiparous (BW = 552 ± 16.0 kg) Chinese Holstein cows at 45 (±6.0) d in milk were used in a multiple 3 × 3 Latin square involving 3 dietary treatments. All diets were isonitrogenous and isocaloric with ratio of forage to concentrate at 45: 55 (DM basis), and contained nearly the same concentrate mixture, but different forage source (%): corn silage 21, corn stover 19, and alfalfa hay 5 (CS); corn silage 19, Chinese wild rye hay 21, and alfalfa hay 5 (CW); and corn silage 19, Chinese wild rye hay 9, and alfalfa hay 17 (AH). Each period lasted for 21 d with the first 14 d for adaptation. Neither dry matter intake nor milk yield was significantly affected by the source of fiber. However, an increased trend occurred in milk yield for diet AH. Percent of milk protein was higher ($P < 0.05$) in cows on diet AH than that on CW (3.00 ± 0.104 vs. 2.91 ± 0.192%), with an intermediate value (2.94 ± 0.200%) for diet CS, but milk fat,

milk lactose, and total solid content were not affected across the treatments. Milk efficiency (milk yield / DM intake) was higher for diet AH than for CS (1.55 ± 0.032 vs. 1.42 ± 0.032, $P < 0.05$) with medium value for diet CW (1.49 ± 0.039). Rumen fluid pH was not affected, but ammonia-nitrogen concentration was higher ($P < 0.05$) for diet CS than for CW or AH. Volatile fatty acid concentrations were higher ($P < 0.05$) in cows consuming diet AH than those on CS (113 vs. 103 mmol/L), with no difference between diets CW and AH or CS. Apparent total tract digestibility of DM was higher ($P < 0.05$) for diet AH than for CS or CW (70.2 vs. 63.7 or 64.5%), while the digestibility of NDF (61.8 vs. 57.2 or 56.9%) and ADF (58.8 vs. 53.2 or 52.5) was higher ($P < 0.05$) for diet CS than for CW or AH. Excretion of purine derivatives (374 vs. 323 or 338 mmol/d) was higher for diet AH than for CS or CW but with no difference between diets CS and CW, and microbial N flow to the duodenum (215 vs. 186 or 195 g/d) was higher in cows on diet AH than in those on CS with no difference between diets CW and AH or CS. These results indicated that corn stover could replace Chinese wild rye grass in the diets for lactating cows, and that high proportion of alfalfa hay in the diet is beneficial for milk protein production.

Key Words: dietary fiber source, microbial protein, lactation performance