TH247 Influence of concentrate and protein levels on milk production by Holstein cows. R. P. Lana*[1,2], G. F. Sobreira[1], M. I. Leão[1], J. A. Freitas[3], D. C. Abreu[1], W. C. Lopes[1], and G. Guimarães[1], [1]*Universidade Federal de Viçosa*, *Viçosa, MG, Brazil*, [2]*CNPq*, *Brasília, DF, Brazil*, [3]*Universidade Federal do Paraná*, *Palotina, PR, Brazil*.

According to the Biotechnology and Biological Sciences Research Council (1998), formerly AFRC, all existing feeding systems are designed to balance nutrients to meet the animals' requirements, but the authors recognize that in practice, the farmer has no obligation to do that if it is contrary to the economic profitability. An experiment was developed to evaluate the effect of four levels of concentrate - CON (30, 40, 50 and 60%) and four of crude protein - CP (12, 14, 16 and 18%) in the total dry matter (DM) on milk production and composition in confined Holstein cows. Forty-eight animals (640 kg LW) were allotted in two 4 x 4 Latin squares (six cows/pen), in four periods of 28 days, divided in four sub periods of seven days. The CON was distributed in the plots and the CP in the subplots. The forage was corn silage and the CON constituted of corn meal, soybean meal, urea, and mineral supplements. There were no effects (P>0.05) of CP and CP*CON on animal body weight, feed intake (forage, CON, and total DM), milk production and composition, showing that 12% CP was as effective as 18% in the cows performance. The 30% CON diet presented DMI, CON intake and milk production of 17.5, 5.3 and 19.1 kg, respectively. The CON level increased (P<0.01) DM and CON intake, and decreased (P<0.01) forage intake by 0.188 kg, 0.288 kg, and 0.093 kg, and increased (P<0.05) milk production by 0.151 kg per unit (%) of CON level, with no effect on milk composition (P>0.05). Although milk production increased, the marginal response reduced (P<0.05) with increasing CON (0.88, 0.43, and 0.58 kg of milk/kg of CON DM, for the levels of 40, 50 and 60% versus 30% CON). Relation lesser than 1 kg of milk/kg of CON can compromise the profitability, and then diet formulation should consider the cost-benefit ratio and not the balance of nutrients to meet the nutritional requirements of the animals, especially after breeding.

Key Words: Concentrate, Milk, Protein

TH248 Blood and ruminal metabolites of early lactating Iranian Holstein cows fed raw or roasted whole soybean. M. H. Fathi Nasri*[1], M. Danesh Mesgaran[2], R. Valizadeh[2], and H. Farhangfar[1], [1]*The University of Birjand*, *Birjand, Iran*, [2]*Ferdowsi University of Mashad*, *Mashad, Iran*.

This study evaluated responses of early lactation Iranian Holstein cows to feeding roasted whole soybean (SB) or raw SB in diets with lucerne hay and corn silage as the primary forage source. Treatments consisted of a total mixed ration that included 387 g/kg forage supplemented with 1) 120 g/kg of roasted SB and 82 g/kg of cottonseed meal (CSM), 2) 120 g/kg of raw SB and 82 g/kg of CSM or 3) 120 g/kg of soybean meal (SBM) and 82 g/kg of cottonseed (CS), on a dry matter (DM) basis. The diets which were formulated to be iso-nitrogenous and iso-caloric were offered to fourteen multiparous Holstein cows (body weight = 617.0 kg, days in milk = 16.9) that were assigned randomly to one of three experimental diets for a 45-d trial. Roasted SB were obtained by roasting seeds for 1.5 to 2 min in a commercial roaster (exit temperature of seeds was about 140-145°C) and immediately placing, without cooling, in covered wooden barrels for 45 min. A dietary effect on rumen pH values, glucose and beta-hydroxy butyrate (BHB) concentrations were not detected among cows fed different diets (Table 1). Rumen ammonia N concentration were significantly lower for the cows fed roasted SB compared with those fed raw SB. The lower ruminal ammonia concentration in cows fed roasted SB diet compared with raw SB diet, possibly arose as a consequence of lower ruminal protein degradability of roasted SB. Plasma urea nitrogen (PUN) concentrations were also significantly (p<0.031) lower in cows fed roasted SB than in cows fed raw SB that confirms the reducing of ruminal protein degradability of roasted SB.

Table 1.

Item	SBM plus CS	Raw SB plus CSM	Roasted SB plus CSM	SEM	Contrast[1]	
pH	6.22	6.18	6.20	0.08	NS[2]	NS
Ammonia N	13.7	14.3	12.8	0.30	0.024	NS
Glucose	57.3	59.0	59.3	2.86	NS	NS
Beta-hydroxy-butyrate	8.97	9.95	9.16	1.88	NS	NS
Plasma urea N	18.3	18.8	16.5	0.68	0.031	NS

[1] Contrast includes 1) roasted SB vs. raw SB and 2) SB plus CSM vs. SBM plus CS. [2] P > 0.05.

Key Words: Whole Soybean, Early Lactation, Iranian Holstein Cow

TH249 Endogenous nitrogen (EN) flows: Effects of metabolizable protein (MP) supply in lactating dairy cows. D. Valkeners[1], H. Lapierre[1], U. Schönhusen[2], P. Junghans[2], C. C. Metges[2], and D. R. Ouellet*[1], [1]*Agriculture and Agri-Food Canada*, *Sherbrooke, QC, Canada*, [2]*Research Unit Nutritional Physiology*, *Dummerstorf, Germany*.

The current NRC model (2001) estimates EN at the duodenum as 1.9 g per d per kg DMI, with no allowance for differences in diet quality. The current study used 4 lactating cows in a replicated incomplete 3×3 Latin square to study the effect of MP supply on EN flows. Cows were fed every 2h a TMR. Three concentrates were formulated to provide NE_L according to requirements (126 MJ/d) and to supply incremental amounts of MP:1430 (Low), 1920 (Medium) and 2160 (High) g MP/d, which corresponded to 72, 98 and 111% of estimated MP requirements. From d 27 to 35, cows were infused into a jugular vein with L-[^{15}N] leucine (0.45 mmol/h). On d 34 and 35, rumen and intestinal mucosa, duodenal digesta and feces were sampled (4 samples/d) to determine EN flows (see Table), as previously described (Ouellet et al., 2002; JDS 85:3013). The N flows across the gut are presented in the Table. Total duodenal N flow increased from Low to High MP as did the flow of undigested feed. The duodenal flow of free EN and of total EN increased linearly with increased MP supply, although, contribution of EN to bacteria protein was unaffected by treatments. The EN loss in feces did not vary with treatments and represented 2.1 g/kg of DMI. Overall, total EN varied (P = 0.03; linear) with increasing MP supply (4.2, 4.7 and 4.8 ± 0.2 g/kg of DMI), representing 16% of duodenal N flow. Contribution of EN to bacteria flow is about equal to free EN and needs to be included in EN duodenal flows. Fecal EN flow provides a direct estimation of metabolic fecal loss.

Table 1. Duodenal and fecal nitrogen flow in dairy lactating cows fed different level of metabolizable protein

Item	Treatment			SEM	P	
	Low MP	Medium MP	High MP		Linear	Quadratic
Intake	356	468	516	7.8	0.001	NS
Total	383	510	574	9.5	0.001	NS
Undigested feed	60	123	170	7.4	0.001	NS
Free endogenous N	19	26	27	2.1	0.04	NS
Bacterial N from endogenous	51	55	55	2.6	NS	NS
Bacterial N from feed	215	256	276	7.2	0.01	NS
Bacterial N from urea	39	49	46	3.5	0.06	NS
Total fecal N	140	156	159	6.6	0.06	NS
Fecal endogenous N	36	36	35	2.6	NS	NS

Key Words: Endogenous, Gastrointestinal Tract, Metabolizable Protein

TH250 Is D-methionine (Met) used by the dairy cow? H. Lapierre*[1], G. Holtrop[2], A. G. Calder[3], J. Renaud[1], and G. E. Lobley[3], [1]*Agriculture and Agri-Food Canada*, *Sherbrooke, QC, Canada*, [2]*BioSS, Rowett Research Institute*, *Aberdeen, UK*, [3]*Rowett Research Institute*, *Aberdeen, UK*.

Rumen-protected forms of Met are an equimolar mixture of the two isomers, D and L. Only L-Met can be used for protein synthesis, but it is unclear if the D isomer can be transformed into L in ruminants. Four lactating dairy cows averaging 675 kg BW and 32.5 kg/d of milk received a basal diet (12.0%CP) in twelve equal meals per day plus an abomasal infusion of AA (590 g/d, casein profile without Met). In a first study, they received portal infusions of 5, 10 or 15 g/d of DL-Met, in two incomplete Latin squares. On the last d, six arterial samples were collected at 45 min intervals. Concentrations of L- and D-Met were determined by gas-chromatography-mass spectrometry. Increasing infusion rates of DL-Met increased total Met plasma concentrations (19.7, 25.0 and 34.4 ± 0.6 μM, P<0.001) and the proportion of D (19.4, 30.5 and 37.3 ± 0.7 %, P<0.001). The fractional removal of D-Met from plasma (infusion rate/plasma pool of D-Met) decreased (P=0.02) at the highest infusion rate, averaging 5.6, 5.5 and 5.0 ± 0.1 /h, approximately 7-8 times slower than removal of L-Met (44/h). A second study determined if the removed D-Met was transformed into L-Met. The same cows were infused for 8 h with L-[$^2H_3$]Met (1.3 mmol/h) to determine whole body irreversible loss rate (ILR; 21.2 ± 2.6 mmol/h) based on plasma [$^2H_3$]Met enrichment. At 2h cows received a bolus venous injection of D-[^{13}C]Met (6.8 mmol) and arterial samples were collected after 10, 20, 30, 40, 60, 90, 120, 150, 180, 240, 300, 360, 420 and 480 min. The ^{13}C enrichments of the D and L isomers were expressed relative to L-[^{12}C]Met. Enrichment of L-[^{13}C]Met averaged 14.4 ± 3.7 mole percent excess 10 min after the bolus injection and declined exponentially thereafter. The minimum proportion of D-Met transformed into L-Met, calculated from (ILR × area under curve of L-[^{13}C]Met enrichment/dose D-Met) averaged 75 ± 6%. In conclusion, D-Met is transformed into L-Met in dairy cows, but with the rate of removal of the D-isomer much slower than the L form.

Key Words: Methionine, Isomer, Ruminant

TH251 Response in feed intake, blood metabolites, and milk production to varying ruminal protein undegradability in early lactation Holstein cows. M. Jahani-Moghadam[1], H. Amanlou[2], and A. Nikkhah*[2,3], [1]*Islamic Azad University*, *Karaj, Iran*, [2]*Zanjan University*, *Zanjan, Iran*, [3]*University of Illinois*, *Urbana*.

Effects of different dietary ratios of rumen undegradable (RUP) to degradable (RDP) protein on ruminal digestion, feed intake, blood metabolites, and milk yield were determined in early-lactation cows. Four multiparous (43 ± 5 days in milk) and four primiparous (40 ± 6 days in milk) tie-stall-housed Holstein cows were used in a duplicated 4 × 4 Latin square design trial with four 21-d periods. Each period had 14-d of adaptation. Diets contained, on a dry matter (DM) basis, 23.3% alfalfa hay, 20% corn silage, and 56.7% concentrate. Cows were first offered alfalfa hay at 0700, 1500, and 2300 h, and 30 min after each alfalfa hay delivey were offered a mixture of corn silage and concentrate. Treatments were diets with RUP:RDP ratios of 1) 5.2:11.6% (CO), 2) 6.1:10.6%, 3) 7.1:9.5%, and 4) 8.1:8.5%. Different RUP:RDP ratios were obtained by partial and total replacement of untreated soybean meal (SBM) with xylose-treated SBM. An in situ study showed that DM (27.1 vs 21.3%) and crude protein (CP, 20.4 vs 3.6%) of untreated SBM had greater rapidly degradable fractions. The slowly degradable CP was degraded more quickly in xylose-treated SBM than in untreated SBM (5.8 vs 2.0%/h). Treatment cows produced more milk (32 vs 29 kg/d) and had greater yields of milk protein, lactose, solids-non-fat and total solids than cows fed untreated SBM. Increasing dietary RUP:RDP ratio reduced blood urea N linearly (22.5 vs 18.4, 17.6, 16.7 mg/dL). Feed costs dropped at RUP:RDP ratios of 6.1:10.6 and 7.1:9.5 but not at the ratio of 8.1:8.5%, compared to the control 5.2:11.6% ratio. Intake of DM and CP, rumen pH, blood glucose, albumin and total protein, fecal and urine pH, changes in body weight and body condition score, and milk lactose and solids-non-fat percents did not differ among treatments. Therefore, increasing dietary RUP:RDP ratio from 5.2:11.6% up to 7.1:9.5% improved milk production and reduced feed costs in early lactation cows fed diets based on barley and corn grain, SBM, alfalfa hay and corn silage. Reduced blood urea may suggest reproductive benefits.

Key Words: Rumen Degradability, Soybean Protein, Early Lactation Cow

TH252 Effect of rumen degraded and rumen undegraded protein onmicrobial protein synthesis in mid-lactation cows. S. K. Ivan-Dinh*[1], R. L. Baldwin, VI[2], and R. A. Kohn[1], [1]*University of Maryland*, *College Park*, [2]*USDA-ARS, Bovine Functional Genomics Laboratory*, *Beltsville, MD*.

The objective of this study was to determine the effect of rumen degraded protein (RDP) and rumen undegraded protein (RUP) on microbial protein synthesis in lactating dairy cattle, and evaluate the ability of the

National Research Council (NRC) 1989 and the NRC 2001 models to predict these flows. Eight mid-lactation Holstein cows were assigned to a repeated 4 × 4 Latin square, balanced for carryover effects. The isoenergetic diets were arranged in a factorial design (RDP at 10.0 and 12.5% and RUP at 5.6 and 8.0% of ration dry matter). The 8.0% RUP diets tended to increase liquid flow out of the rumen (P = 0.06), N flowing with the liquid fraction (P = 0.09), and liquid-associated bacterial N flow (P = 0.10). Potential transfer of excess RUP to the rumen in the form of urea-N did not increase microbial N flow out of the rumen. Rumen degradable protein did not affect flow of total N or microbial N out of the rumen. The NRC 1989 model predicted MN flow, total N flow, and rumen N balance more accurately than the NRC 2001 model. The NRC 1989 model predicted a negative rumen N balance across all four diets with no mean or linear bias, while the NRC 2001 predicted positive rumen N balance for all diets with a significant mean bias. The low estimate of MN flow by the NRC 2001 model resulted in an overestimate of rumen N balance, which could lead to inaccuracies in prediction of RDP and RUP requirements. The NRC 2001 underestimate of MN flow from the rumen resulted because the model does not account for the potential of urea-N recycling to be greater than ammonia absorption from the rumen, which would provide additional N for microbial protein synthesis. An accurate prediction of the RDP and RUP requirements is necessary given the potential negative environmental impact of overfeeding either one of these protein sources. Since MN is an integral part of the RDP prediction equations, model predicted MN flow needs to match actual flow, and currently the NRC 1989 prediction reflects the actual flow better than the NRC 2001 prediction.

Key Words: Rumen Degraded Protein, Rumen Undegraded Protein, Microbial Protein Synthesis

TH253 Nitrogen balance and excretion from grazing lactating cows supplemented with conjugated linoleic acid (CLA). D. E. de Oliveira*[1], S. R. de Medeiros[2], and D. P. D. Lanna[3], [1]*Centro de Educação Superior do Oeste, Universidade Estadual de Santa Catarina/CEO, Chapecó, Santa Catarina, Brasil*, [2]*Centro Nacional de Pesquisa de Gado de Corte, Campo Grande, Mato Grosso do Sul, Brasil*, [3]*Universidade de São Paulo/ESALQ, Piracicaba, São Paulo, Brasil*.

The synthetic conjugated linoleic acid (CLA) has been used to alter milk composition, improve reproductive performance and increase CLA content of bovine milk with potential benefits to human health. Although CLA has been extensively studied, few reports have evaluated the changes in nutrient excretion of CLA-treated cows. The objective of this study was to measure the nitrogen (N) secretion in milk and estimate the excretion of N in cows receiving CLA. Twenty six lactating Holstein × Gir cows (28 to 84 DIM) were used in a complete randomized design, eleven cows were individually fed 150g of CLA (30.5% c9t11, 33.1% t10c12) and the remaining fifteen cows were fed 150 g of Megalac (MEG), mixed in the concentrate (4 kg/day, as fed). All cows grazed a pasture of Stargrass that contained, on average, 14.6% CP, 2.1% fat, 65.8% NDF, 44.0% NDFIP, 29.2% ADF, 13.6% ADFIP, 4.9% lignin, and 9.7% ash on DM basis. The mean chemical composition of the concentrate was 25.1% CP, 5.6% fat, 11.0% NDF, 6.6% NDFIP, 3.9% ADF, 2.5% ADFIP, 3.3% lignin, 16.1% ash. The n-alkanes C_{32}, C_{31} and C_{33} were used to estimate individual forage intake. The CNCPS v. 5.04 was used with the inputs above to estimate N balance for each individual cow and the data were analyzed using SAS PROC GLM. CLA supplementation had no effect on milk yield (CLA = 15.9, MEG = 14.6 kg/day; P=0.25), decreased milk fat content (CLA = 2.1, MEG = 3.1%; P=0.0001) and increased milk protein content (CLA = 3.1, MEG = 2.8%; P=0.005). The DM intakes of forage (CLA = 11.5, MEG = 12.1 kg/day; P=0.46) and concentrate (CLA = 3.5, MEG = 3.4 kg/day; P=0.81) were similar between treatments. There was no effect of treatment on CP intake (CLA = 2.5, MEG = 2.5 kg/day; P=0.68), total N excretion (CLA = 330, MEG = 340 g/day; P=0.49), and N digestibility (CLA = 88.3, MEG = 88.3%; P=0.97). The CLA supplementation affected N distribution (% of total N intake) in milk (CLA = 19.4, MEG = 15.7%; P=0.006), reduced the N excretion as a function of daily milk protein yield (CLA = 647, MEG = 847 g/kg; P=0.009). CLA treatment decrease in N excretion per unit of milk protein produced.

Key Words: Nitrogen Balance, Nitrogen Excretion, Conjugated Linoleic Acid

TH254 Effects of an extruder-expelled soybean meal product on milk production and components for Holstein dairy cows. Y.-H. Chung*, K. S. Heyler, J. A. Hartzell, V. A. Ishler, and G. A. Varga, *The Pennsylvania State University*, *University Park*.

Soybean meal (SBM) has been treated in various ways to enhance the quantity of rumen undegradable protein, and several commercial sources of treated SBM are available for use in the diets for dairy cattle. An extruder-expeller processed SBM product (SoyChoice; Wenger's Feed Mill, Inc., Rheems, PA) is produced by mechanically pressing the oil out of the meal and its effects on milk yield and components for Holstein dairy cows were evaluated. This extruder-expelled SBM product was fed at 4% ration DM for 17 d. A similar SBM product (Turbomeal; J. L. Moyer and Sons Inc., Turbotville, PA) was fed at 3.6% ration DM and served as the control. Both rations were formulated to a similar nutrient composition and contained 15% CP and 33% NDF (DM basis). Cows were fed once and milked twice daily. Milk yield for individual cows was recorded at each milking, and individual milk was sampled weekly from two consecutive milkings and analyzed for components. In situ degradability of this SBM product was conducted. Milk yield for the treatment group (cow=32, first-calf heifer=26; DIM=132±109 SD) was similar before (41.2 kg/d) and after (42.7 kg/d) the 17-d treatment period and did not differ from the control group (41.4 kg/d) (cow=34, first-calf heifer=26; DIM=126±102 SD). Percentages and yields of milk components were not affected by treatment and were similar before and after treatments. Percentages of milk fat and protein were 3.5 and 3.1% and 3.7 and 3.1% for the treatment and control groups, respectively. The calculated income over feed costs was 3.9% greater for the treatment compared with the control. In situ DM disappearance for this SBM product was 60, 68, and 84% and in situ CP disappearance was 43, 54, and 75% at 12, 16, and 24 hours of rumen incubation. The estimated effective ruminal degradability for this SBM product was 67.8% and fractional degradation rate was 8.5%/h. Based on similar production results, it is concluded that this extruder-expelled SBM product is comparable to a similar SBM product evaluated and offers another source of protein in dairy cow rations.

Key Words: Extruder-Expelled Soybean Meal, Milk Yield and Component, Rumen Degradation Kinetic

TH255 Increasing methionine, lysine or both does not increase milk protein percent in either high producing or low producing dairy cows. H. F. Bucholtz*[1], J. S. Liesman[1], P. N. Naaz[2], M. J. Stevenson[3], W. H. Heimbeck[3], and R. A. Patton[4], [1]*Michigan State University*, *East Lansing*, [2]*Upper Peninsula Experiment Station*, *Chatham, MI*, [3]*Evonik-Degussa AG*, *Hanau, Germany*, [4]*Nittany Dairy Nutrition*, *Mifflinburg, PA*.

The objective was to determine the interaction between production level and predicted levels of lysine (LYS) and methionine (MET) on milk yield and milk protein. Forty midlactation Holstein cows (16 primiparous and 24 multiparous) were randomly assigned within parity to either high or low production blocks and within each block were assigned to 1 of 4 dietary treatments, designed to be isonitrogenous but varying in content of MET and LYS. Diets were: low MET and low LYS (LL); high MET and low LYS (HL); low MET and high LYS (LH); or high MET and high LYS (HH). MET and LYS were increased by adding a RPMet (Mepron®, Evonik-Degussa Corp.) or by replacing corn gluten meal with blood meal. Mean analyzed nutrient content of diets was 17.1% CP, 18.7% ADF, 28.5% NDF and 27.48% starch. Calculated MET and LYS as % of MP were: LL, 1.88 and 6.07; HL, 2.22 and 6.05; LH, 1.82 and 6.38; HH, 2.11 and 6.37 according to the NRC model. Experiment was for 3 periods of 21 d. Statistical analysis was by the Proc Mixed of SAS. Model included terms for parity (primiparous or multiparous), production level (high or low), block, period and diet. Production data is presented below. Diet had no effect on any production variable, nor were there any diet*parity or diet*production interactions. This may have been due to failure to reach levels of MET and LYS as recommended by NRC. We conclude from this study that increasing MET and LYS as % MP to cows in midlactation does not increase kg milk protein regardless of production levels. This may be due to preset homeostatic regulation.

Table 1.

Variable	High Production				Low Production				
Diets	LL	HL	LH	HH	LL	HL	LH	HH	SEM
DMI kg	26.0	25.8	26.9	25.7	23.7	24.3	23.7	23.5	1.02
Milk kg	39.4	39.1	39.3	36.6	29.8	27.2	32.0	28.2	2.54
Fat %	3.26	3.39	3.30	3.66	3.58	3.89	3.58	3.71	0.18
Fat kg	1.28	1.32	1.28	1.32	1.06	1.04	1.14	1.04	0.09
Protein %	2.91	3.06	3.02	3.19	3.25	3.51	3.26	3.31	0.13
Protein kg	1.14	1.20	1.18	1.16	0.95	0.95	1.04	0.93	0.07
Lactose %	5.02	4.79	5.03	4.80	4.99	4.98	4.98	4.98	0.10
Lactose kg	1.98	1.88	1.97	1.76	1.49	1.35	1.60	1.40	0.14
MUN mg-dl	12.62	13.09	14.84	13.61	13.90	11.98	11.98	13.39	0.62

Key Words: Methionine, Lysine, Milk Protein

TH256 Ammonia emissions and olfactometry analysis of limit fed high and low concentrate diets with different forage quality in dairy heifers. G. J. Lascano*, P. A. Topper, A. Adviento-Borbe, D. Topper, R. C. Brandt, E. F. Wheeler, and A. J. Heinrichs, *The Pennsylvania State University*, *University Park*.

Ammonia emissions and odor are being used to regulate animal production. The objectives of this study were to observe the effects of restricted feeding dairy heifers high concentrate (HC) and low concentrate (LC) diets with different forage quality on NH_3 emissions and odor. A split plot design with diet type as the whole plot and forage quality as subplot was administered in a 4-period (21 d) 4 × 4 Latin square using 8 Holstein heifers (321 ± 21 kg initial BW). Periods consisted of 17 d adaptation and 4 d total fecal and urine collection. Corn silage-based diets containing either 80 or 20% forage (DM basis) with 0, 20, 40 or 60% of forage provided by corn stover (CS; quality denominator) were evaluated. NH_3 concentration was determined using an infrared photoacoustic gas analyzer over a 24-h period and urine:feces as-collected from first 2 d of total collection. Odor was evaluated by a certified panel of human assessors utilizing a triangular forced-choice dynamic olfactometer (EN 13725: 2003). NH_3 emissions were different between HC and LC (6.98 vs.10.57 ± 0.44 mgNH_3/g manure; $P < 0.01$), and decreasing quality of forage linearly increased NH_3 emission rate on HC diets ($P < 0.01$). Total daily NH_3 emissions were not different between quality or diet type. Feces:urine was lower for the HC diet (0.48 vs. 2.44 ± 0.44; $P < 0.01$). More feces relative to urine (g/g) was produced as quality of forage decreased ($P < 0.01$). Total manure (kg/d) was significantly higher as forage quality increased ($P < 0.01$), and decreased linearly with the addition of CS in the diets ($P < 0.01$). Results suggest that odor was less offensive as forage quality decreased. We conclude that NH_3 emissions were higher for the LC diets on a unit of manure basis, likely due to a shift in feces:urine. Lower quality forages increased these emissions linearly. Finally, forage quality seemed to have an effect on odor in this study.

Key Words: Ammonia Emissions, Odor, Forage Quality

TH257 Effect of abomasal glucose infusion on splanchnic amino acid metabolism in freshening dairy cows. M. Larsen* and N. B. Kristensen, *University of Aarhus*, *Tjele, Denmark*.

Six Holstein cows implanted with ruminal cannulas and permanent indwelling catheters in the major splanchnic blood vessels were used to investigate the effect of post ruminal glucose supply on splanchnic metabolism of amino acids. Cows were assigned to one of two treatments: Continuous abomasal infusion (INF) of 1500 g glucose/d (via the rumen) or no infusion (control; CON). Treatments were initiated at the day of second calving. Cows were fed ad libitum and the ration was offered in equal meals with 8 hour intervals. Eight hourly sets of arterial, portal vein, and hepatic vein (n = 2 for CON) samples were collected simultaneously starting 30 min before the morning feeding on 4, 15, and 29 days in milk (DIM). Plasma flows were measured by pAH dilution. Essential amino acids (EAA) analyzed in blood plasma were VAL, LEU, ILE, MET, LYS, THR, PHE and HIS; non-EAA analyzed were ASP, ALA, CYS, GLN, GLU, GLY, PRO, SER and TYR. Data was analyzed as a split-plot design, with cows as whole plots (random factor), treatments as whole plot factor and DIM as sub plot factor. Dry matter intake decreased ($P = 0.05$) with INF compared with CON (11 and 17 ± 1 kg/d, respectively). Net portal fluxes of EAA and non-EAA tended to decrease ($P < 0.10$) with INF compared with CON (EAA: 67 and 139 ± 22 mmol/h, respectively; non-EAA: 41 and 121 ± 23 mmol/h, respectively). However, net portal flux of EAA and non-EAA per kg DMI were not affected ($P > 0.10$) by treatment. Net hepatic fluxes of EAA and non-EAA were not affected ($P > 0.10$) by treatment (EAA: 4 and -7 ± 27 mmol/h, respectively; non-EAA: -52 and -99 ± 33 mmol/h, respectively). Net hepatic fluxes of EAA and non-EAA per kg DMI were not affected ($P > 0.10$) by treatment. Net portal and net hepatic fluxes of EAA and non-EAA increased ($P < 0.05$) with DIM for both treatments. In conclusion, abomasal infusion of 1500 g glucose/d did not increase the amount of amino acids available for peripheral tissues

in freshening dairy cows and an amino acid sparing effect of glucose could not be detected.

Key Words: Amino Acids, Glucose, Metabolism

TH258 The performance of calves fed a milk replacer containing wheat protein. A. B. Chestnut* and D. L. Carr, *Vigortone Ag Products*, *Hiawatha, IA*.

The value of wheat protein as a 50% replacement of milk protein in a calf milk replacer was evaluated. The experimental milk replacer (WP) containing wheat protein was formulated to contain 22% crude protein and 18% fat. The control milk replacer (MP) contained 22% crude protein and 20% fat with all the protein derived from milk ingredients. The milk replacers were formulated with similar levels of minerals and vitamins. Both milk replacers were medicated with neomycin (400g/ton) and oxytetracycline (200 g/ton). The trial was conducted with a group of Holstein bull calves that were 10 ± 4 d of age. Calves were randomly assigned to milk replacer treatments. Individual calf weights were recorded on days 1, 21 and 35 of the study. Each calf received 284 g of milk replacer twice daily from d 1 to 28 and once daily from d 29 to 35. Starter feed (18% crude protein) was offered ad libitum beginning d 1 and starter feed intakes were recorded for each calf. Data were analyzed as a completely randomized design using analysis of variance. Differences between means were tested using the least significant difference method. Calves fed WP had similar weight gains as calves fed MP (Table 1). In this study calves fed WP tended (P<0.10) to eat more starter feed than calves fed MP.

Table 1. Effect of wheat protein in milk replacer on calf performance

	Wheat Protein (WP)	All Milk Protein (MP)	P value
No. head	36	34	
Initial age, d	9.9	10.0	ns
Initial wt, kg	46.9	46.3	ns
21 d gain, kg	8.51	8.29	ns
35 d gain, kg	19.29	18.38	ns
Total starter intake, kg	22.9	19.6	< 0.10

Key Words: Calves, Milk Replacer, Wheat Protein

TH259 Effect of Optigen® and ruminally degradable protein level on fermentation, digestion, and N flow in rumen-simulating fermenters. G. A. Harrison*, M. D. Meyer, and K. A. Dawson, *Alltech Biotechnology*, *Nicholasville, KY*.

Replacing plant protein with non-protein nitrogen (NPN) from urea or Optigen® (blended, controlled-release urea) increases ruminally degradable protein (RDP) but effects of RDP source on ruminal metabolism are not well defined. Effects of N source in diets and RDP level were investigated in single-flow rumen-simulating fermenter cultures. Cultures were fed diets with 3 N sources (plant protein, Optigen, urea) and 4 levels of RDP (2.1, 2.3, 2.5, 2.7 g/d). Twelve cultures were used in a 3 × 4 factorial design with 12 dietary treatments and 3 experimental runs. RDP was increased by N from plant protein, urea, or Optigen. Cultures were fed 12.5 g as fed of experimental diets twice daily for 6 days. Samples were collected immediately prior to morning feeding during the last 3 days of the experiment for fermentation analysis. A composite effluent sample from each fermenter was used for DM and NDF disappearance. Nitrogen flow measures were estimated by purine to N ratios for effluent and bacteria. Data were analyzed for effects of dietary treatment using the GLM procedure of SAS. Orthogonal contrasts were used to estimate effects of N source and RDP level (linear). N source affected fermentation with isoacids (m*M*) being higher in plant protein cultures ($P<0.0001$) and ammonia concentration lower in urea cultures ($P<0.10$). CP degradability was greater in urea cultures ($P<0.10$). RDP level affected culture fermentation with linear increases in A:P ratio and ammonia as RDP increased ($P<0.0001$). True DM digestion, CP degraded, bacterial N yield, and efficiency (g bacterial N/kg DM truly digested) increased in a linear fashion with higher RDP ($P<0.001$). Nitrogen source did affect fermentation and N partitioning but not digestion and bacterial N yield. Increasing RDP level shifted fermentation and improved digestion and bacterial yield. Interactions between N source and RDP level on suggest that ruminal microbes respond differently to RDP depending on N source.

Key Words: Ruminally Degradable Protein, Non-Protein Nitrogen, Optigen

TH260 Effect of Optigen® and dietary neutral detergent fiber level on fermentation, digestion, and N flow in rumen-simulating fermenters. G. A. Harrison*, M. D. Meyer, and K. A. Dawson, *Alltech Biotechnology*, *Nicholasville, KY*.

The sustained release of N from Optigen® (blended, controlled-release urea) may be advantageous in diets containing higher neutral detergent fiber (NDF) and lower fermentable carbohydrate. Effects of NPN source and NDF level were investigated in single-flow rumen-simulating fermenter cultures. Cultures were fed diets with 2 NPN sources (urea, 0.58%; Optigen, 0.66% DM) and 3 NDF levels (low=36.5, mid=43.8, high=51.1% DM). Twelve cultures were used in a 2 × 3 factorial design with 6 dietary treatments and 2 experimental runs. Diets were formulated at 16% CP, 75% forage (DM basis) and NDF was increased by changing ratios of corn silage, hay, and straw. Cultures were fed 12.5 g as fed of experimental diets twice daily for 6 days. Samples were collected immediately prior to morning feeding during the last 3 days of the experiment for fermentation analysis. A composite effluent sample from each fermenter was used for DM and NDF disappearance. Nitrogen flow measures were estimated using purine to N ratios for effluent and bacteria. Data were analyzed for effects of dietary treatment using the GLM procedure of SAS. Orthogonal contrasts were used to determine effects of NPN source and NDF level. NPN source did affect culture pH with Optigen cultures being higher (6.40 vs. 6.50, ($P<0.01$). Compared to low NDF, high NDF cultures had higher pH (6.32 vs. 6.58, ($P<0.0001$), more ammonia (4.4 vs. 6.5 mg/dl, ($P<0.05$), lower true DM digestion (65.2 vs. 54.2%, ($P<0.001$), and lower CP degradability (75.8 vs. 70.1% CP, ($P<0.05$). Mid NDF cultures had intermediate values. Bacterial N yield tended to be greater in low compared to high NDF cultures (0.350 vs. 0.314 g/d, ($P=0.11$). On low NDF and high diets, Optigen-fed cultures produced less bacterial N than did urea-fed cultures (-4.8 and -3.3%, respectively). However, on mid NDF diets, Optigen-fed cultures produced 9.7% more bacterial N than their urea-

fed counterparts. Optigen inclusion may be more advantageous when not at dietary extremes.

Key Words: Neutral Detergent Fiber, Non-Protein Nitrogen, Optigen

TH261 Diet formulation strategy and Optigen® effects on fermentation, digestion, and N flow in rumen-simulating fermenters. G. A. Harrison, M. D. Meyer*, and K. A. Dawson, *Alltech Biotechnology*, *Nicholasville, KY*.

Inclusion of Optigen® (blended, controlled-release urea) in ruminant diets allows for formulation changes due to space created with a condensed N source. Effects of two dietary formulation strategies, increasing degradable protein (RDP) or increasing forage, were investigated in single-flow rumen-simulating fermenter cultures. Twelve cultures were used in a completely randomized design with 6 dietary treatments and two experimental runs. Six diets were formulated at 18% CP (DM basis): control (62.5% RDP, 50% forage), urea (65% RDP, 50% forage), Optigen G1 (65% RDP, 50% forage), Optigen G2 (62.5% RDP, 50% forage), Optigen F1 (65% RDP, 53% forage), and Optigen F2 (62.5% RDP as % of CP, 53% forage). NPN from urea (0.48%) and Optigen (0.55%) primarily replaced N from soybean meal. Cultures were fed 12.5 g as fed of experimental diets twice daily for 6 days. Samples were collected from all cultures immediately prior to morning feeding during last 3 days of experiment for fermentation analysis. A composite effluent sample from each fermenter was used for DM and NDF disappearance. Nitrogen flow measures were estimated using purine to N ratios for effluent and bacteria. Data were analyzed for effects of dietary treatment using the GLM procedure of SAS. Orthogonal contrasts were used to determine effects of RDP and forage level (Optigen diets). Dietary treatment did not affect pH, ammonia, digestion, or N flow measures. Cultures fed higher RDP diets degraded more protein (64.3 vs. 67.1% CP, $P<0.05$) and had less undegraded feed N (0.251 vs. 0.231, $P<0.05$). Forage level in Optigen diets did not affect fermentation, digestion, or N flow. Allowing RDP to increase from 62.5 to 65% of CP as Optigen replaced plant protein did not have any negative effects on fermentation or digestion. The formulation strategy of increasing forage (in this case, corn silage) in diets containing Optigen does not appear to have a negative impact on performance in rumen-simulating fermenters.

Key Words: Diet Formulation, Non-Protein Nitrogen, Optigen

TH262 Response of lactating cows to the partial replacement of soybean meal by Optigen® II or urea. J. F. dos Santos[1], M. N. Pereira*[1], G. S. Dias Júnior[1], L. L. Bitencourt[1], N. M. Lopes[1], S. Siécola Júnior[1], and J. R. M. Silva[2], [1]*Universidade Federal de Lavras*, *Lavras, MG, Brazil*, [2]*Centro Federal de Educação Tecnológica*, *Januária, MG, Brazil*.

Performance and nutrient utilization response of cows to the substitution of soybean meal by two sources of non-protein nitrogen was evaluated. Eighteen Holsteins, 150±82 DIM at the beginning of the trial, were randomly assigned to a sequence of three treatments, in six concurrently run 3x3 Latin Squares, with 21-day periods. The crude protein content of the consumed diet was 16.4% for Optigen® II (Alltech Inc., Nicholasville, USA) and Control and 16.5% for urea. Diet crude protein from Optigen® II was 1.59% of DM and from urea 1.57%. Dietary content of Optigen® II and urea were 0.61% and 0.56% of DM, respectively. The composition of the Control TMR was (% of DM): Corn silage (41.9), tifton hay (1.8), mature ground corn (14.2), whole cottonseed (7.6), buffer-fat premix (3.9), citrus pulp (12.6), soybean meal (18.0). For the Optigen® II and urea diets, content of soybean meal was 14.1% and citrus pulp was 15.9 and 16.0%, respectively. Data was analyzed with a model containing the effects of square, cow within square, period and treatment. Two orthogonal contrasts were evaluated: 1) Urea *vs.* soybean meal and 2) Optigen® II *vs.* soybean meal. The partial replacement of soybean meal by non-protein nitrogen sources reduced intake with no effect on milk yield, there was a tendency for increased milk to intake ratio on these diets. Optigen® II induced excretion of milk urea similar to soybean meal and lower than urea

Table 1. Performance and total tract diet digestibility

	Optigen® II	Control	Urea	SEM	Contrast 1	Contrast 2
Milk yield (kg)	31.6	31.5	31.5	.36	.97	.87
Fat yield (g)	1044	1062	1039	15.9	.31	.44
Protein yield (g)	941	944	942	9.1	.87	.77
MUN (mg dl^{-1})	15.5	15.4	16.6	.27	<.01	.68
DMI (kg)	22.4	23.2	22.4	.26	.04	.04
Milk/DMI	1.396	1.344	1.398	.0212	.07	.09
Energy/ DOMI [1]	1.327	1.304	1.317	.0330	.77	.61
OM digestibility	71.1	71.3	71.6	1.07	.87	.89
NDF digestibility	45.0	46.6	47.5	2.45	.79	.64

[1] Milk energy over digestible organic matter intake (Mcal kg^{-1})

Key Words: Optigen® II, Urea, Milk Urea

TH263 The effects of reducing dietary nitrogen on ammonia emissions from dairy housing. J. Cyriac*, L. Li, K. F. Knowlton, L. C. Marr, J. A. Ogejo, J. Ligon, M. Reed, and M. D. Hanigan, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

This study investigated the potential of reducing NH3 emissions from dairy housing by reducing the nitrogen (N) content in lactating dairy cow diets. A replicated crossover design was used with 2 pens per treatment, 2 periods (18 d each) per replicate, and 2 replicates. Forty eight mid-lactation Holstein cows were randomly assigned to one of 4 pens. Pens were randomly assigned to one of the treatment diets. The diets contained 15% or 18% crude protein (CP) which differed in rumen-degradable protein content. Feed intake and milk yield were recorded on d 11 through 18. Milk samples were analyzed for 4 d in the final week of each period. On each of d 11 through 18, manure was allowed to accumulate on the floor of one pen for 8 h, and NH3 volatilization from the floor was measured for 10 h. Subsequent pens were measured on succeeding days resulting in 2 volatilization rate measurements for each pen during the 8 d period. Manure samples were collected for analysis of N and phosphorus. The Proc Mixed procedure of SAS was used to analyze the data. Dry matter intake was significantly increased for the 15% CP vs the 18% CP diets fed cows (23.2 and 25.4 kg/cow/d,

respectively; P <0.0001) but there were no significant changes in milk yield (35.7 vs 37.2 kg/cow/d, respectively). Milk compositional analysis indicated that milk urea N increased significantly (P<0.0001) as the CP content of the diets increased averaging 17.3 and 21.5 mg/dl, respectively, for the 15 and 18% CP diets. Consistent with the level of protein feeding, the N content of fresh manure samples from the 15% CP diet was significantly lower than from the 18% CP diet (3814 vs 4140 mg N/L; P=0.03). However, the measured gaseous NH3 loss from the barn floor was not significantly different between 15% CP and the 18% CP diets (116 vs 107 mg/h-m2, respectively; P=0.75).This study indicated that reducing N in the diet reduced milk urea N and manure total Kjeldahl N excreted into the environment but did not alter NH3 emissions from the barn floor.

Key Words: Nitrogen, Manure, Ammonia

TH264 Characterization of wheat-based distiller's dried grain with solubles (DDGS) for ruminants. M Undi*, J. C. Plaizier, K. H. Ominski, and K. M. Wittenberg, *University of Manitoba*, *Winnipeg, MB, Canada*.

Advanced processing technology in the ethanol industry has improved DDGS quality for when corn is the primary feedstock. This study was designed to characterize wheat-based DDGS from western Canadian processing plants. Chemical analyses were carried out on wheat DDGS obtained from multiple runs of a plant using advanced processing technology and a plant using old processing technologies. For comparative purposes corn-based DDGS was obtained from three US plants. As well, rumen-fistulated animals were used to determine in situ dry matter and nutrient degradability of wheat and corn DDGS. Fistulated animals were fed two diets; a 50:50 concentrate:forage diet and a 95:5 grass forage:DDGS diet. Dacron bags containing 5 g of DDGS were incubated for 0, 2, 4, 6, 12, 18, 24, 48, and 72 h. Chemical analysis of DDGS samples from plants using advanced processing technologies showed that crude fat and starch were low and CP high in wheat DDGS relative to corn DDGS, averaging 66 and 148 g fat kg^{-1} fat, and 7 and 48 g starch kg^{-1}, and 435 and 323 g CP kg^{-1}, DM basis, respectively. Wheat DDGS advanced processing technologies contained, g kg^{-1} DM basis, 1.2 Ca, 1.1 P, 4.1 Mg, 10.1 K, and 4.1 S. New-generation wheat DDGS had an effective DM degradability of 65.6% (5% h^{-1} flow rate), with a, b, and c fractions being 46.3%, 50.6%, and 0.03% h^{-1}, respectively. Diet type did not affect degradation parameters, however, effective DM degradability was higher in the old versus new technology wheat-based DDGS.

Key Words: Wheat, Corn, DDGS

TH265 Digestibility of corn distillers protein treated with glutamic acid fermentation solubles or not and exposed to heat damage. P. Summer*, *Ajinomoto USA, Inc.*, *Eddyville, IA*.

The objective of this trial was to evaluate the effects of glutamic acid fermentation solubles (GAFS) and heat upon the enzymatic digestibility of protein in corn distillers grains plus solubles (DGS). A coproduct from glutamic acid production, GAFS was obtained from Ajinomoto Food Ingredients, Eddyville, Iowa. The trial was a 2 × 2 factorial with GAFS added to DGS to equal either 0 or 10% of the dry weight of DGS and heated at either 50 or 140°C in a forced air oven for 4 hours followed by drying at 30°C. All treatments were applied in triplicate. Dried samples were rinsed to remove all soluble nitrogen and the water insoluble feed was dried gently (30°C). Samples within treatment were pooled and analyzed for Kjeldahl nitrogen (TKN) and ammonia nitrogen (AN). Intestinal protein digestibility of rinsed samples was estimated by incubating 15mg of nitrogen from each treatment (n=6) with pepsin (1g/L, Sigma P-7012) for one hour followed by pancreatin (3g/L, Sigma P-7545) and thymol (50mg/L) for 24 hours in 50ml polypropylene tubes. Trichloroacetic acid was added to stop digestion and precipitate proteins and large peptides. Three blanks were included. The tubes were centrifuged (3,200 X g) and the supernatant was analyzed for total nitrogen. Protein digestibility of the feed was calculated as the mg of nitrogen in the digest supernatant divided by the original mg of nitrogen in each tube. The TKN (% of DM), AN (% of DM), and protein digestibility of rinsed treatments were 5.16, 0.51, 48.1; 5.06, 0.53, 41.2; 5.16, 0.46, 47.2; and 5.26, 0.48, 48.3 for DGS-50, DGS-140, DGS+GAFS-50 and DGS+GAFS-140, respectively. Treatments were similar in TKN and AN. The main effects of GAFS (P = 0.13) and temperature (P = 0.15) upon protein digestibility were not significant. There was a significant interaction between GAFS and temperature (P = 0.05) as protein digestibility decreased in DGS but not in DGS+GAFS at high temperature. These data suggest GAFS or a component within GAFS protects protein in DGS from heat damage.

Key Words: Distillers Grains, Protein, Digestibility

TH266 Influence of Optigen® on nitrogen behavior in lactating dairy cows. R. L. Stewart, Jr.*[1], J. M. Tricarico[1], D. L. Harmon[2], W. Chalupa[3], K. R. McLeod[2], G. A. Harrison[1], L. M. Clark[2], M. D. Meyer[1], R. Garcia-Gonzalez[1], and K. A. Dawson[1], [1]*Alltech, Inc.*, *Nicholasville, KY*, [2]*University of Kentucky*, *Lexington*, [3]*Global Dairy Consultancy Co. Ltd.*, *Holderness, NH*.

A study was conducted to compare N balance (Exp. 1) and in situ degradation (Exp. 2) of diets formulated for lactating dairy cows containing Optigen®, a controlled release NPN source, vs. soybean meal. Treatments (isonitrogenous, 16.7 % CP) consisted of: 1) soybean meal (SBM) vs. 2) NPN fed as 150 g/h•d^{-1} Optigen® to replace a portion of the CP provided by SBM (OPT). In Exp. 1, six mid-lactation, multiparous Holstein cows (BW = 550 kg) were utilized in a crossover design to investigate N balance. Each period consisted of 14-d adaptation and 7-d N balance. In Exp. 2, two 600-kg ruminally cannulated steers were utilized in a crossover design to compare in situ degradation characteristics of DM, N and NDF of the diets above. Incubation times included 0, 2, 4, 6, 8, 16, 24, and 48 h. Dry matter and N disappearance data were fitted to the equation where $y= A + B(1-e^{-Ct})$; y= disappearance (%), A= fraction available at time 0, B= fraction degraded at a measurable rate, and C= fractional rate of disappearance of fraction B. In Exp. 1, N intake was similar (P < 0.23: 518 g/d). Total N output (feces, urine, and milk) did not differ (P > 0.49) between the diets (483 g/d) and the resulting N balance was similar (P > 0.91; 36 g/d). Nitrogen efficiency (7.9 kg/kg), measured as kg of milk per kg of CP intake, did not differ (P > 0.91). In Exp. 2, the A (33.0 %) and B fractions (52.5 %) and the disappearance rate of B (8.0 %/h) for DM were similar between OPT and SBM (P > 0.21). Likewise, the A, B, and C fractions of N were similar (P > 0.33) between OPT and SBM diets (28.3 %; 61.3 %; and 9.3 %/h, respectively). However, the total degradable fraction of DM (A + B fractions) tended to be higher (P < 0.06) in the OPT diet compared to the SBM diet (86.5 and 83.3 %). Neutral detergent fiber digestibility tended (P < 0.14) to be higher for OPT at 24h (48.7 vs. 39.9%) but was

similar ($P > 0.24$) at 48 h (61.1 %). These results demonstrate Optigen® can be utilized to provide a portion of the CP without negatively affecting N balance or DM, N and NDF behavior in the rumen.

Key Words: Optigen, NPN, Nitrogen Balance

TH267 Meta-analysis of milk protein yield response data to lysine and methionine supplementation. D. Vyas* and R. A. Erdman, *University of Maryland*, *College Park*.

Previous reports on milk protein responses to metabolizable amino acid (MAA) supplementation focused on lysine (LYS) and methionine (MET) expressed as a percentage of metabolizable protein and not to the actual amounts of MAA supplemented. The objective of this study was to determine the milk protein yield (g/d, MPG) responses to the amounts of LYS and MET supplemented. Meta-analysis was performed on results from 21 published articles involving 36 treatment comparisons of postruminal LYS and MET supplementation in lactating dairy cows. A broken-line regression model using the NLmixed procedure in SAS 9.1 (Robbins et al., 2006, J. Anim. Sci. 84(Suppl E):E155–E165) was used. The following statistical model was used: MPG ~ Normal (L + (U x z1) + E + (E x z1) + lvar, errvar), where: z1 = (MAA (g/d) < R) x (R-MAA (g/d)); R is the abscissa of breakpoint; L is maximal milk protein. Slope = 0; U is the slope and lvar and errvar are the variance components of L and error term, respectively.
Experiment (E) effects were removed by designation as random effects within the model. With MET and LYS supplementation, the breakpoints (R) were 121 and 275 g/d, the maximum protein yields (L) were 1212 and 1160 g/d, and the slopes were -3.50 and -2.49, respectively. Assuming MET and LYS concentration of 2.71 and 7.63 g/100g milk protein, this implies only 9.5 % and 19 % efficiency of use of these supplemental MAA for protein synthesis. It should be recognized that overall efficiencies of MAA utilization tends to be underestimated when amino acid supply is close to the animal′s needs.

Table 1. Parameter estimates for lysine and methionine

Amino acids	L	U	R	SEM	Adj. R^2
Methionine	1212	-3.50	121	30.75	0.96
Lysine	1160	-2.49	275	47.29	0.89

SEM= Standard error of Mean

Key Words: Metabolizable Amino Acids, Milk Protein

TH268 Do feedstuffs contain a constant protein fraction that is both undegradable in the rumen and indigestible in the small intestine? S. E. Boucher*[1], C. M. Parsons[2], and C. G. Schwab[1], [1]*University of New Hampshire*, *Durham*, [2]*University of Illinois*, *Urbana*.

To evaluate differences in intestinal digestibility of rumen undegraded amino acids (AA) within feeds and to determine if feeds contain a constant protein fraction that is both undegradable in the rumen and indigestible in the intestine, as is assumed in the AAT/PBV Protein System (1995), samples of soybean meal (SBM), SoyPlus® (SP), dried distillers grains with solubles (DDGS), and fishmeal (FM) were obtained from FeedAC, Inc. Feeds were analyzed for AA and incubated in situ for 16 h in the rumen of 4 lactating cows. After incubation, bags were rinsed, washed in methylcellulose solution, and dried. Rumen undegraded residues (RUR) were pooled by sample, analyzed for AA, and ruminal degradation of AA (RDAA) was calculated as disappearance from the bags. Sub-samples of the intact feeds (IF) and RUR were tube fed to 4 cecectomized roosters each, and total excreta were collected for 48 h and analyzed for AA. Endogenous AA losses were estimated from fasted birds, and standardized intestinal AA digestibility (SDAA) of the IF and RUR was calculated. Indigestibility coefficients of the IF were calculated as 100 - % SDAA and indigestibility of RUR was calculated as ((100 - % RDAA)*(100 - % SDAA))/100. The results indicate that SDAA in RUR differs within feeds, and SDAA coefficients were most often lowest for Lys, His, Cys, and Pro and highest for Trp, Leu, and Met. The observed ranges of SDAA in the RUR of SBM, SP, DDGS, and FM were 88-99, 85-99, 63-100, and 55-99%, respectively. The indigestibility coefficients of the IF and RUR also differed within all feeds and were lower for the RUR than for the IF. It appears that SBM, SP, DDGS, and FM do not contain a constant protein fraction that is both undegradable in the rumen and indigestible in the small intestine, but rather they contain a protein fraction that is indigestible in the intestine but partly degradable in the rumen and/or digestible in the intestine after rumen incubation.

Key Words: Amino Acid Digestibility, Rumen Undegraded Protein, AAT/PBV System

TH269 Effects of 2-hydroxy 4-(methylthio) butanoic acid isopropyl ester (HMBi) on the organic matter digestibility (OMD) and energy value of corn dried distillers grains with solubles (DDGS). E. Devillard*, L. Ducrocq, C. Richard, and P. A. Geraert, *Adisseo*, *Commentry, France*.

HMBi used in dairy cow rations is a source a metabolisable methionine for the animal. In addition, HMBi presents the particularity to enhance rumen function. Indeed, HMBi was shown to increase the rumen fermentations and consequently the energy value of different feedstuffs (Robert et al. 2002). Corn DDGS being largely available through the biofuel production, the potential of using HMBi to improve energy values of such feedstuffs was investigated. This was carried out using the rumen fermentation simulation technique (HFT gas test) where 4 different corn DDGS with different compositions were incubated with rumen fluid, and HMBi at 2 different doses. Gas production was measured and allowed to calculate OMD, and energy values of corn DDGS. Using a dose of 2.5% HMBi of the substrate dry matter (DM), the OMD of the 4 different DDGS was increased significantly. The increase varied between 2.1 to 3.2 % compared to the untreated control, depending on the DDGS. This corresponded to at least 2.9 % increase of the energy value of the corn DDGS. When the dose of HMBi added to the incubation was lowered to 0.1% HMBi of the substrate DM, OMD and energy values were also improved, numerically for 2 DDGS and significantly for the 2 others. With such a dose, the increase of energy value of DDGS could reach 1.5%. In order to further investigate the results obtained with the HFT technique, batch incubations were performed using the DDGS having exhibited the highest response. Its NDF and ADF digestibilities were improved with 0.1% HMBi supplementation and did not increase further when this dose was increased. These results show that i) HMBi can improve energy values of corn DDGS, ii) the effects of HMBi on corn DDGS vary with their type and composition, iii) improvement observed

at low dose could mainly be due to the increase in fibre degradation, iv) increasing dose of HMBi would not lead to a further improvement of fibre degradation, but could favour other fermentation processes.

Key Words: HMBi, Energy Value, Corn DDGS

TH270 Effects of feeding a controlled rumen release urea on productivity of Holstein cows. A. Highstreet*[1], J. Robison[1], P. H. Robinson[2], and J. G. Garrett[3], [1]*California State University*, *Fresno*, [2]*University of California*, *Davis*, [3]*Balchem Encapsulates*, *New Hampton, NY*.

While urea is often added to rations of lactating dairy cattle, it is solubilized and converted to ammonia rapidly in the rumen which could lead to inefficient use of dietary N. Our objective was to determine if a controlled rumen release urea (Nitroshure (NS) Balchem, New Hampton, NY), increases performance, and efficiency of capture of dietary N in milk, when it replaced urea in diets of lactating dairy cows. NS was determined to be 45.0% N and 9.9% fatty acids that were 80% C18:0, 17% C16:0 and 3% others. Ruminal in sacco incubation, with hand washing of bags, showed 72, 89 and 99% rumen N solubilization (includes loss at t=0 h) at 0.5, 4 and 12 h respectively. Pens of multiparous lactating cows (2 early and 2 mid-lactation) on a California dairy were fed one of 2 TMR formulated to supply 5% of ration CP as urea or NS. The study was 2 experiments (early and mid-lactation) in 2×2 factorials within switchover designs with 2 experimental periods of 4 weeks. All pens were fed twice daily to appetite with daily intakes recorded by pen. TMR and TMR ingredients were sampled twice in the final week of each period for chemical analysis. Cows were milked thrice daily with milk yield and components measured at the end of each period. Urine samples were collected from 20 cows/pen voluntarily urinating at the end of each period with fecal collections from these same cows 24 h later. There were no differences among TMR in nutrient analyses, with average CP and NDF of 17.9 and 33.4% respectively. DM intakes did not differ due to treatment in either early or mid-lactation. In mid-lactation, there were no differences in milk production, or component levels or outputs, due to replacement of urea with NS in the TMR, while early lactation cows had increased (P<0.01) milk fat and protein %, as well as milk fat, protein and energy outputs. Neither early or mid-lactation cows had different urinary or fecal N output due to treatment, capture of dietary N in milk was not impacted, and whole tract NDF digestibility was unaffected. Feeding a controlled rumen release urea in replacement for urea at about 5% of dietary CP improved performance of early lactation high producing dairy cows.

Key Words: Urea, Dairy, Rumen

TH271 In vitro ruminal protein degradation and microbial protein formation of seed legumes. S. Colombini[1] and G. A. Broderick*[2], [1]*University of Milan*, *Milano, Italy*, [2]*U.S. Dairy Forage Research Center*, *Madison, WI*.

Seed legumes such as peas, lupins and faba bean are important feeds for dairy cows in Europe and other regions. Ruminal protein degradability was quantified using the inhibitor in vitro (IIV) system for samples of 5 seed legumes: 2 peas (cv. Alembo and Helena), 1 white lupin (*Lupinus albus*, cv. Multitalia), 1 blue lupin (cv. Quilinok), and 1 faba bean (*Vicia faba minor*, cv. Chiaro). Incubations were stopped by adding acid at 0, 2, 4 and 6 h; ruminal escape was computed assuming a passage rate of 0.06/h. Five standard proteins were included. Additional incubations were conducted without growth inhibitors in an attempt to correct for N incorporation by bacteria. These were conducted for 2, 4 and 6 h with ruminal inoculum containing ammonium sulfate enriched with N-15. Net microbial growth (growth above blank) was estimated from total non-ammonia N (NAN) plus N-15 enrichment of total NAN and isolated bacterial NAN. Significant differences were observed among protein sources in IIV degradation traits (Table 1). Typical estimates of degradation rate and rumen-undegraded protein (RUP) were obtained for the standard proteins. The 2 pea sources had slower degradation rates and greater RUP than the lupins and faba bean. The IIV system ranked the RUP contents of the 5 legumes differently from the Cornell model. Excessive variation prevented reliable estimates of degradability in uninhibited inoculum. However, there was a trend (P = 0.15) for an effect of seed legume on microbial NAN formation; greater content of starch and water soluble carbohydrate may have supported greater formation of bacterial NAN for Alembo peas and Chiaro faba beans. Both microbial growth and protein escape should be considered when evaluating feeds rich in protein and fermentable energy.

Table 1. In vitro ruminal protein degradability and microbial NAN formation

			Inhibitor in vitro			Cornell model		Uninhibited
Source	Cultivar	N (%)	Rate	RUP	Rank	RUP (%)	Rank	Microbial NAN
			(/h)	(%)				[mg/(h*100 ml)]
Casein		14.07	0.230	18				
Solvent SBM		7.16	0.106	35				
Expeller SBM		7.07	0.031	67				
Alfalfa hay		2.74	0.039	59				
Alfalfa silage		2.98	0.057	45				
Pea	Alembo	3.40	0.088	39	2	16	4	3.5
Pea	Helena	4.17	0.078	42	1	20	3	2.3
White lupin	Multitalia	5.62	0.137	29	5	11	5	1.9
Blue lupin	Quilinok	5.11	0.124	30	4	20	2	2.0
Faba bean	Chiaro	4.41	0.095	38	3	24	1	2.7
SE			0.008	2.3				0.7
P > F			< 0.01	< 0.01				0.15

Key Words: Seed Legumes, Protein Degradation, Rumen-Undegraded Protein

TH272 In situ ruminal degradation of nitrogen fractions of cottonseed and canola meals. T. Tashakkori, M. Danesh Mesgaran*, A. R. Heravi Mousavi, and H. Nasri Moghaddam, *Ferdowsi University of Mashhad*, *Mashhad, Iran*.

The experiment was investigated to determine ruminal degradation of nitrogen fractions [true protein (TP), buffer insoluble protein (BIP), neutral detergent insoluble protein (NDIP) and acid detergent insoluble protein (ADIP)] of cottonseed meal (CP= 280 g/kg DM) and canola meal (CP= 420 g/kg DM) using nylon bag technique. Two Holstein steers (450±50kg body weight) fitted with ruminal fistula were used.

Samples were weighed into nylon bags (19×12 cm, pore size= 48μm, n= 8) and incubated in the rumen for 0.0, 8, 24, 48 and 72 h. Nitrogen fraction concentrations were determined in intact and incubated samples using standard procedures. Data were applied to the equation of P= a+b(1-e-ct); P= degradability potential, a= rapidly degradable fraction, b= slowly degradable fraction, c= degradable constant, t= time. True protein degradation of cottonseed meal (a= 0.35±0.059, b= 0.49±0.394, c= 0.018±0.028) was markedly different from those of canola meal (a= 0.24±0.041, b= 0.71±0.046, c= 0.08±0.013). BIP degradation of cottonseed meal (a= 0.42±0.031, b= 0.89±0.723, c= 0.01±0.011) was higher than canola meal (a= 0.35±0.035, b= 0.63±0.047, c= 0.06±0.012). NDIP degradation coefficients of cottonseed meal and canola meal were a= 0.45±0.063 and 0.16±0.086, b= 0.66±1.46 and 0.71±0.01, c= 0.008±0.026, 0.056±0.023, respectively. Ruminal degradation of ADIP of canola meal and cottonseed meal were a= 0.15±0.175 and 0.29±0.102, b= 0.29±0.226 and 0.17±0.126, c= 0.086±0.179 and 0.04±0.114, respectively. Results of the present study indicate that the nitrogen fractions of cottonseed meal and canola meals were degraded in the rumen with different kinetics.

Key Words: In Situ, Nitrogen Fraction, Degradation