

Ruminant Nutrition: Management and Misc Additives - Dairy

W195 Effect of two levels of diet density and milking frequency on performance of Holstein fresh lactating cow. N. Aghaziaraty*, H. Amanlou, D. Zahmatkesh, E. Mahjoubi, and S. Siari, *Zanjan University, Zanjan, Iran.*

The aim of this study was to investigate the effect of diet density and milking frequency on performance of fresh lactating cows. 20 fresh lactating cows (8 primiparous and 12 multiparous) arranged in a 2×2 factorial block design. The cows were fed two levels of diet density (high density (H) or low density (L) diet) and milked 3 time (3x) or 6 time (6x) daily. The four treatment combinations were L3, L6, H3 and H6, and experimental period comprised from day of 3 to 25 postpartum. The effect of milking frequency on DMI ($P<0/05$), milk production ($P<0/002$), and yield of milk fat ($P<0/003$) and milk protein ($P<0/002$) was significant and for 6x cows was higher, but on percentage of milk fat, milk protein, SNF, and blood metabolites was not significant. The NEFA concentration was affected by milking frequency ($P<0/01$). The effect of diet density on DMI, percentage of milk fat, milk protein, blood metabolites, and SNF was not significant, but on milk production ($P<0/035$), yield of milk fat ($P<0/02$) and milk protein ($P<0/01$) was significant and was higher for high density diet. The interaction of milking frequency and diet density was not significant for any measured parameters in this study. Final conclusion is that increasing milking frequency and diet density in early lactation can increase milk production.

Key Words: Fresh Cow, Milking Frequency, Diet Density

W196 Effect of applying bacterial inoculants to corn silage on the performance of dairy cattle. K. G. Arriola*, A. T. Adesogan, S. C. Kim, T. W. Kang, A. F. Pedroso, O. C. Queiroz, J. L. Foster, and C. R. Staples, *University of Florida, Gainesville.*

This study examined the effect of applying different bacterial inoculants to corn silage at the point of ensiling on the performance of lactating dairy cows. Corn plants were harvested at 35% DM, chopped and ensiled in Ag bags after application of 1) nothing (CON), 2) a homolactic inoculant (B2+) containing 3.63×10^{10} cfu/g of *Pediococcus pentasaceus* and *Propionibacteria freudenreichii* 3) a heterolactic inoculant (BUC) containing 4.95×10^{10} cfu/g *Lactobacillus buchneri*; and 4) a combo inoculant (500) containing 4.99×10^{10} cfu/g of *P. pentosaceus* and *L. buchneri*. Each of the 4 silages was mixed into separate total mixed rations consisting of 44% corn silage, 50% concentrate and 6% alfalfa hay (DM basis). Fifty two lactating Holstein cows were classified according to milk production and parity and randomly assigned at 22 DIM to the four dietary treatments. Cows were fed ad libitum and milked twice daily for 49 d. Dietary treatment did not affect intakes (kg/d) of DM (20.1), CP (3.65), NDF (5.72), or ADF (3.54), or digestibility (%) of DM (73.8) or CP (72.4). However, cows fed B2+ had lower NDF digestibility than those fed other diets (45.3 vs. 53.0%). Consequently, cows fed B2+ had lower digestible NDF intake (kg/d) than those fed other diets (2.5 vs. 3.1 kg/d). Nevertheless, dietary treatment did not affect milk yield (32.3 kg/d), efficiency of milk production (1.64), concentrations of milk fat (3.18%) and protein (2.78%), or yields of milk fat (1.02 kg/d) and protein (1.26 kg/d). Inoculant application to corn silage did not affect the milk yield or feed intake of the cows.

Key Words: Inoculants, Corn Silage, Cow

W197 Timing of herbage allocation on milk production and composition in mid-lactation dairy cows in winter. M. Vaccaro², F. Luparia^{1,2}, C. A. Cangiano¹, D. A. Garcarena¹, and G. A. Gagliostro*¹, ¹*Instituto Nacional de Tecnología Agropecuaria, INTA, Balcarce, Buenos Aires, Argentina,* ²*Facultad de Ciencias Agrarias, UNMDP, Balcarce, Buenos Aires, Argentina.*

The objectives were to evaluate milk yield and composition and dry matter intake (DMI) when the daily pasture strip was allocated each morning (M) or afternoon (A) in winter. Sixteen Holstein cows in mid-lactation (132 ± 11 DIM) were used in a cross over design. Cows were paired based on average milk production during early lactation and randomly assigned to one of two treatments: M: pasture was offered from 0530 to 1100 h and A: pasture was offered from 1100 to 1630 h. In both treatments cows grazed an oat (*Avena sativa*) sward at a daily herbage allowance of 13 kg DM/cow. During the rest of the day cows received 7.3 kg DM/d of maize silage, 2.7 kg DM/d sunflower meal and 6.2 kg DM/d of concentrate (TMR). Each experimental period lasted 20 d with the first 15 d for diet adaptation and the last 5 days for data collection. Data were analyzed as a cross-over design that included effects of treatment, period and sequence. Pasture DM (250 vs 275 g/kg) and soluble carbohydrate (229 vs 199 g/kg DM) contents were higher ($P<0.01$) during the afternoon. Milk production (22.1 kg/cow/d), 4%FCM (20.7 kg/cow/d) and milk fat content (35.9 g/kg) did not differ. Milk protein content was increased ($P<0.01$) in A (38.5 vs. 37.6 g/kg) and milk protein yield did not differ (0.80 kg/d). The efficiency of milk to yield cheese (kg cheese/100 kg of milk) resulted higher ($P<0.01$) in A (10.56) compared to M (10.31). Lactose content was increased ($P<0.01$) in A (51.4 vs 50.5 g/kg). Milk urea content (35 mg/dl) did not differ. Intakes (kg DM/cow/d) of pasture (3.94) and stall TMR diet (15.47) did not differ. The afternoon grazing management in winter improved milk protein content and the value of milk yield for cheese making. These results could probably be linked to a higher concentration of soluble carbohydrates in the afternoon grazed pasture.

Key Words: Morning or Afternoon Grazing, Pasture Water Soluble-Carbohydrates, Grazing Dairy Cows

W198 Effects of feed bunk competition on the feeding behavior of growing dairy heifers. T. J. DeVries*¹ and M. A. G. von Keyserlingk², ¹*University of Guelph, Kemptville, ON, Canada,* ²*The University of British Columbia, Vancouver, BC, Canada.*

Decreased feed bunk access for adult dairy cows increases competition and promotes feeding behavior patterns that increase the between-cow variation in the composition of ration consumed. To date, there is limited data on the effects of feed bunk competition on the behavior of growing dairy heifers. The objective of this study was to determine how feed bunk competition influences the feed sorting, feeding behavior, and feed intake of dairy heifers. Thirty-six prepubertal Holstein heifers, consuming a TMR diet, were assigned to one of 2 treatments: 1) noncompetitive (1 heifer/feed bin) or 2) competitive (2 heifers/feed bin). Dry matter intake and feeding behavior were monitored for 7 d for each animal. Fresh feed and orts were sampled on the last 3 d of the treatment period from each bin and were subjected to particle size analysis. The particle size separator consisted of three screens (18, 9, and 1.18 mm) and a bottom pan resulting in 4 fractions (long, medium, short and fine).

Sorting activity for each fraction was calculated as the actual intake expressed as a percentage of the predicted intake. To determine if sorting occurred, each fraction was tested for a difference from 100%. Overall, the heifers sorted against long particles (93.8%; $P \leq 0.01$), and sorted for medium (102.2%; $P \leq 0.005$) and short (102.7%; $P \leq 0.02$) particles. There was no difference in sorting behavior between the treatments. The competitively-fed heifers did not have lower daily DMI (6.3 vs 6.2 kg/d; SE=0.3, $P=0.8$), but did consume a higher proportion of their daily DMI in the later hours of the day. The competitively-fed heifers tended to have shorter feeding times (191.8 vs 212.5 min/d; SE=7.8, $P=0.08$), particularly during peak feeding times. These changes translated into a tendency for a higher intake rate (0.047 vs. 0.038 kg/min; SE=0.004, $P=0.15$) throughout the day for the competitively-fed heifers. These results suggest that increased competition at the feed bunk promotes feeding behavior patterns that will likely increase the between-heifer variation in composition of ration consumed.

Key Words: Heifers, Sorting, Competition

W199 Relationship between indices of energy status and plasma lipids, lipid-soluble vitamins and hepatic-derived export proteins in periparturient Holstein and Jersey cows. P. Rezamand*, T. A. Hoagland, R. M. Clark, and S. M. Andrew, *University of Connecticut, Storrs.*

In an observational study, the effect of breed on indices of energy status and plasma concentrations of lipid-energy metabolites, lipid-soluble vitamins, and hepatic-derived export proteins were investigated. Fifteen Holstein and 15 Jersey cows were monitored from cessation of lactation at wk -9 before expected calving date (ECD) through 8 wk of the subsequent lactation. Body condition scores (BCS) were measured at wk -9, -4, -2 and -1 (before ECD), and at wk 1, 3, 5, 7 and 8 postpartum (PP). Body weights (BW) were measured at wk -4 and -2 before ECD, and daily milk yield, weekly milk energy yield, and BW were measured for 8 weeks PP. Plasma metabolites were determined at wk -2 (before ECD) and at wk 1, 2, 4, and 8 PP. Data were analyzed using the mixed model of SAS with wk as a repeated measure. Although milk yield was greater for Holstein cows, there were no breed differences in milk energy yield adjusted to metabolic body size. Holstein cows lost more BW as compared with Jersey cows (128.1 vs. 89.1 \pm 11.6 kg). Although Holstein cows had greater BCS at wk -4 and wk -2 (before ECD), Jersey cows had a greater BCS at wk 8 PP ($P = 0.001$). Plasma non-esterified fatty acid and β -hydroxy butyrate (BHB) concentrations at wk 1 PP tended to be greater (+133 μ Eq/L and +170 μ mol/L) for Holstein than for Jersey cows. Holstein cows had reduced plasma concentrations of phospholipid (20 vs. 35.1 \pm 4.1 mg/dL; $P = 0.03$) and β -carotene (3.51 vs. 5.69 \pm 0.55 μ g/mL; $P = 0.03$) and greater plasma cholesterol concentrations PP compared with Jersey cows ($P = 0.001$). Holstein cows with high peak plasma BHB concentrations (>1000 μ mol/L) and no clinical signs of ketosis had reduced plasma apolipoprotein B (24.1 vs. 30.6 \pm 1.23 mg/dL), transthyretin (0.79 vs. 1.00 \pm 0.04), and retinol-binding protein (0.84 vs. 1.02 \pm 0.04) compared with Holstein cows with low peak BHB ($P < 0.003$). These findings suggest that the association between increased lipid mobilization and reduced synthesis or release of export proteins was greater for Holstein than for Jersey cows.

Key Words: Energy Status, Transition Period, Holstein and Jersey

W200 Effects of monensin and propylene-glycol on milk production and milk composition of Holstein lactating cows. H. Bahrami-Yekdangi, K. Rezayazdi, M. Dehghan-Banadaky*, A. Nejati-Javaremi, and F. Fatehi, *University of Tehran, Tehran, Iran.*

We evaluated the effects of Monensin and propylene glycol on feed intake, milk production and milk composition on 16 primiparous and multiparous Holstein lactating cows (60 \pm 30 DIM, Milk production 33 \pm 3 Kg/day) between September and November of 2007. Cows were used in a completely randomized design with 4 treatments (additives) and 4 replication (cows) and were fed a balanced total mixed ration (60% concentrate and 40% forages) with or without additives. Cows in group 1 were fed TMR without additive (control), Cows in group 2 were fed TMR with 335 mg/day monensin, Cows in group 3 were fed TMR with 400 ml/day propylene glycol, and cows in group 4 were fed TMR with 335 mg/day Monensin and 400 ml/day propylene glycol. Data were analyzed using mixed models for repeated measurement.

Experimental treatments did not affect feed intake and milk composition but propylene glycol significantly increased milk yield of cows (32.23, 34.53, 35.91 and 33.79 kg/day for groups 1-4 respectively). Monensin and/or propylene glycol significantly increased concentrations of plasma glucose (51.92, 56.15, 56.92 and 58.56 mg/dl for groups 1-4 respectively) and insulin (0.43, 0.65, 0.54 and 0.91 mg/dl for groups 1-4 respectively). Concentration of Plasma triglycerides (13.67, 11.97, 11.63 and 8.96 mg/dl for groups 1-4 respectively) were lower in Monensin and/or propylene glycol treated cows ($P < 0.05$). Treatments had not significantly effect on concentration of plasma calcium and phosphorus ($P > 0.05$).

Key Words: Monensin, Propylene-Glycol, Milk

W201 Feed sorting in growing dairy heifers: Effects of dietary dilution. A. M. Greter*¹, T. J. DeVries², and M. A. G. von Keyserlingk¹, ¹*The University of British Columbia, Vancouver, BC, Canada,* ²*University of Guelph, Kemptville, ON, Canada.*

An alternative to limit feeding of dairy heifers is to limit the nutrient density of a formulated diet fed ad libitum, primarily through the addition of a low-quality, inexpensive feedstuff to the ration. The objective of this study was to determine how adding straw to the TMR of growing dairy heifers affects their intake, feeding behavior, and feed sorting behavior. Six prepubertal Holstein heifers were subjected to 3 treatment diets in a replicated 3x3 Latin square design. The treatment diets were: 1) control (17.0% corn silage, 52.1% grass silage, 30.9% concentrate), 2) control diet with 10% straw, and 3) control diet with 20% straw. DMI and feeding behavior were monitored for 7 d for each animal on each treatment. Fresh feed andorts were sampled on the last 3 d of each treatment period for each heifer and were then subjected to particle size analysis. The particle size separator contained 3 screens (19, 8, and 1.18 mm) and a bottom pan, resulting in 4 fractions (long, medium, short, and fine). Sorting activity for each fraction was calculated as the actual intake expressed as a percentage of the predicted intake. To determine if sorting occurred, each fraction was tested for a difference from 100%. Heifers sorted against long particles (90.2%; $P \leq 0.07$) and for short particles (106.3%; $P < 0.05$) on all 3 diets. On the 10% and 20% straw diets heifers sorted for medium particles (102.9 and 105.5%; $P \leq 0.01$). Heifers also sorted for fine particles on the 20% straw diet (107.8%; $P = 0.02$). Feeding time increased (180.2, 193.3, and 199.2 min/d; SE=13.4, $P = 0.05$), whereas DMI decreased (8.1, 7.1, and 6.2 kg/d; SE=0.3, $P < 0.001$) with the addition of straw in the diet. Energy and nutrient requirements were

sufficiently met when the animals consumed the control and 10% straw diet. The results suggest that a moderate level of straw may be included in the diet to target nutrient intake without negatively affecting feeding behavior or growth potential. Furthermore, the ad libitum feeding of a diluted diet provides increased opportunity for these animals to express their natural foraging behavior.

Key Words: Sorting, Heifers, Straw

W202 Fenugreek as forage for dairy cows 2. Effect on rumen fermentation and turnover. A. W. Alemu* and L. Doepel, *University of Alberta, Edmonton, AB, Canada.*

Six multiparous Holstein cows fitted with ruminal cannula were used in a 3x3 replicated Latin square design to examine the effect of two varieties of fenugreek haylage, AAFC F70 and CDC Quatro, on rumen fermentation and turnover rate. Cows were fed isonitrogenous diets consisting of 50% concentrate, 10% barley silage, and 40% AAFC F70 haylage (F70), CDC Quatro haylage (QUAT), or alfalfa haylage (ALF) once daily. Periods were 18 d, with the last 7 d for sample collection. Rumen VFAs, lactate, and ammonia were measured over the last 24h of each period and rumen pH was monitored continuously using indwelling pH probes from d 12-15. Rumen digesta mass and kinetics of rumen neutral detergent fiber (NDF) were determined by complete ruminal evacuation. Data were analyzed using orthogonal contrast of alfalfa vs. fenugreek (FEN) and F70 vs. QUAT. Differences were considered significant at $P < 0.05$. Rumen pH was unaffected by treatment. Rumen ammonia nitrogen (NH_3N) was higher with FEN than with ALF ($P = 0.02$). Ruminal VFAs were not different between treatments except for total VFA, which was higher for ALF than FEN. Mean pool sizes of rumen digesta (84.4 kg) and rumen NDF pool (6.7 kg) were not affected by treatment. Rumen NDF passage rate (Kp), NDF intake rate (Ki) and NDF digestion rate (Kd) were higher for ALF than FEN, and Kp and Ki were higher for QUAT than F70. Rumen turnover time was higher for cows fed F70 than for those fed QUAT, which were both higher than for cows fed ALF. Overall, longer turnover times and slower NDF digestion rates likely contributed to the lower DMI of the FEN fed cows.

Table 1.

	Treatment				Contrasts	
	F70	QUAT	ALF	SEM	ALF vs. FEN	F70 vs. QUAT
DMI,kg/d	16.8	18.7	22.9	0.7	<0.001	0.10
pH	5.9	6	5.9	0.1	0.88	0.52
NH_3N ,mg/dl	22.1	20.7	16.5	1.6	0.02	0.56
Total VFA, mmol/L	113	111.1	125.3	6.4	0.02	0.75
Acetate*	57.1	58.9	59	3.4	0.65	0.50
Propionate*	29.7	26.8	27.3	2.8	0.74	0.37
Butyrate*	8.4	9.2	8.8	1.6	0.99	0.63
$\text{K}_i, \text{d}^{-1}$	64.2	77.9	87.6	5.0	0.001	0.003
$\text{K}_p, \text{d}^{-1}$	28.4	36.7	40.8	3.6	0.02	0.03
$\text{K}_d, \text{d}^{-1}$	35.9	41.2	46.8	3.9	0.03	0.16
Turnover time ¹ ,h	20.4	16.6	13.5	1.3	0.01	0.03

* Individual VFA reported as mmol/100mmol; ¹(Ruminal DM(kg)/DMI (kg/d)x24

Key Words: Fenugreek, Rumen Fermentation, Rumen Kinetics

W203 Viability of commercial active dry yeast products decreases with high-temperature storage. J. Miranda* and B. J. Bradford, *Kansas State University, Manhattan.*

Active dry yeast (ADY) products are utilized as feed additives in the dairy industry, with the goal of modulating ruminal fermentation and improving productivity. Several proposed modes of action for ADY require that viable cells are fed; however, little information is available regarding viable cell count of commercial ADY products or the effects of summer storage conditions on viability. Samples of 6 ADY products were acquired through normal distribution channels to measure viable yeast cell count. Viable cells were quantified in 3 different samples of each product (from different lots) on receipt. In addition, 1 sample of each product was stored for 3 months at 40°C with ambient humidity, and viable cell count was assessed monthly. Viable yeast cells were quantified according to AOAC method 997.02, with the procedure modified to allow 5 minutes for sample homogenization in phosphate buffer. Colony forming units per gram (CFU/g) were log₁₀-transformed and analyzed by ANOVA to assess effects of storage on yeast viability. Across products, 44% of samples analyzed did not contain the minimum CFU/g guaranteed on the respective product labels, and mean viable cell counts were less than the label claim for 4 of the 6 products sampled, with only 1 product meeting the label claim on all 3 samples collected. Across products, high-temperature storage significantly decreased viable cell count ($P < 0.001$), with mean CFU/g decreasing by more than 85% with each month of storage at 40°C (9.88, 7.37, 6.28, and 5.43 log₁₀ CFU/g for 0, 1, 2, and 3 months of storage, respectively). Active dry yeast products provide highly variable numbers of viable yeast cells, and viability decreases substantially with high-temperature storage.

Key Words: Feed Additives, Dairy Nutrition, Active Dry Yeast

W204 Exogenous amylase enzymes for lactating dairy cows. C. M. Klingerman*, E. E. McDonell, W. Hu, M. C. Der Bedrosian, and L. Kung, Jr., *University of Delaware, Newark.*

An experimental (7B, Novozymes A/S, Bagsvaerd, Denmark and Dutch State Mines, Heerlen, Netherlands) and a commercial formulation (AMA, Alltech Biotechnology, Nicholasville, KY) of enzymes, with α -amylase activity, were evaluated for activity at various pH, stability in ruminal fluid, the potential to improve in vitro ruminal fermentations and the potential to improve production performance of lactating cows. When incubated (40°C) in buffer with a pH of 5.4, 7B had about 10-25 times more amylase activity than AMA. When the pH was increased to 6.0, enzyme activity increased by 100% for 7B but it decreased by about 26% for AMA. Both formulations maintained enzyme activity when they were incubated in in vitro ruminal fermentations over a 24 h period. After 6 h of ruminal in vitro fermentations, additions of 7B resulted in linear increases ($P < 0.05$) in apparent total VFA production for flint and dent corn but had no effect on floury corn. In a lactation trial, 28 Holstein cows (68 ± 31 days in milk, 46.9 ± 9.1 kg milk/d) were fed a TMR supplemented with nothing (CTRL), a low dose of 7B (7BL, 0.88 ml/kg TMR DM), a high dose of 7B (7BH, 4.4 ml/kg TMR DM), or AMA (0.4 g/kg TMR DM). The experiment was conducted as a 4 × 4 Latin square design with 21-d periods. Cows fed 7BL produced more (47.1 kg/d, $P < 0.05$) milk than cows fed CTRL (43.2 kg/d) and 7BH (44.2 kg/d) but produced similar amounts to cows fed AMA (45.4 kg/d). The production of 3.5% fat corrected milk was greater ($P < 0.05$) from cows fed 7BL and AMA when compared to CTRL. The percentage of milk fat and milk protein were unaffected by treatment. Cows fed

7BL, 7BH, and AMA ate similar amounts of DM (ave. of 28.5 kg/d) and cows fed the latter two diets consumed more ($P < 0.05$) DM than did cows fed CTRL (27 kg/d). Cows fed 7BL had a greater ($P < 0.05$) apparent total tract digestion of DM, OM, and NDF when compared to the CTRL and 7BH diets but digestion of these components were similar to cows fed AMA. The formulations of amylase enzymes evaluated in this study varied greatly in their activity, but were both stable in rumen fermentations and had the ability to increase animal performance.

Key Words: Amylase, Enzyme, Dairy

W205 Evaluation of nutritional management strategies for cows with a short (40-d) dry period. H. M. Dann*¹, M. P. Carter¹, H. M. Gauthier¹, K. W. Cotanch¹, P. D. Krawczel¹, C. S. Mooney¹, C. S. Ballard¹, R. J. Grant¹, T. Eguchi², and T. Nakao², ¹William H. Miner Agricultural Research Institute, Chazy, NY, ²ZEN-NOH National Federation of Agricultural Co-operative Associations, Tokyo, Japan.

Dairy producers are adopting the use of shorter dry periods for cows, but are unsure of the best nutritional strategy to use. The objective of this study was to evaluate the effect of two nutritional strategies for feeding dry cows with a 40-d dry period on periparturient metabolism and subsequent lactational performance. Holstein cows ($n = 101$) housed in pens with freestalls were used in a randomized design to test the effects of diet: 1) low-energy (1.4 Mcal NE_L/kg) for the entire dry period (LL; $n = 51$) and 2) low-energy for the far-off period and high-energy (1.6 Mcal NE_L/kg) for the close-up period (LH; $n = 50$). The far-off and close-up periods started at 40 ± 3 d and 21 ± 3 d from expected parturition, respectively. Body condition score (BCS) and body weight (BW) were recorded (dry-off and wk -3, -2, -1, 0, 2, 4, 8). Serum nonesterified fatty acids (NEFA) and β -hydroxybutyrate (BHBA) were analyzed (dry-off and every other day from d -7 to 13). Milk yield (daily from wk 1 to 8) and composition (weekly from wk 2 to 8) were measured. Health problems were recorded (entire study). Data were analyzed by ANOVA using the MIXED procedure (except health data) and Fisher's Exact Test using the FREQ procedure (health data) of SAS. Cows fed LL and LH had similar ($P > 0.10$) BCS (3.65) and BW (727 kg) during the far-off period. During the close-up period, cows fed LH had more BCS gain ($P \leq 0.05$; 0.16 vs. -0.07), more BW gain ($P \leq 0.05$; 28 vs. 9 kg), and lower serum NEFA ($P \leq 0.05$; 355 vs. 458 μ Eq/L) than cows fed LL. There was no carryover effect of treatment ($P > 0.10$) on postpartum serum NEFA (845 μ Eq/L) and BHBA (7.2 mg/dL), change in BCS (-0.32) and BW (39 kg), milk yield (44.1 kg), and health disorders. Cows fed LH tended ($P \leq 0.10$, treatment \times time) to have higher serum BHBA at d 5, 7, and 9 than cows fed LL. Milk fat content tended ($P \leq 0.10$) to be lower for cows fed LL than LH (3.54 vs. 3.76%). Both nutritional management strategies (LL and LH) are acceptable based on data collected during the first 8 wk postpartum. However, both strategies need to be evaluated based on performance during a complete lactation.

Key Words: Dry Period, Nutrition, Transition Cow

W206 Effect of dietary malic acid supplementation on rumen methanogenesis and performance of lactating dairy cows at pasture. P. A. Foley¹, D. A. Kenny¹, D.K. Lovett¹, T. M. Boland*¹, and F. P. O'Mara², ¹University College, Dublin, Ireland, ²Teagasc, Oak Park, Ireland.

It has been estimated that enteric fermentation from dairy cows which naturally results in methane production accounts for almost 14% of the total greenhouse gas emissions associated with agriculture in Ireland. There is evidence from in vitro studies that organic acids such as malic acid can inhibit ruminal methanogenesis. However, there is equivocation between published reports on the utility of this strategy in vivo. Furthermore, most of the limited in vivo work to-date has been conducted with small ruminants or beef cattle with little information on effects in lactating dairy cows, particularly under pasture based production systems. The objective of the current study, therefore, was to examine the effect of dietary malic acid supplementation on methane emissions from lactating dairy cows grazing pasture. Twenty-four mid lactation Holstein-Friesian cows with a pre trial mean (\pm s.e.) milk yield of 23.9 kg/d (\pm 4.3 kg) and a BW of 628.1 kg (\pm 36.5 kg) were blocked on days in milk, pre trial milk yield and live weight, and within block, randomly allocated to one of two diets over a six week period. Diets consisted of ad libitum grazed grass plus 6 kg concentrate containing either (1) 0 g (CON) or 480 g of malic acid (MA; 2.6% DMI). Cows were allowed a three-week acclimatisation period followed by a 5-day methane measurement period. Individual methane measurements were made using the SF6 tracer gas technique, while herbage intake was estimated for each animal using the n-alkane technique. Measurements for milk yield were taken daily for each animal using flow meters while samples for compositional analysis were collected on a weekly basis. The dietary inclusion of MA had no effect ($P > 0.05$) on DMI or on ruminal methane emissions ($P > 0.05$). Furthermore, supplementation had no effect ($P > 0.05$) on animal performance in terms of milk yield, milk composition and weight gain.

W207 The impact of a blend of synthetic antioxidants (AGRADO® Plus) on milk production and milk fat synthesis when fed a diet high in unsaturated fatty acids. C. L. Preseault*¹, M. Vázquez-Añón², G. R. Bowman², C. S. Ballard³, H. M. Dann³, and A. L. Lock¹, ¹University of Vermont, Burlington, ²Novus International Inc., St. Louis, MO, ³William H. Miner Agricultural Research Institute, Chazy, NY.

Dietary-induced milk fat depression (MFD) is a result of changes in rumen biohydrogenation (BH) of unsaturated fatty acids and the passage of specific BH intermediates out of the rumen that subsequently reduce milk fat synthesis in the mammary gland. The objective of this study was to examine the impact of a blend of synthetic antioxidants, AGRADO® Plus (Agrado), on milk fat synthesis and milk production when cows were fed a diet with a high unsaturated fatty acid load (UFAL). The experiment was designed as a crossover with two 21-d periods. Sixteen lactating Holstein cows (163 ± 47 days in milk) were fed 1 \times /d and milked 3 \times /d. Cows were assigned randomly to one of two treatments: 1) basal diet (Control) and 2) basal diet supplemented with 0.02% (DM basis) of Agrado. The basal diet was designed to induce MFD, primarily through feeding distillers' grains (15% DM) to induce a high rumen UFAL. Individual feed intake and milk yield were recorded daily and milk samples collected every 5 d for milk composition. Data were analyzed as a crossover design with model effects for diet, period, sequence, day, and treatment by day using the MIXED procedure of SAS. There was no effect of treatment ($P > 0.05$) on DMI (26.6 ± 0.5 kg/d) or milk yield (49.8 ± 1.7 kg/d). Compared with pre-treatment values, MFD was observed when cows were fed both the Control and Agrado treatments, but the extent of MFD was significantly less across both periods when cows were fed Agrado; milk fat content was 3.22 and 3.32% ($P < 0.01$) and milk fat yield was 1.58 and 1.64 kg/d ($P < 0.05$) for the Control and Agrado treatments, respectively. This resulted in a

trend for 3.5% fat-corrected milk to be higher for cows on the Agrado treatment ($P < 0.10$). No other milk components were different between the two treatments ($P > 0.05$). Overall, data demonstrate the potential for dietary antioxidants in improving milk fat content and yield. Further studies, however are required to verify and extend these results and to determine the mechanism by which antioxidants impact rumen lipid metabolism and milk fat synthesis.

Key Words: Antioxidants, Milk Fat, Biohydrogenation

W208 Response of lactating cows to the supplementation with live yeast. L. L. Bitencourt^{*1}, M. N. Pereira¹, B. M. L. de Oliveira¹, J. R. M. Silva², G. S. Dias Júnior¹, F. Lopes¹, R. C. M. de Melo¹, and S. Siécola Júnior¹, ¹Universidade Federal de Lavras, Lavras, MG, Brazil, ²Centro Federal de Educação Tecnológica, Januária, MG, Brazil.

Performance and nutrient utilization of dairy cows supplemented with *Saccharomyces cerevisiae* strain CNCM I-1077 (Lallemand SAS, France) was evaluated. Twenty Holsteins, averaging 143±49 days in lactation at the beginning of the trial, formed ten blocks based on milk yield and were randomly assigned to a sequence of two treatments, in a cross-over design, with 28-day periods. Measurements were performed on the fourth week of each period. Treatments were: 10 g of the product Natucell (Ouro Fino Saúde Animal, Brazil) capable of providing 1×10^{10} cfu of live yeast or the same amount of placebo. Treatments were fed daily by allocation to each cow over the individually fed TMR. Diet composition was (% of DM): Corn silage (43.9), tifton hay (2.0), steam-flaked corn (14.4), pelleted citrus pulp (16.9), and soybean meal (21.7). Diet crude protein content was 16.8%, NDF was 30.9%, and NFC was 41.0% of DM. Data was analyzed with a model containing the effects of block, cow within block, period and treatment. Yeast supplementation increased daily milk (29.4 vs. 28.5 kg, $P=0.11$), protein (0.919 vs. 0.884 kg, $P=0.05$) and lactose yields (1.265 vs. 1.212 kg, $P=0.06$), and had no effect on milk fat ($P=0.53$). Daily dry matter intake was 21.4 kg with yeast and 20.7 for the control ($P=0.11$). Total tract apparent digestibility of the NDF was 48.1% with yeast and 43.2% for the control ($P=0.08$). There was a tendency for increased intake of digestible organic matter with yeast supplementation ($P=0.07$). Rumen fermentation and microbial parameters did not change between treatments. The concentration of purine derivatives in urine was numerically increased by yeast supplementation ($P>0.20$). The positive performance response to live yeast supplementation may have been the result of better diet digestibility.

Key Words: Yeast, Digestibility, Fiber

W209 The effect of feed sorting on chewing behavior, production, and rumen fermentation in lactating dairy cows. D. D. Maulfair^{*}, M. Fustini, and A. J. Heinrichs, *The Pennsylvania State University, University Park.*

Ration sorting is thought to allow cows to effectively eat different rations throughout the day, causing fluctuations in rumen fermentation patterns that can be detrimental to production. The objective of this experiment was to study the effects of varying TMR particle size on the sorting behavior of lactating dairy cows and to evaluate effects on chewing behavior, milk yield, milk components and rumen fermentation. Eight multiparous (parity = 2.3 ± 0.5) Holstein cows (90 ± 32 DIM initially;

642 ± 82 kg BW) were randomly assigned to replicated 4×4 Latin Squares. During each of the 4 periods cows were fed diets that varied only in the chop length of dry grass hay. When sieved through the Penn State Particle Separator (PSPS), the percentage of hay on the top screen (19.0 mm) was 23.1, 65.7, 86.6, and 94.9% for the short (S), medium (M), long (L), and extra long (XL) hay respectively. This resulted in the TMR of each diet having 6.4 (S), 17.4 (M), 18.6 (L), and 23.1 (XL) % on the top screen of the PSPS. The diet consisted of 29.4% corn silage, 22.9% ground corn, 17.6% alfalfa haylage, and 11.8% grass hay on a DM basis (DM 53.8%, forage 58.8%, NDF 32.1%, starch 27.7%). Chewing behavior was monitored using the IGER Behavior Recording system. No differences ($P < 0.05$) in chewing behavior between diets were found. Ruminating time/d was 518.7 ± 15.8 (S), 524.5 ± 15.4 (M), 495.6 ± 15.4 (L), and 522.5 ± 15.4 (XL) min/d (mean \pm SE). Chewing time was 373.4 ± 19.4 (S), 383.9 ± 18.9 (M), 365.7 ± 18.9 (L), and 385.6 ± 18.9 (XL) min/d. Milk production and DMI were also similar between diets. Milk yield was 39.0 ± 1.7 (S), 38.5 ± 1.7 (M), 37.3 ± 1.7 (L), and 36.3 ± 1.7 (XL) kg/d. DMI was 25.6 ± 1.0 (S), 25.3 ± 1.0 (M), 23.6 ± 1.0 (L), and 23.9 ± 1.0 (XL) kg/d. In addition no differences were found in milk fat, milk protein, MUN, rumen pH, rumen VFA and boluses/d. Despite drastic differences in particle size between these diets, there were no changes in chewing behavior, production, and rumen fermentation found in this study.

Key Words: Sorting, Particle Size, Rumination

W210 Effect of feed sorting on fecal particle size. M. Fustini^{*2}, D. D. Maulfair¹, A. J. Heinrichs¹, and A. Formigoni², ¹The Pennsylvania State University, University Park, ²University of Bologna, Bologna, Italy.

Increasing forage particle size of a TMR increases sorting activity by cows. Under this condition cows eat different diets during the day, with a higher intake of more palatable particles during the first meals and poorer quality feed during the later meals. The amount and timing of peNDF consumption and the impact of NFC, largely determine the fluctuations in rumen environment. The purpose of this study was to evaluate the effect of feed sorting and different diets throughout the day on fecal particle size distribution during a 24-h period. Four multiparous Holstein cows (BW = 659 ± 88 kg; DIM = 104 ± 15 d) were used in a 4×4 Latin Square design (21 d). During each of the 4 periods, cows were fed a diet that differed in the chop length of the grass hay. The diet was formulated to contain 58.8% forage (DM basis) in which dry hay comprised 11.8% of DM (20% of the forage). When sieved through the Penn State Particle Separator (PSPS) the percentage of hay on the top screen (19.0 mm) was 23.1, 65.7, 86.6, and 94.9% for the short (S), medium (M), long (L), and extra long (EL) hay respectively. This resulted in the TMR of each diet having 6.4 (S), 17.4 (M), 18.6 (L), and 23.1% (EL) on the top screen of the PSPS. Fecal samples were collected by rectal sampling 1 d during the last wk of each period at 0, 1.5, 3.5, 5.5, 8.5, 11.5, 14.5, 18, 21.5, and 24.5 h after feeding. Each sample was wet sieved in duplicate with screen apertures of 6.7, 3.35, 1.18, 0.6, and 0.15 mm using a vibrational sieve shaker. All diets resulted in similar fecal particle size distributions: fecal mean particle lengths (mm) of the 4 diets were 1.14 ± 0.16 (S), 1.15 ± 0.14 (M), 1.12 ± 0.15 (L), 1.12 ± 0.15 (EL), suggesting a possible sorting behavior against long particles. Each diet showed a daily variation in fecal particle size distribution, possibly an indication of inconstant rumen activity or passage.

Key Words: Fecal Particle Size, TMR Particle Size

W211 Interaction between particle sizes of alfalfa hay and concentrate on lactation performance, chewing activity, and ruminal pH of dairy cows. M. A. Bal* and E. B. Buyukunal Bal, *Kahramanmaraş Sutcu Imam University, Turkey.*

The objectives of this study were to determine the interactions between alfalfa hay and concentrate particle sizes on intake, milk yield, milk composition, chewing activity, and ruminal pH of dairy cows. Alfalfa hay was chopped either at 4 cm (long; L) or 1 cm (short; S) TLC using a hay harvester mounted with 10 or 58 mm screens. Particle size of concentrate was obtained by grinding dry corn with a hammer mill either at 1 mm (coarse; C) or less than 1 mm (fine; F) mean particle size. Four lactating multiparous Holstein cows (averaging 70 DIM) were used in a 4x4 Latin Square design in a 2x2 factorial arrangement of treatments with 21-d periods. Treatment diets consisted of 33.5% alfalfa hay, 16.5% corn silage, 22.5% dry corn, 7% cottonseed meal, 6% soybean meal based concentrate (DM basis) which was formulated to contain 16% CP and 1.45 Mcal/kg NE_L, and were fed once daily as a TMR. Mean particle sizes of treatment alfalfa hays and concentrates were 4.9, 3.1, 0.9, and 0.5 mm for L, S, C, and F, respectively. Mean particle sizes of treatment TMRs were 4.0, 3.8, 3.0, and 2.6 mm for LC, LF, SC, and SF, respectively. Intake of DM was not different among treatments averaging 23.6 kg/d. Similarly, yields of milk and milk protein were not different among treatments averaging 22.8 and 0.75 kg/d, respectively. However milk fat yield tended to be higher (P= 0.07) for C (0.82 kg/d) than F (0.73 kg/d). There was an interaction trend (P= 0.1) for milk protein percentage of cows received SC (3.31%) compared to LC (3.24%). Although cows received LF (371 min/d) spent more time for eating than SF (332 min/d), cows received LC (325 min/d) spent less time for eating than SC (356 min/d; P< 0.05). Ruminal pH was higher at 9 h of post-feeding (P< 0.05; time-alfalfa hay particle size interaction) for both SF (6.50) and SC (6.36) compared to LF (6.06) and LC (6.17). The data indicate that cows received C had higher milk fat percentage and yield but particle size of alfalfa hay had no effect on lactation performance and ruminal pH possibly due to closest particle lengths.

Key Words: Particle Size, Lactation Performance, Ruminal pH

W212 Effects of live yeast supplementation on lactation performance and ruminal pH of dairy cows fed medium and high levels of dietary concentrate. M. A. Bal*¹, S. Goksu¹, and V. Akay², ¹*Kahramanmaraş Sutcu Imam University, Turkey*, ²*Global Nutritech Ltd., Kocaeli, Turkey.*

The objectives of this study were to determine the effect of live yeast supplementation (Global Nutritech Ltd., Kocaeli, Turkey) and dietary concentrate level interaction on DMI, milk yield, milk composition, and ruminal pH. Four multiparous Holstein cows (averaging 83 DIM) were assigned to one of four dietary treatments in a 4x4 Latin Square design in a 2x2 factorial arrangement with 21-d periods. The dietary treatments (DM basis) were: 1) 50% concentrate + 10 g/cow/d live yeast (50LY), 2) 50% concentrate + no live yeast (50NLY), 3) 70% concentrate + 10 g/cow/d live yeast (70LY), and 4) 70% concentrate + no live yeast (70NLY). Treatment 1 and 2 consisted of 43% corn silage, 7% alfalfa hay, 50% concentrate, and had 13.8% CP, whereas Treatment 3 and 4 consisted of 23% corn silage, 7% alfalfa hay, 70% concentrate, and had 15.7% CP. Diets were fed once daily as a TMR. Live yeast supplementation had only a numerical difference on DMI (18.0 vs. 17.5 kg/d), milk yield (20.2 vs. 19.1 kg/d), 3.5% FCM (19.4 vs. 18.8 kg/d) and ECM (20.0 vs. 19.2 kg/d) compared to no live yeast supplementation,

respectively. Live yeast supplementation tended to increase (P= 0.06) milk fat yield in 50LY (0.66 kg/d) compared to 50NLY (0.62 kg/d). Similarly live yeast supplementation tended to increase (P= 0.08) SNF percentage in 50LY (9.83%) compared to 50NLY (9.63%). Percentage of lactose tended to be higher (P= 0.07) for 50LY (4.52%) than 50NLY (4.41%). A more distinct effect of live yeast supplementation on ruminal pH was observed at 9 h of post-feeding (P= 0.05) and cows received 70NLY had the lowest ruminal pH (5.81) compared to cows received 70LY (6.40; P< 0.05). Although there were only numerical increases in DMI, milk yield, 3.5% FCM and ECM with the supplementation of live yeast, results indicated that live yeast supplementation at 50% dietary concentrate would increase milk protein, SNF, and lactose percentages. Ruminal pH reductions during the feeding of high dietary concentrate diets can be prevented with live yeast supplementation.

Key Words: Live Yeast, Lactation Performance, Ruminal pH

W213 Efficacy of SOLIS[®], NOVASIL[™]Plus, and MTB-100[®] to reduce aflatoxin M₁ levels in milk of dairy cows fed aflatoxin. R. Kutz*¹, J. Sampson¹, D. Ledoux¹, J. Spain¹, and M. Vázquez-Añón², ¹*University of Missouri, Columbia*, ²*Novus International, St. Charles, MO.*

An experiment was conducted to determine the efficacy of three adsorbents, SOLIS[®](SO; Novus International, Inc), NOVASIL[™]Plus(NOV), and MTB-100[®](MTB), in reducing aflatoxin M₁ (AFM₁) concentrations in milk of dairy cows fed an aflatoxin (AF)-contaminated diet. Twelve early to mid lactation dairy cows averaging 163 days in milk (DIM) were used in a 4 × 4 Latin Square Design (LSD) with 3 replications. Cows were blocked by parity, body weight, milk production, and were provided *ad libitum* access to feed and water. Within each replicate, cows were randomly assigned to the 4 dietary treatments for 4 consecutive 7 day periods. Diets included: AF (112 µg AFB₁/kg diet dry matter (DM)); AF plus 0.5% SO; AF plus 0.5% NOV; and AF plus 0.5% MTB. Milk samples were collected on days 6 and 7 of each of the 4 experimental periods. Feed intake, milk production, percent milk fat, percent milk protein, and somatic cell count scores were not affected (P > 0.05) by dietary treatments and averaged 22.29 kg/day DM, 33.87 kg/day, 3.78%, 2.95%, and 1.60, respectively across all treatments. Transfer rates of AF from feed to milk averaged 2.64, 1.48, 1.42, and 2.52% for cows fed AF, AF+SO, AF+NOV, and AF+MTB, respectively. Daily AFM₁ excretion in milk averaged 66, 37, 35, and 63 µg/day for cows fed AF, AF+SO, AF+NOV, and AF+MTB, respectively. The addition of SOLIS[®] and NOVASIL[™]Plus to the AF diet resulted in a significant (P < 0.05) reduction in milk AFM₁ concentrations (SO, 45%; NOV, 48%) and AFM₁ excretion (SO, 44%; NOV, 46%). In contrast, MTB-100[®] was not effective (P > 0.05) in reducing milk AFM₁ concentrations (4%), AFM₁ excretion (5%), or AF transfer from feed to milk (2.52%). Results indicate that SOLIS[®] and NOVASIL[™]Plus at 0.5% of the diet were effective in reducing milk AFM₁ concentrations in cows consuming a totally mixed ration containing 112 µg AFB₁/kg diet DM.

Key Words: Aflatoxin, Adsorbents, Lactating Dairy Cows

W214 Effect of an essential oil blend on performance of periparturient and early lactation dairy cows. M. D. Tassoul* and R. D. Shaver, *University of Wisconsin, Madison.*

Multiparous Holstein cows (n = 40) were used to examine effects of dietary supplementation with an essential oil blend (EO, CRINA®). Cows were randomly assigned to either control (C) or EO supplemented (1.2 g/cow/d) TMR. Treatments began three weeks prepartum and continued through 15 weeks in lactation. The dry cow TMR contained 70% forage comprised of 70% corn silage, 15% alfalfa silage and 15% wheat straw (DM basis). The lactation TMR contained 50% forage comprised of 60% corn silage, 33% alfalfa silage, 7% alfalfa hay (DM basis). Dry cow and lactation TMR were formulated to contain 12 and 17% CP (DM basis), respectively. There were no differences in plasma NEFA, BHBA, glucose, and urea-nitrogen concentrations measured on days -21, -7, -1, 1, 8, 15, 22, and 29 relative to calving. There was no difference in prepartum DMI, but lactation DMI was lower for EO than C (22.7 vs. 24.5 kg/d, P = 0.04). There were no differences in milk or FCM yields (P > 0.10). Milk true protein (TP) was 0.15%-units greater for C than EO (P = 0.03). Milk TP yield was greater for C than EO during weeks 1-5 (1.46 vs. 1.35 kg/d, P = 0.03). Energy balance tended to be lower for EO than C (-4.1 vs. -1.6 Mcal/day, P = 0.06), and was lower during weeks 6-10 and 11-15 (-1.8 vs. 0.8, P = 0.02; -1.0 vs. 3.3 Mcal/d, P = 0.006, respectively). Weekly body weights and condition scores were unaffected by treatment (P > 0.10). Feed efficiency (FE) tended to be greater for EO than C (2.15 vs. 1.99 kg milk/kg DMI, P = 0.06), and was greater during weeks 6-10 (2.18 vs. 1.97 kg milk/kg DMI, P = 0.04) and 11-15 (2.13 vs. 1.89 kg milk/kg DMI, P = 0.02). Fat-corrected milk FE tended to be greater for EO than C (1.98 vs. 1.83 kg FCM/kg DMI, P = 0.07). During weeks 6-10 FCM FE tended to be greater for EO than C (1.89 vs. 1.72 kg FCM/kg DMI, P = 0.08) and during weeks 11-15 was greater for EO (1.80 vs. 1.58 kg FCM/kg DMI, P = 0.03). Results suggest that dietary addition of EO improves feed efficiency in lactating dairy cows, but further research is needed to determine the mode of action.

Key Words: Essential Oils, Feed Efficiency

W215 Effects of essential oil combinations on in vitro rumen microbial fermentation of a high-concentrate diet for beef cattle. I. Fandiño¹, S. Calsamiglia¹, A. Ferret¹, D. Moya¹, J. Martin-Tereso², and H. ter Wijlen*², ¹Universitat Autònoma de Barcelona, Spain, ²Nutreco, The Netherlands.

Seven essential oils (*Tea Tree* TE, *Thyme* TH, *Oregano* OR, *Rosemary Moroc* RM, *Rosemary Tunes*, *Salvia* SA, *Clove* CL) and 13 different essential oil combinations were used in a 24 h batch fermentation study with a 10:90 forage:concentrate diet (16% CP, 32% NDF, 38 % starch) to study their effects on rumen microbial fermentation. Treatments were supplied at 10, 50, 200 and 400 mg/L of culture fluid and tested in triplicate in 2 consecutive periods (n = 6). Differences were declared at P < 0.05. Monensin reduced acetate (Ac) proportion, acetate to propionate (A:P) ratio, butyrate (Bu) proportion, branch-chained VFA (BCVFA) and NH₃-N concentration, and increased propionate (Pr) proportion, as expected. The TE and OR (50 and 200 mg/L) decreased Ac proportion and A:P ratio, and increased Pr and Bu proportions; TH (50 and 200 mg/L) decreased Ac proportion and A:P ratio, and increased Pr proportion; TH (200 mg/L) also decreased Bu proportion; SA (400 mg/L) increased Pr proportion, reduced A:P ratio and NH₃ N concentration, and tended to reduce total VFA concentration; TH and RM (400 mg/L) increased Ac and decreased Bu proportions, and total VFA concentration, and TH (400 mg/L) also decreased BCVFA and NH₃ N concentrations, suggesting that deamination was inhibited; CL (400 mg/L) decreased Pr proportion, and increased Bu proportion and A:P ratio. The combina-

tions 75%TE+25%TH (400 mg/L), 75%TE+25%CL (200 and 400 mg/L), 50%TE+50%CL (400 mg/L), 75%TE+25%OR (400 mg/L) and 50%TE+25%TH+25%OR (200 and 400 mg/L) decreased Ac proportion and A:P ratio and increased Pr proportion; 75%TE+25%CL (400 mg/L) tended to reduce pH, and 50%TE+25%TH+25%OR (400 mg/L) tended to reduce NH₃ N concentration. Careful selection and combination of these extracts may allow the manipulation of rumen microbial fermentation.

Key Words: Rumen Fermentation, Plant Extract

W216 Dose-response effects of Rumensin® supplementation on ruminal digestion kinetics of fiber and starch. M. S. Allen and Y. Ying*, Michigan State University, East Lansing.

Eight ruminally and duodenally cannulated multiparous Holstein cows were assigned randomly to replicated 4 x 4 Latin squares in a dose response arrangement of treatments. Treatments were Rumensin® supplementation at 0, 8, 16, and 24 ppm DM. Diets consisted of corn silage and alfalfa silage (2:1 ratio, DM basis), high moisture corn, distiller's grains (6.9% of diet DM), protein supplement, minerals and vitamins and contained 25% NDF, 18.5% forage NDF, 28.6 % starch and 16.5% crude protein. Treatment periods were 28 d with the final 11 d used for sample and data collection. Ruminal digestion kinetics were calculated using the pool and flux method. Rumensin® treatment increased dry matter intake (P = 0.02 cubic) but did not affect milk yield (mean = 39.8 kg/d, P = 0.77). Quadratic effects of treatment were detected for rates of digestion (P = 0.05) and passage (P = 0.02) of potentially digestible NDF; rate of digestion increased from 1.94 %/h for 0 ppm to 2.50 %/h for 8 ppm and then declined to 1.63 %/h for 24 ppm and rate of passage decreased from 2.56 %/h for 0 ppm to 2.06 %/h for 8 ppm and then increased to 3.09 %/h for 24 ppm. These resulted in quadratic effects of treatment on ruminal and total tract NDF digestibility (P < 0.08). Greater ruminal pool sizes of NDF, OM, and DM for 8 and 16 ppm compared to 0 and 24 ppm (all P < 0.06 for quadratic effect) were due primarily to greater dry matter intake because NDF turnover rate in the rumen was not affected by treatment (P > 0.80). Ruminal and total tract starch digestibility as well as starch digestion kinetics were not affected by treatment. Treatment tended (P = 0.09) to decrease ruminal pH linearly from 6.26 to 6.14. Treatment tended (P = 0.07 quadratic) to increase true ruminal OM digestibility for 8 and 16 ppm compared to 0 and 24 ppm but did not affect total tract OM digestibility. Lower concentrations of Rumensin® (8-16 ppm) might increase ruminal and total tract NDF digestibility without decreasing its filling effect in the rumen.

Key Words: Rate of Digestion, Rate of Passage, Rumen Fill

W217 Effect of feeding essential oils and monensin on fatty acid profiles of milk fat. M. L. He*¹, W. Z. Yang¹, C. Benchaar², A. V. Chaves¹, and T. A. McAllister¹, ¹Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada, ²Agriculture and Agri-Food Canada, Dairy and Swine R&D Centre, Sherbrooke, QC, Canada.

Essential oils (EO) from plant extracts have been reported to have an antibacterial activity against gram-negative and gram-positive bacteria. Several of the gram-positive bacteria are involved in ruminal biohydrogenation of fatty acids (FA), thus suggesting that feeding EO could

lower biohydrogenation of FA because of a decrease in the number of bacteria involved in that process. In addition, it has been reported that cows fed monensin produced milk with greater concentration of trans-10 18:1 and trans-11 18:1. The objectives of this study were to evaluate the effects of two EO (garlic and juniper berry oils) and monensin on FA profiles of milk fat. Four ruminally fistulated Holstein cows were used in a 4 × 4 Latin square experiment. Cows were fed for ad libitum intake a TMR without supplementation (control), or supplemented with monensin (330 mg/day), garlic oil (5 g/day), or juniper berry oil (2 g/day). The FA composition of saturated, monounsaturated or polyunsaturated was not affected ($P > 0.10$) by supplementation of EO and monensin. However, proportion of conjugated linoleic acid trans 10, cis 12 (CLA t10, c12) was higher ($P < 0.04$) for cows fed EO (0.11%) or monensin (0.12%) than for control cows (0.09%). Supplementation of monensin also increased ($P < 0.10$) the proportion of total trans FA compared with the control. The higher trans FA was primarily due to higher C18:1 trans 6-8 FA with monensin. These results indicate that supplementation of the dairy cow diet with garlic or juniper berry EO or monensin had the potential to increase the proportion of CLA t10, c12 in milk fat with minimal overall effects on FA of milk fat. The results also confirm the increase of trans-10 18:1 in milk fat by feeding monensin to dairy cows.

Key Words: Plant Essential Oil, Milk Fatty Acids, Dairy Cows

W218 Effect of abomasal infusion of formate on milk protein of cows fed a methionine deficient diet. J. A. A. Pires*, N. J. Benevenga, G. A. Broderick, and R. R. Grummer, *University of Wisconsin, Madison.*

Carbon from formate is transferred to the methyl group of Met in milk protein via the folate cycle. We hypothesized that post-ruminal formate infusion to dairy cows would partially compensate for dietary Met deficiency and enhance milk protein production. Six midlactation cows were used in a balanced replicated 3×3 Latin square design, with 7 d periods and sample collection during last 4 d of each period. Treatments were continuous abomasal infusions of L-Met (20 g/d; positive control), sodium formate (3× molar amount of L-Met; requirements for methyl groups may be 2 to 4× that for methionine in support of protein synthesis) or sodium acetate (1/2 molar amount of formate, to provide equal amount of carbon; negative control). Cows consumed a diet deficient in metabolizable Met and Lys (18 g/d and 25 g/d, respectively, for a cow producing 40 kg milk/d; estimated from NRC, 2001) ad libitum for at least 4 wk prior to treatment administration. One wk prior to initiation of abomasal infusions, feed was offered at a rate to meet requirements for milk produced the previous 7 d. L-Lys was mixed with each treatment (25 g/d), leading to an estimated total supply of 2.4% Met and 7.1% Lys (MP basis). As expected, Met infusion increased milk protein percent (Table 1), but protein yield was not different, probably due to greater variability in milk production. Formate did not differ from acetate for any of the measurements. The formate infusion rate may have been insufficient to elicit a production response. Formate may also have been catabolized by gastrointestinal tract, or it may have been diverted to other products of the folate cycle in the liver.

Table 1. Treatment effects on milk production and composition.

	Acetate	Formate	Methionine	SEM	<i>P</i>
Milk yield, kg/d	31.5	32.2	31.7	2.29	0.68
Protein, %	3.04 ^b	3.02 ^b	3.18 ^a	0.07	0.01
Protein yield, g/d	956	970	1,005	66	0.32
Fat, %	3.73	3.65	3.56	0.20	0.39
Fat yield, g/d	1,183	1,170	1,130	110	0.61
Lactose, %	4.78	4.79	4.78	0.04	0.99
Lactose yield, g/d	1,512	1,544	1,518	116	0.73
MUN, mg/dL	9.84	9.68	9.85	0.53	0.90

a, b: $P \leq 0.01$

Key Words: Methyl-Donor, Formate, Methionine

W219 Feeding rumen-protected choline reduces the risk of hepatic lipidosis in transition dairy cows. F. S. Lima¹, B. A. Barton*², and J. E. P. Santos¹, ¹*University of Florida, Gainesville,* ²*Balchem Co., New Hampton, NY.*

Objectives were to determine the effects of feeding rumen-protected choline (RPC) on hepatic tissue composition and hepatic lipidosis in dairy cows. Holstein cows, 46, 20 multiparous and 26 primiparous, were fed either 0 (n = 25) or 60 g of RPC to deliver 15 g/d of choline (n = 21; Reashure, Balchem) top dressed onto the diet once daily from 25 d prepartum to 80 d in milk (DIM). Blood was sampled at 1 and 14 d postpartum and analyzed for concentrations of 3-OH-butyrate (BHBA). Hepatic tissue collected by percutaneous biopsy at 9 DIM was analyzed for concentrations glycogen, triglycerides and dry matter (DM). Cows were categorized as having hepatic lipidosis if hepatic triacylglycerol concentration was > 5% on a wet basis. Data were analyzed using the Mixed and Logistic procedures of SAS and odds ratios (OR) and 95% confidence intervals (CI) were calculated. Concentrations of BHBA were similar ($P = 0.53$) for cows fed control and RPC at d 1 (1012.7 ± 137.5 vs. 836.6 ± 143.4 mMol) and d 14 (927.0 ± 137.5 vs. 926.3 ± 143.3 mMol) postpartum. Concentration of glycogen in hepatic tissue was similar ($P = 0.35$) for cows fed control and RPC (0.94 ± 0.15 vs. 1.14 ± 0.16 %). Similarly, concentration of triglycerides in the hepatic tissue did not differ ($P = 0.31$) for cows in the control and RPC diets (5.9 ± 1.2 vs. 4.1 ± 1.3 %); however concentrations of triglycerides on a DM basis tended ($P = 0.10$) to be greater for control than RPC cows (10.4 ± 1.7 vs. 6.0 ± 1.9 %). Feeding RPC reduced the risk (OR = 0.23; 95% CI = 0.05, 1.06) of cows to have hepatic lipidosis (40.0 vs. 14.3%; $P = 0.05$). Concentrations of glycogen in hepatic tissue declined as concentrations of triglycerides increased (glycogen % = $1.251 - 0.04451 \times$ triglycerides%; $r^2 = 0.11$, $P = 0.01$). Feeding rumen protected choline reduced triglyceride concentration in liver DM tissue and the risk of hepatic lipidosis in early lactation dairy cows.

Key Words: choline, dairy cow, fatty liver

W220 Effects of alcohol-fermented feedstuff on the feed intake, feed efficiency, milk quality and profitability of Holstein cows. J. K. Choi¹, B. W. Kim², and J. S. Shin*², ¹*Dae Han Feed, Incheon, Kyonggee, South Korea,* ²*Kangwon National University, Chuncheon, Kangwon, South Korea.*

This study was performed to determine the effects of alcohol-fermented feedstuff (AFF) on the milk yield, feed efficiency, milk composition, somatic cell count of Holstein cows and the earning per cow. Fifty percent corn meal was combined with 50% brewery meal to make AFF in addition with 5% molasses and 2% yeast for fermentation. Feeding trials were divided into control, T1, T2, and T3 groups which were supplied by 0, 5, 10, and 15% of AFF out of whole dairy feedstuff (50% corn meal and 50% sudangrass silage), respectively. The experiment was conducted from July to November in 2006. Forty Holstein cows were assigned using a completely randomized design. The groups fed AFF diets had a higher feed intake; control (19.40kg), T1 (20.64kg), T2 (21.89kg) and T3 (22.19kg). Especially, the feed intake in T3 group increased by 14.9% compared to control. The milk yields were lower in T1 and T2 groups than control, however the most yield was observed in T3 group, which was increased by 20.6% compared to control. The feed efficiency in control, T1, T2 and T3 groups were 1.04, 0.78, 0.87 and 1.09, respectively. The feed efficiency of 4% FCM production was improved in T2 and T3 groups, especially in T3 group in which it was improved by 19.8% compared to control. There was no significant difference in milk fat, milk protein, lactose, total solid, solid not fat, milk urea nitrogen, and citric acid between the groups. Somatic cell counts in control, T1, T2, and T3 groups were 457,810, 285,200, 254,860, and 73,310 cells/ml, respectively. Most earnings were resulted in T3 group (10.43 dollar per cow/day), least in T1 and T2 groups (8.56 and 8.49 dollar per cow/day), and intermediate in control (9.21 dollar per cow/day). These results indicate that the use of about 15% alcohol-fermented feedstuff with a conventional dairy feedstuff can ensure more profitable earnings as well as improved milk quality in the Holstein farm.

Key Words: Alcohol, Milk Quality, Holstein

W221 Effect of feeding polyphenols on growth, health, nutrient digestion, and immunocompetence of calves. R. A. Oliveira¹, C. D. Narciso¹, R. Bisinotto¹, M. A. Ballou*², and J. E. P. Santos¹, ¹University of Florida, Gainesville, ²Texas Tech University, Lubbock.

Objectives were to determine effects of feeding polyphenols from pomegranate extract (POMx) on growth, health, nutrient digestion, and immunocompetence of calves. Holstein calves (n = 67), at 3 ± 1 d of age (d 0 = birth day) were assigned to 0 (control), 5 (POMx5), or 10 g/d (POMx10) of POMx containing 10% gallic acid equivalent. Calves received colostrum in the first 24 h, pasteurized milk thereafter until 61 d of age, and grain was fed in the first 70 d of age. Grain intake, attitude and fecal scores, incidence and duration of health disorders were evaluated daily. Rectal temperature was measured for the first 21 d of age. Body weight was measured at 2, 30 and 70 d of age. Neutrophil phagocytic and killing activities and antibody response to immunization with ovalbumin were measured. Peripheral blood mononuclear cells (PBMC) were cultured and cytokine production measured. Concentrations of glucose and 3-hydroxybutyrate (BHBA) were measured in plasma. Nutrient digestion was measured using total fecal collection during a 3-d period. Feeding POMx tended to reduce (P=0.07) grain intake and the response was linear (847 vs 787 vs 754 g/d), with effects observed after 30 d of age. BW gain in the first 30 d was similar (P=0.98) and averaged 377 g/d, but BW gain after 30 d of age declined linearly (P=0.02) with feeding POMx (830 vs 784 vs 721 g/d). Plasma concentrations of glucose decreased and of BHBA increased with age, but treatments had no effect (P>0.55). Neutrophil phagocytic (61.3 vs 62.0 vs 64.6%) and killing percentages (54.8 vs 53.4 vs 58.2%) were similar (P>0.65) for control, POMx5 and POMx10, respectively. In

vitro production of tumor-necrosis factor-alpha was similar among treatments, but a linear increase (P=0.05) in PBMC production of interferon gamma (102 vs 200 vs 297 pg/mL) and interleukin-4 (271 vs 432 vs 497 pg/mL) was observed. Serum anti-ovalbumin IgG increased with immunizations, and response was enhanced (treatment x day, P=0.04) by feeding POMx. Results indicate that humoral immune response was enhanced by feeding polyphenols despite reduction in grain intake and BW gain after 30 d of age.

Key Words: Calf, Polyphenols, Immunity

W222 Changes in milk aflatoxin concentrations in response to investigational sequestering agents added to aflatoxin-contaminated diets fed to lactating Holstein cows. L. Waltman*, S. Davidson, B. A. Hopkins, G. W. Smith, and L. W. Whitlow, North Carolina State University, Raleigh.

Three experiments (EXP) were conducted to determine the effect of investigational sequestering agents, including clays or non-digestible yeast oligosaccharides (NYO), on milk aflatoxin concentrations in lactating Holstein cows consuming aflatoxin. All EXP included two periods in a randomized block design. Cows were fed an aflatoxin-contaminated total mixed ration (TMR) for both periods of all trials. During the first period, cows received no sequestering agents, but agents were included in the TMR for the second period. In EXP 1 and 2 there were two 7 d periods and 12 cows per treatment. Milk samples from d 5-7 and d 11-13 were analyzed for milk aflatoxin (AFM1) concentrations by HPLC. Two treatments in EXP 1 were: 1) control (no agent) and 2) 100g/d of a mixture of NYO-A and diatomite-montmorillonite (DMM). Four treatments in EXP 2 were: 1) control (no agent), 2) 10g/d NYO-B, 3) 10g/d NYO-C, and 4) 10g/d NYO-D. In EXP 3 there were two 8 d periods and 14 cows total. Milk samples from d 4-8 and d 11-16 were analyzed for AFM1 concentrations by ELISA. Three treatments in EXP 3 were: 1) control (no agent) (n=4), 2) 50g/d NYO-C (n=5), and 3) 227g/d bentonite (n=5). For all EXP, the percent differences in AFM1 concentrations between periods 1 and 2 were calculated. All percent differences were normalized using a correction factor that converted values for controls to zero. The changes from zero (%) due to sequestering agents were considered significant at P < 0.05. In EXP 1, the addition of a mixture of NYO-A and DMM resulted in a 5.2% numerical increase in AFM1 concentration. In EXP 2, investigational agents NYO-B, NYO-C, and NYO-D resulted in 8.0%, 6.2%, and 9.5% numerical increases in AFM1 concentrations respectively. In EXP 3, NYO-C resulted in a 5.1% numerical decrease in AFM1 concentrations, and the bentonite resulted in a 60.4% significant decrease in AFM1 concentrations. In summary, the bentonite in EXP 3 reduced AFM1 concentrations (P=0.01). There were no significant changes (P>0.25) in AFM1 concentrations in response to investigational sequestering agents other than bentonite.

Key Words: Aflatoxin, Milk, Binder

W223 Effect of monensin concentration on dry matter intake during the transition period of lactating dairy cows. M. A. Shah*¹, G. Schroeder¹, B. D. Strang¹, and H. B. Green², ¹Cargill Animal Nutrition, Elk River, MN, ²Elanco Animal Health, Greenfield, IN.

Feeding monensin to dairy cows is known to increase milk production efficiency (milk/unit energy intake). We analyzed data collected from

966 cows from nine randomized complete block design trials conducted in the US and Canada in which 4 doses of monensin (0, 7, 15, 22 g/ton of dry matter intake (DMI)) were fed for a complete lactation. The PROC MIXED and PROC NLIN procedures in SAS were used to analyze data. DMI and milk yield data were analyzed with monensin dose as fixed effect and location as a random variable. Location and cows were used as random factors and week in milk (WIM) as repeated measure in the model. Increased production efficiency (Milk/DMI) (1.51, 1.52, 1.56 and 1.59 ± 0.03 ; $P < 0.0001$) was a result of a linear reduction in DMI (20.4, 20.4, 19.8 and 19.6 ± 0.17 kg/d; $P = 0.003$) and similar milk yield (31.6 ± 0.4). When weekly DMI data for the first 12 WIM was analyzed using an exponential model ($DMI(t) = a - b \times \exp(-c \times t)$; where $DMI(t)$ = weekly DMI for corresponding WIM, a = asymptotic maximum DMI, b = potential increase in DMI, c = fractional rate of increase of DMI with WIM, and t = WIM) the rate of change in DMI was linearly increased as monensin dose increased (0.036, 0.047, 0.045, and $0.051 + 0.004$ % per d; $P = 0.007$). This also resulted in a linear increase in production efficiency (1.89, 1.92, 1.96, and 2.01 ± 0.04 ; $P < 0.0001$). These results may indicate that monensin may have a different effect on DMI depending on rumen dynamics or energy status of the cow. A faster intake recovery was associated with a reduction in the incidence of ketosis (12.7 % for control versus 6.2, 7.0 and 4.2 % for monensin treated, $P = 0.03$, 0.06 and 0.04, respectively), but there was no effect on reproductive efficiency (services per conception, days open, days to first service, calving interval and days open) except lower first service conception rate (37.5%) at 22 g/ton compared to the control group (49.6%). Feeding monensin to transition cows may help improve energy balance through a higher rate of DMI increase during early lactation.

Key Words: Monensin Concentration, Exponential Model, DMI

W224 Effect of malic acid on rumen fermentation *in vitro* with DHA diet. L. Liu, J. Q. Wang*, D. P. Bu, S. J. Liu, K. L. Liu, H. Y. Wei, and L. Y. Zhou, *Chinese Academy of Agricultural Sciences, Beijing, China*.

The objective of this study was to evaluate changes in rumen fermentation when different levels of malic acid were added in a DHA-enriched diet. The rumen-simulation technique (RUSITEC) apparatus containing eight vessels was employed in this experiment. Treatments were as follows: (1) base diet rich in DHA (CON); (2) base diet with 10 mM malic acid (Trt1) and (3) base diet with 20mM malic acid. This study was repeated at two-week intervals. Experimental period was 7 d including 6 d for adaptation and 1 d for sampling. Culture fluid was collected every 3 h over a 12 h period on the last day of each experimental period. The concentration of VFA was analyzed by gas chromatography (model 6890, Series II; Hewlett Packard Co., Avondale, PA). Data were analyzed with PROC MIXED procedure of SAS for a completely randomized design with repeated measures. The results showed that with the addition of malic acid, culture fluid pH numerically decreased ($P > 0.05$) from 6.17 to 6.14 and 6.09 for CON, Trt1 and Trt2, respectively. However, addition of malic acid in a DHA diet had no effect on acetate concentration in culture fluid ($P > 0.05$). Contrarily, propionate and butyrate concentration in culture fluid increased when malic acid was added. Compared to CON, concentration of propionate in Trt1 and Trt2 increased by 30.37% and 62.37%, respectively. Butyrate concentration increased by 21.76% and 24.85% for Trt1 and Trt2. The proportion of acetate to propionate decreased significantly ($P < 0.01$). Results suggest that malic acid supplementation in a DHA diet changes the rumen fermentation process.

Acknowledgement; Research supported by Ministry of Science and Technology (2006BAD12B03).

Key Words: DHA Diet, Malic Acid, Rumen Fermentation

W225 Effect of physical particle size on ruminal and post-ruminal disappearance of nutrients of a mixed concentrate in Holstein steers. H. Jahani-Azizabadi¹, M. Danesh Mesgaran*¹, and A. Rahmatimanesh², ¹*Ferdowsi University of Mashhad, Mashhad, Mashhad, Iran*, ²*Heram Talaei Shargh Feed Mill Company, Nishabour, Iran*.

In situ ruminal and post-ruminal disappearance [dry matter (DM), crude protein (CP) and ether extract (EE)] of a mixed concentrate prepared as fine mesh (fm), fine pellets (fp) and coarse pellets (cp) were studied. All pellets were provided in a condition of 70°C with pressure of 3 bars in 7 seconds. Concentrate was composited of cereal grain, soybean meal, canola meal, fish meal, urea, wheat bran, beet pulp, bagasse, salt, sodium bicarbonate, mineral and vitamin premix, anionic salt, molasses, sugar, protected fatty acid and Mg oxide (318, 60, 150, 15, 3.6, 250, 33, 40, 6.7, 8.6, 8, 15, 55, 30, 5 and 2.1 g/kg DM, respectively). Four Holstein steers (430 ± 50 kg, BW) fitted with ruminal fistulae and T-shaped intestinal cannulae were used. Steers fed (DM basis) 2.5 kg of alfalfa hay, 2.1 kg of corn silage, 1.5 kg of straw and 2.5 kg of concentrate (170 g CP/kg of DM). Approximately 5 g of sample (DM) was placed in polyester bag (12x19 cm, pore size of 48 μ m, n=8), then incubated in the rumen for 12 h. After removal from the rumen, bags were washed and dried. Then, 1 g DM of un-ruminal disappeared sample was weighed into a mobile bag (3x6 cm, pore size of 48 μ m, n=8) and inserted in small intestine, then removed from the voided feces and rinsed in cold tap water. DM, EE and CP of intact and incubated samples were determined. Data were analyzed using completely randomized design. Ruminal DM, CP and EE disappearance of fm was significantly ($P < 0.01$) lower than fp and cp. Ruminal DM, CP and EE disappearance of fp was significantly ($P < 0.01$) higher than cp (0.71, 0.61 and 0.65 vs. 0.67, 0.58 and 0.59, respectively). Post-ruminal DM, CP and EE disappearance of fm concentrate (0.45, 0.50 and 0.80, respectively) was significantly ($P < 0.01$) higher compared with fp (0.35, 0.38 and 0.68, respectively) and cp (0.39, 0.38 and 0.57, respectively). Results of the present study indicated that the physical particle size of a mixed concentrate might impact on ruminal and post-ruminal disappearance of DM, CP and EE.

Key Words: Physical Processing, Disappearance, Mobil Nylon Bag

W226 Influence of an α -amylase on *in vitro* ruminal fermentation and starch degradation. W. Hu*¹, M. E. Persia², and L. Kung, Jr.¹, ¹*University of Delaware, Newark*, ²*Syngenta Animal Nutrition, Research Triangle Park, NC*.

A thermostable α -amylase was isolated and then expressed in corn grain. Although this amylase was specifically developed for use in ethanol production, because it has completed the FDA consultation process for food and feed, the utility of this amylase as a feed enzyme on rumen fermentation and starch degradation *in vitro* was explored. In experiment 1, pure corn grains were fermented individually with inoculums of rumen fluid and artificial saliva for 6 h at 40°C. Four corns were evaluated: flint, opaque and two corns with near identical nutrient profiles: one containing amylase (CA) and the other the isogenic control (IC).

Flint corn produced less ($P < 0.05$) total VFA (18.3 mM) than the other three corns (an average of 25.3 mM), validating the ability of the assay to detect differences in fermentation among hybrids. No difference ($P > 0.05$) was noted in total VFA production from CA when compared to IC, but there was a small but significant increase in starch degradation (90.6 vs. 89.7%, $P < 0.01$). In experiment 2, mixtures of the CA and IC corns (0, 25, 50, 75 and 100% CA grain concentrations) were fermented using the same *in vitro* model. Total VFA production was not different ($P > 0.05$) among treatments for any concentration of CA (0 to 100%). These data suggested that the amylase was not sufficiently active at the physiological temperature of the rumen. To test this hypothesis, CA and IC were incubated in water at 40 and 65°C for 24 h to determine starch degradation. Apparent starch degradation at 40°C was 1.99 and 1.60% for CA and IC, respectively. When both grains were incubated at 65°C, the apparent starch degradation was 10.56 and 0.85% for CA and IC, respectively. This >10-fold increase in starch degradation of the CA grain incubated at 65°C resulted in an interaction between corn variety and temperature. These data clearly demonstrate that amylase activity is expressed sufficiently in CA at a high temperature (65°C) but the amylase activity does not have any positive or negative effects at physiological temperature of the rumen (40°C) when used as a feed enzyme for ruminant production.

Key Words: Corn, Amylase, Starch

W227 N and energy synchronization of barley: Effect of variety and growth year. P. Yu* and K. Hart, *University of Saskatchewan, Saskatoon, SK, Canada.*

The objective of this study was to investigate N and energy synchronization of six barley varieties during three consecutive growth years of 2003, 2004 and 2005 in order to determine the magnitude of the differences between the varieties and growth years which affect optimizing rumen fermentation. The synchronization of N and energy was indicated by hourly effective degradation ratio between effectively degraded N and CHO. The difference in cumulative amounts degraded at successive hours was regarded as the amount of degraded each h. The experimental design was a RCBD and the data was analyzed using SAS Mixed Model procedure. The results showed less difference at the beginning of the incubations. However, with increasing incubation times, the difference was highly increasing among the varieties. At the beginning of the incubation, hourly effective degradation ratio of N/CHO was 3 to 5 g/kg. At 10 h incubation, the ratio ranged from 24 to 30 g/kg ($P < 0.05$). With further increasing times, the ratios were also increased ($P < 0.05$). However, the different varieties resulted in different magnitude of increments in ratio. The lowest increase was from 3 to 41 g/kg for CDC Trey. The highest increase was from 5 to 225 g/kg for Cowboy. The variations between the growth years were smaller at the beginning of incubations, but variations increased ($P < 0.05$) with increasing incubation times.

Key Words: Synchronization, Hourly Effective Degradation Ratio of N to CHO, Barley Variety

W228 Effects of fibrolytic enzymes on *in vitro* digestibility of destoned olive cake. D. Elia¹, P. P. Danieli¹, P. Bani², and U. Bernabucci*¹, ¹*Dipartimento di Produzioni Animali, Viterbo, Italy*, ²*Istituto di Zootecnica, Piacenza, Italy.*

Olive cake has a poor digestive utilization and can negatively interfere with the ruminal microflora activity. The use of exogenous enzymes can improve ruminal digestion of fibrous feedstuffs. Aim of the present study was to evaluate the effect of two different exogenous enzymes treatment (Natuzym S.F.[®] cellulase = CELL and an experimental impure macerage preparation = MAC) on *in vitro* feed utilization of destoned olive cake (DOC). CELL and MAC were added at the dose of 0.8 g/kg of DOC. *In vitro* evaluations were carried out using, as a substrate, the treated (CELL and MAC) or untreated (C) olive cakes alone or added (5 or 10%) to a TMR for dairy cattle. NDF digestibility (48 hours = NDFD) was measured according to the Ankom DaisyII procedure whereas *in vitro* gas production (GP) test was carried out for 72 hours in glass bottles by a pressure transducer method and measuring final AGV concentration in the fermentation liquor. Enzymatic treatment did not reduce NDF content of DOC. NDFD was numerically but not statistically lower in the treated samples (26.16, 23.55 and 22.56% for C, CELL and MAC, respectively). Enzymes reduced GP (0.26, 0.20 and 0.19 ml/mg of incubated sample, for C, CELL and MAC, respectively), but higher VFA concentration was measured for CELL. When added to the TMR substrate, olive cake increased GP and VFA concentration in a dose dependent manner. Enzymatic treatments significantly improved GP (+17%) but not VFA production. The additional amount of gas production due to addition of olive cake to TMR was not simply explained by the higher substrate available, suggesting an interference with the microbial activity. Adding olive cake had only minor influence on main VFA molar ratio, but total isoacids were significantly reduced. Enzymatic treatments did not improve DOC digestibility but had some positive effects when treated DOC was added to TMR. In general, olive cake showed positive effects on *in vitro* digestibility of TMR for dairy cattle.

Key Words: Destoned Olive Cake, *In Vitro* Digestibility, Exogenous Fibrolytic Enzymes

W229 The effect of alcohol fermented feedstuff made of byproduct on *in vitro* fermentation characteristics and NDF disappearance. J. S. Shin¹, G. Z. Lin², and B. W. Kim*¹, ¹*Kangwon National University, Chuncheon, Kangwon, South Korea*, ²*Linyi Normal University, Linyi, Shandong, China.*

An *in vitro* study was conducted to examine the influence of alcohol-fermented feedstuff formulated with byproduct on the fermentation characteristics and NDF disappearance. Dietary treatments were a commercial beef cattle feed-based sudan grass silage (Control) and soybean curd-based alcohol-fermented feedstuff (AFS). The control was composed of 70% commercial beef cattle feed and 30% sudangrass silage. Fifty percent commercial beef cattle feed and 50% soybean curd dreg were combined to make AFS with addition of 5% molasses and 0.5% yeast for fermentation. The ruminally cannulated Korean cattle were utilized to investigate the change of ammonia, pH, alcohol, volatile fatty acids, and NDF disappearance at 0, 2, 4, 8 and 12-h *in vitro* incubation. Ammonia concentrations and pH were similar for both dietary treatments during all incubation periods, although the decrease of pH was slightly less in AFS compared to control during later periods of incubation (pH 6.4 in control and pH 6.6 in AFS at 12-h incubation). The alcohol concentrations were significantly higher in AFS at all incubation times. Especially, the difference of alcohol concentrations between control and AFS was greatly increased with longer incubation time (0.5 mg/dl in control and 4 mg/dl in AFS at 2-h incubation vs 0.7 mg/dl in control and 7 mg/dl in AFS at 12-h incubation). The acetate concentration was

slowly decreased in AFS compared to control with longer incubation time. Lower concentrations of propionate and butyrate were observed in AFS at all incubation times ($p < 0.05$). The NDF disappearance did not differ between control and AFS, although AFS showed little higher NDF disappearance during initial periods of incubation (4% in control and 6% in AFS at 2-h incubation). It is concluded that an alcohol fermented feedstuff made of the industrial byproduct such as soybean curd dreg can be effective materials to substitute the conventional beef cattle feed and resulted in similar or better fermentation characteristics and NDF disappearance during *in vitro* incubation.

Key Words: *In Vitro*, Alcohol, Soybean Curd

W230 Comparison of chemical composition and digestibility among wheat straws treated by white-rot fungi. O. D. Montañez-Valdez*¹, J. H. Avellaneda-Cevallos², E. O. Garcia-Flores³, J. M. Tapia-Gonzalez¹, G. Rocha-Chavez¹, I. E. Morales-Zambrano¹, and E.C. Guerra-Medina³, ¹Centro Universitario del Sur de la Universidad de Guadalajara, Ciudad Guzman, Jalisco, México, ²Universidad Técnica Estatal de Quevedo, Quevedo, Los Rios, Ecuador, ³Centro Universitario de la Costa Sur de la Universidad de Guadalajara, Aulán de la Grana, Jalisco, México.

A study was conducted to evaluate the effect of *Pleurotus pulmonarius* on chemical composition and *in situ* digestibility of DM, OM, ADF, NDF of wheat straw. Wheat straw treated and untreated with *Pleurotus pulmonarius*, were obtained from a commercial facility. Ten samples were obtained at random and combined to analyze dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose (HC) and lignin (L) of each wheat straw. Data were analyzed by mean comparison using a T Student test. No differences ($P \geq 0.05$) between treatments were found for DM, CP and hemicellulose; however, treated straw ($P \leq 0.05$) showed higher percentages of OM, NDF, and ADF. There were no differences ($P \geq 0.05$) among treatments on *in situ* digestibility of DM, OM, ADF, NDF, CP or HC, but the highest coefficients of digestibility were observed in the treatment of treated straw. The growth of *Pleurotus pulmonarius* on wheat straw changes its chemical composition by increasing organic matter content and modifying cell wall components, this may improve the nutritional quality of agricultural byproducts. This process may allow using *Pleurotus pulmonarius*-treated straw for ruminant feeding.

Table 1. Chemical composition and *in situ* digestibility for untreated and *Pleurotus pulmonarius* treated wheat straws (%)

Component	NC ¹	TS ²
DM	96.43a	96.54a
OM	83.87b	88.07a
CP	4.42a	4.78a
ADF	40.38b	45.81a
NDF	61.44b	67.25a
HC	21.06a	21.44a
Lignin	11.45b	8.50a
Ash	16.13a	11.93b
Coefficients of digestibility <i>in situ</i>		
DM	60.23	63.40
OM	87.34	89.98
ADF	54.89	59.76
NDF	52.64	57.30
HC	51.06	57.66

¹ Negative control ²Treated wheat straw ^{a,b}Different letters in the same row differ ($P \geq 0.05$)

Key Words: Agricultural Byproducts, *Pleurotus*, Chemical Composition

W231 Effects of genetics and water management on corn plant NDF digestibility. I. Fusaro*¹, N. Brogna², A. Palmonari², G. Biagi², C. J. Sniffen³, and A. Formigoni², ¹Dipartimento di Scienze Degli Alimenti, Università di Teramo, Teramo, Italy, ²DIMORFIPA, Università di Bologna, Ozzano dell'Emilia, Bologna, Italy, ³Fencrest, LLC., Holderness, NH.

Objective of this study was to evaluate the NDF digestibility of three corn hybrids selected for silage: T (traditional), L and BMR (high digestibility hybrid provided by Long Island Cauliflower Association). The hybrids were grown in farms with different agronomic conditions in Northern Italy. Two farms had 55% gravel soil with a furrow irrigation system (F) while the other two had a sandy loam soil and a sprinkler system (S). The hybrids were seeded in March with a density of 7 plants/m². Nitrogen was applied as urea at 450 kg per ha, at the fifth leaf stage. The growing season had low rainfall (120 mm instead of 190 mm of the last thirty year); average and highest temperatures recorded were respectively 30.5 (May, June, July) and 38.6 °C (July). F irrigation system spread water 355 mm/m² for 6 times while 50 mm/m² for 5 times for S system. At the harvest time (last week of July) for each hybrid and from each farm 4 samples of chopped corn and 8 entire plants, randomly selected, were collected. The plants were separated into stalk, leaves and ear; the ears were then split into grain, cob and husk. The husks were analyzed with leaves, and grain has not been processed. All the samples were dried at 60°C and analyzed for chemical composition and *in vitro* NDF digestibility at 24h (IVNDFd), with Tilley&Terry technique. The results relative to irrigation system showed no statistical differences for IVNDFd in fresh corn samples and plant parts ($P > 0.05$). The IVNDFd was higher in BMR fresh corn samples than in T and L ($P < 0.05$), as L than T but without statistical differences. BMR cob and stalk showed the better results in IVNDFd than the L and T hybrids ($P < 0.05$). Cob IVNDFd was higher in L than in T hybrid ($P < 0.05$). Higher digestibility of L chopped corn than T one, could be a consequence of this characteristic. These results show that a proper choice of the corn hybrid is important to achieve a better corn silage digestibility over the irrigation strategy.

Key Words: Corn Hybrids, Irrigation, NDF Digestibility

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