

than 85% of the Brazilian herd, the energy required for maintenance appears to be lower. The maintenance energy requirements of Nellore cattle have been estimated in Brazil, but little effort has been made to gather data from different studies and to analyze them as a whole to increase confidence in the estimates. Therefore, the objective in this study was to estimate the energy required for maintenance of Nellore cattle, using data obtained from the Brazilian literature. Individual observations were collected from seven different trials comprising 135 intact Nellore males that averaged 303 kg (SD = 62.0 kg) empty body weight. Retained energy (RE) was obtained by comparative slaughter, metabolizable energy (ME) intake (MEI) was measured directly, and heat production was calculated as the difference between MEI and RE. Metabolizable energy intake ranged from 122 kcal.kg<sup>-0.75</sup> (maintenance level) to 352.02 kcal.kg<sup>-0.75</sup> (high energy intake). The ME required for maintenance (ME<sub>m</sub>) was estimated using traditional and orthogonal regressions. The orthogonal regression equation obtained for RE on MEI was: RE = - 0.0457 + 0.398 \* MEI (r<sup>2</sup> = 0.67). Rearranging and solving for RE = 0, ME<sub>m</sub> = 0.114 Mcal.kg<sup>-0.75</sup>.d<sup>-1</sup>. Considering efficiency of utilization of ME for maintenance as 0.64 (the mode of the 7 experiments), a value of NE<sub>m</sub> = 0.73 Mcal.kg<sup>-0.75</sup>.d<sup>-1</sup> was obtained, which is 18% lower than the NRC (2000) recommendation for intact males (0.77 x 1.15 = 0.89 Mcal.kg<sup>-0.75</sup>.d<sup>-1</sup>). It can be concluded that Nellore cattle indeed have lower endogenous energy expenditures than *Bos taurus* cattle.

**Key Words:** Beef cattle, Energy, Nellore cattle

#### T201 Predicting dry matter intake of Nellore cattle in Brazil.

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Dry matter intake (DMI) is a factor that must be estimated before an animal's diet can be properly calculated. Given the fact that it is almost

impossible to account for the many factors that control feed intake, empirical equations have been developed for its prediction. Almeida et al. (2005) published an equation to predict feed intake of Nellore cattle in Brazil, based on BW and NE<sub>m</sub>, (Eq. 1), but limited validation has been conducted. Thus, the objective in this study was to test that equation and to develop an alternative one that could be largely adopted by the Brazilian beef cattle industry. A data set of 144 individual observations (8 experiments) was used to challenge Eq. 1. A second data set comprised of 155 records on Nellore males (14 trials) was used to develop the new equation, which was validated using a third independent data set of 66 animals. Eq. 1 did not precisely predict the DMI of Nellore cattle, as evidenced by both the slope (β<sub>1</sub>) and intercept (β<sub>0</sub>) of the regression of observed on estimated values, which were significantly different from 1 and 0 (P<0.01) respectively. The evaluation of the MSPE indicated that Eq. 1 was accurate but lacked in precision. The equation overpredicted DMI when actual DMI was low. Conversely, as DMI increased it was underestimated by the equation, showing a not precise prediction pattern. The equation developed using the backward regression procedure of SAS was: DMI (kg/d) = 0.872 + 5.1645 \* ADG - 1.6624 \* ADG<sup>2</sup> + 0.00002882 \* BW<sup>2</sup> (r<sup>2</sup> = 0.79); where ADG = average daily gain (kg/d) and BW = body weight (kg). The variables presented in the model are easily measured and are frequently available, making the adoption of this equation by the Brazilian cattle industry a more practical approach. The validation of this new equation showed that β<sub>1</sub> and β<sub>0</sub> were not statistically different from 1 and 0 respectively (P>0.22). The correlation between predicted and observed values (r=0.89) was high. It can be concluded that the equation based on ADG and BW predicts DMI of individual Nellore cattle more accurately and precisely than the Eq. 1. Depending upon the purpose, nutritionists have another alternative to estimate DMI.

**Key Words:** Beef cattle, Feed intake, Validation

## Ruminant Nutrition: Minerals & Vitamins

**T202 Net requirements of macrominerals for growth of steers, bulls, and heifers of Nellore x Red Angus crossbreds.** M. L. Chizzotti<sup>\*1,2</sup>, S. C. Valadares Filho<sup>1</sup>, L.O. Tedeschi<sup>2</sup>, G. E. Carstens<sup>2</sup>, F. H. M. Chizzotti<sup>1,2</sup>, M. A. Fonseca<sup>1</sup>, L. F. C. Silva<sup>1</sup>, and M. I. Marcondes<sup>1</sup>, <sup>1</sup>Universidade Federal de Vicosa, Vicosa, MG, Brazil, <sup>2</sup>Texas A & M University, College Station.

A comparative slaughter trial was conducted at the Federal University of Vicosa in Brazil aiming to determine the net requirements of Ca, P, Na, K and Mg. Thirty-six F1 Nellore x Red Angus calves (12 steers, 12 bulls, and 12 heifers), averaging 274 kg BW, were utilized. At the beginning of the trial, three animals from each gender were slaughtered to determine the initial body composition. Three animals of each gender were randomly assigned to two treatments in which diets were offered at 0.75 or 1.5% of BW of concentrate. The diets were based on corn silage and were isonitrogenous (12.5% CP, DM basis). After three growing periods of 28 d, all animals were slaughtered. The cleaned gastrointestinal tract, organs, carcass, head, hide, tail, feet, blood, and tissues were weighed to determine the empty BW (EBW). These parts were ground separately and subsampled for chemical analyses. The log of the contents of each mineral in the empty body was regressed on the log of the EBW to estimate the net requirement for each mineral per kg of empty body gain (EBG). There were no differences (P>0.05) in the net requirements for growth of all macrominerals among genders.

The equations of the pooled data of the net requirements for growth (g/kg EBG) were: 0.33256×EBW<sup>-0.63666</sup> for Ca, 0.11214×EBW<sup>-0.56146</sup> for P, 0.01085×EBW<sup>-0.39924</sup> for Na, 0.00401×EBW<sup>-0.15304</sup> for K, and 0.00359×EBW<sup>-0.46205</sup> for Mg. The mean EBW was 0.9244×BW. Our findings indicated that an animal of 250 kg BW would require 9.342, 4.804, 1.155, 1.698, and 0.269 g/kg EBG of Ca, P, Na, K, and Mg, respectively, and an animal of 450 kg BW would require 6.426, 3.453, 0.913, 1.552, and 0.205 g/kg EBG of Ca, P, Na, K, and Mg, respectively. The net requirements of Ca, P, Na, K, and Mg for growth decrease as BW increase.

<sup>a</sup>Sponsored by FAPEMIG/CAPES, Brazil.

**Key Words:** Cattle, Comparative slaughter, Growth

**T203 Dietary factors affecting phosphorus digestion in lactating cows.** T. H. Yang<sup>\*1</sup>, K. F. Knowlton<sup>1</sup>, C. Shang<sup>1</sup>, E. Schwab<sup>2</sup>, D. Berry<sup>1</sup>, L. Zelazny<sup>1</sup>, N. Whitehouse<sup>3</sup>, K. Pence<sup>1</sup>, and C. Schwab<sup>3</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>University of Wisconsin, Madison, <sup>3</sup>University of New Hampshire, Durham.

The objective of the study was to evaluate the effect of forage and non-fiber carbohydrate content on duodenal and fecal P flow. Eight

Holstein cows (4 primiparous) fitted with ruminal and duodenal cannulae were fed diets containing either 60 or 35% forage and either 30 or 40% NFC in a 2x2 factorial with a replicated 4x4 Latin square design. Dietary P content (% DM) was 0.0.36, 0.36, 0.35, and 0.36 for 60:30, 60:40, 35:30 and 35:40 respectively. Duodenal digesta and feces were collected for 3 d at the beginning of wk 3, every 3 h, advanced 1 h/d. Samples were composited by cow within period and analyzed for total P. Increasing dietary forage content decreased P intake and fecal P excretion, and salivary P flow (daily duodenal P - P intake) tended to increase with increased forage (49.9 vs. 55.8 g/d,  $P < 0.11$ ). Duodenal P flow and apparent P digestibility were unaffected by forage content. Increasing dietary NFC content increased P intake and increased apparent P digestibility (32.8 vs. 41.5%;  $P < 0.02$ ). Cows were in negative P balance but cows fed high NFC diets had less negative P balance. In a subset of samples (4 cows fed diets with 40% NFC and 60 or 35% forage in sequential 3 wk periods), P compounds were extracted with 0.1M NaOH-EDTA and quantified by NMR spectroscopy. Duodenal digesta was higher in orthophosphate, pyrophosphate and lipid phosphate concentration than were feces. Concentration of myo-inositol hexakisphosphate (IHP, or phytic acid) was higher in feces, but duodenal and feces IHP flows were similar. Concentration and flow of "other" P (primarily degradation products of IHP) was higher in duodenal digesta than in feces, indicating post-ruminal degradation. Increasing dietary forage increased orthophosphate concentration in both duodenal digesta and feces, but flow of ortho-P was unaffected by diet. Increased understanding of form and amount of P flow through the digestive tract will support refinements to more accurately match absorbable P supply to P requirements of the lactating cow.

**Key Words:** Phytic acid digestion, Dairy cattle, Nuclear magnetic resonance spectroscopy

**T204 Exogenous phytase plus cellulase and nutrient excretion and digestibility in lactating cows.** M. S. Taylor\*<sup>1</sup>, S. R. Hill<sup>1</sup>, K. F. Knowlton<sup>1</sup>, K. Wilson<sup>2</sup>, and C. Cobb<sup>2</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Animal Feed Technologies, Greeley, CO.

The effect of exogenous phytase + cellulase (CattleAse P<sup>TM</sup>) on nutrient digestibility and excretion was evaluated in 46 Holstein cows (n=23 per trt). Cows were fed corn silage and alfalfa silage based diets with or without a cellulase-phytase blend for 31 days in a CRD. Treatment groups were balanced for parity, days in milk and M.E. projected milk yield (mean = 2.2, 100 and 25,574, respectively). Diets were 37% forage, 18.3% CP, 35.4% NDF, 18% ADF, and 0.42% P (no supplemental P). Cows were fed 1X in Calan doors and milked 2X. Body weight and milk yield were recorded at each milking. Milk samples were collected on d 28 to 31 at 8 consecutive milkings. On d 28 to 31, fecal grab samples were collected from 24 cows (12 per treatment) every 8 h, with sampling times advanced by 2 h each day. Feces samples were pooled by cow. Feed and feces samples were analyzed for sulfuric acid lignin (used as an internal marker) and for N, P, ADF, and NDF. Effect of diet on milk yield and components, body weight, and feed intake was analyzed using PROC Mixed with day as a repeated measure. The effect of treatment on nutrient digestibility and excretion were analyzed with PROC GLM. The phytase + cellulase tended to increase milk yield efficiency (1.68 vs. 1.77 kg milk/kg feed) and milk urea N content was lower in cows fed the enzyme. DMI tended to be lower in cows fed the enzyme (24.4 vs. 22.8 kg/d;  $P < 0.10$ ), and body weight and milk yield were unaffected by treatment. During the feces collection period (d 28-31) DMI was similar between

treatments (25.5 kg/d), and cows fed the enzyme formulation had reduced feces DM excretion (9.55 vs. 7.66 kg/d;  $P < 0.01$ ) and reduced fecal excretion of N (252 vs. 203 g/d;  $P < 0.01$ ) and P (66.9 vs. 55.2 g/d;  $P < 0.01$ ). Apparent digestibility of DM, ADF, NDF, and N tended to increase with the enzyme formulation. Utilization of an exogenous phytase + cellulase formulation reduced fecal nutrient excretion by lactating cows.

**Key Words:** Manure excretion, Phytase, Lactating cows

**T205 Clinical responses to SelenoSourceAF<sup>TM</sup> supplementation in commercial dairy herds.** M. Engstrom\*<sup>1</sup>, B. Crochet<sup>2</sup>, J. Rortvedt<sup>2</sup>, W. Sanchez<sup>1</sup>, and I. Yoon<sup>1</sup>, <sup>1</sup>Diamond V Mills, Inc, Cedar Rapids, IA, <sup>2</sup>Hubbard Milling Co., Mankato, MN.

A commercial field trial with selenium yeast (SelenoSourceAF, Diamond V Mills, Cedar Rapids, IA) was conducted from Nov 2004-Apr 2005 in 6 commercial dairy herds. Herd sizes ranged from 600 to 2200 cows, and total database included 9000 cows. Trial design was a randomized switchback in which herds received either sodium selenite as the sole source of supplemental selenium (Control), or 3 mg/hd/d of supplemental selenium from SelenoSourceAF (SSAF), with the remainder from sodium selenite (about 50% of supplemental selenium from SelenoSourceAF during the lactation, and 80% during the dry period). After 90 days on Control or SSAF, treatments were switched for each herd. Clinical responses (pregnancy rates, abortions, retained placenta, metritis, cystic) were analyzed from DairyCOMP305, and bulk tank somatic cell counts (SCC) were obtained from creameries from 3 of the herds. Reproductive data were analyzed by logistic regression using SAS Proc Genmod, with the model containing terms for farm, period, and selenium source. Results are reported as least squares means in Table 1. A partial replacement of inorganic Se with organic Se from SelenoSourceAF increased 1st-cycle pregnancy rates and decreased % abortions and SCC in commercial dairy herds.

**Table 1. Effects of selenium yeast on clinical responses in dairy cows**

Item	Control	SSAF
1st-cycle pregnancy rate, %	20 <sup>a</sup>	24 <sup>b</sup>
% Aborted	8.3 <sup>a</sup>	7.0 <sup>b</sup>
% Retained placenta	6.0	5.4
% Metritis cases	8.5	8.7
% Cystic cases	3.8	3.4
Avg SCC X 1000	225 <sup>a</sup>	212 <sup>b</sup>

<sup>a,b</sup>Means within a row with different superscripts differ ( $P < 0.05$ )

**Key Words:** Organic selenium, Dairy cows, Clinical responses

**T206 Selenium deficiency in dual purpose cows and its correction with an intraruminal device in a tropical environment.** E. Martínez Cuevas\*<sup>1</sup>, M. Huerta Bravo<sup>1</sup>, R. Lopez Arellano<sup>2</sup>, J. G. Garcia Muñoz<sup>1</sup>, and R. Ramírez Valverde<sup>1</sup>, <sup>1</sup>Universidad Autonoma Chapingo, Chapingo, Mexico, Mexico, <sup>2</sup>Universidad Nacional Autonoma de Mexico, Cuautitlan, Mexico, Mexico.

Objectives of this study were to evaluate the effectiveness of supplementing boluses containing 1.8 g of selenium to correct its deficiency, and to evaluate the effect of selenium supplementation on blood plasma concentration of Se, Cu, Zn, Fe, Ca, P, Mg, Na, and

K. Twenty dry crossbred Zebu-Brown Swiss cows grazing tropical pastures were used. The experiment lasted 98 days, and on day zero each of ten cows was drenched with a bolus; the remaining cows acted as a control group. Jugular blood samples were collected on days 0, 49, and 98 of the experiment. Mineral concentration on blood plasma were analyzed fitting a mixed linear model including the fixed effects of treatment, time, their interaction, and the random effect of cow nested within treatment. Linear and quadratic contrasts were obtained to evaluate the effect of time of sampling on selenium blood plasma concentration. Drenching with selenium boluses increased ( $P < 0.05$ ) selenium blood plasma concentration, and reduced ( $P < 0.05$ ) the daily loss of blood plasma Cu on supplemented cows. Blood plasma concentrations of Zn, Fe, Ca, P, Mg, Na y K, were not affected by selenium supplementation. Time of sampling had a linear effect ( $P < 0.05$ ) on selenium and Cu blood plasma concentrations, whereas for Fe and P the effect was quadratic ( $P < 0.05$ ). Time of sampling had linear ( $P < 0.05$ ) and quadratic ( $P < 0.05$ ) effects on the concentrations of Zn, Ca, Mg, Na, and K. It is concluded that administering boluses containing 1.8 g of selenium corrected selenium deficiency and reduced the loss of plasmatic Cu on the animals utilized in this experiment.

**Key Words:** Grazing, Cattle, Tropics

**T207 Effects of nutrient restriction during early or late gestation and dietary Se supply on cell proliferation and vascularity in maternal jejunal tissue of sheep.** J. J. Reed<sup>\*1</sup>, P. P. Borowicz<sup>1</sup>, R. Reddy<sup>1</sup>, S. L. Julius<sup>1</sup>, J. B. Taylor<sup>2</sup>, T. L. Neville<sup>1</sup>, L. P. Reynolds<sup>1</sup>, D. A. Redmer<sup>1</sup>, K. A. Vonnahme<sup>1</sup>, and J. S. Caton<sup>1</sup>, <sup>1</sup>North Dakota State University, Fargo, <sup>2</sup>USDA-ARS, US Sheep Experiment Station, Dubois, ID.

Pregnant Targhee ewe lambs ( $n = 64$ ;  $50.7 \pm 2.8$  kg) were allotted randomly to one of eight treatments arranged in a  $2 \times 2 \times 2$  factorial design. Factors were Se level, early gestational nutrition, and late gestational nutrition. At breeding, ewes were assigned to two levels of Se supplementation, adequate-Se (ASe;  $8.5 \mu\text{g Se/kg BW}$ ) or a high-Se (HSe;  $85 \mu\text{g Se/kg BW}$ ) diet, formulated using a Se-yeast product. Each diet was similar in CP (13.8%) and ME (2.66 Mcal/kg). Early nutritional treatments (initiated on d 50 of gestation) were control (early-C; fed to NRC recommendations) and restricted (early-R; fed 60% of controls). Late gestation nutritional treatments were the same (late-C vs. late-R) as used during early gestation, but were initiated on d 92. On d 132 of gestation, ewes were slaughtered and tissues harvested. Level of Se had no affect ( $P = 0.51$ ) on percentage of proliferating nuclei in jejunal tissue. Early and late nutrition interacted ( $P = 0.04$ ) and resulted in ewes fed early-R-late-C diets having a greater ( $P = 0.09$ ) proportion of crypt cell proliferating nuclei (11.59%) compared with early-C-late-C (8.44%) and early-R-late-R (8.90%) fed ewes. Ewes fed early-C-late-R diets had similar crypt cell proliferating nuclei (9.97%) compared with other treatments. Total jejunal proliferating cells were reduced ( $P = 0.02$ ) in Se treated ewes and early x late nutrition interactions were present ( $P = 0.05$ ). Ewes fed early-C-late-R diets had greater ( $P = 0.06$ ) total jejunal cell proliferation when compared with early-C-late-C and early-R-late-R fed ewes. Ewes fed early-R-late-C diets had similar total jejunal cell proliferation compared with other treatments. Interestingly, total mucosal cell proliferation data were unaltered treatment. Treatments had no affect on percent jejunal vascularity ( $P = 0.80$ ), capillary area ( $P = 0.65$ ), or total microvascular volume ( $P = 0.61$ ).

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**Key Words:** Intestinal cellular proliferation, Sheep, Vascularity

**T208 Effects of nutrient restriction during early or late gestation and dietary Se supply on Se concentrations in maternal and fetal tissues in sheep.** T. L. Neville<sup>\*1</sup>, J. J. Reed<sup>1</sup>, R. Reddy<sup>1</sup>, M. A. Ward<sup>1</sup>, P. P. Borowicz<sup>1</sup>, J. B. Taylor<sup>2</sup>, K. A. Vonnahme<sup>1</sup>, M. Kappahan<sup>1</sup>, D. A. Redmer<sup>1</sup>, L. P. Reynolds<sup>1</sup>, and J. S. Caton<sup>1</sup>, <sup>1</sup>North Dakota State University, Fargo, <sup>2</sup>USDA-ARS, US Sheep Experiment Station, Dubois, ID.

Pregnant Targhee ewe lambs ( $n = 64$ ;  $50.7 \pm 2.8$  kg) were randomly allotted to one of eight treatments arranged in a  $2 \times 2 \times 2$  factorial design. Factors were Se level, early gestational nutrition, and late gestational nutrition. At breeding, ewes were assigned to two levels of Se supplementation, an adequate-Se (ASe;  $8.5 \mu\text{g Se/kg BW}$ ) or a high-Se (HSe;  $85 \mu\text{g Se/kg BW}$ ) diet, formulated using a Se-yeast product. Each diet was similar in CP (13.8%) and ME (2.66 Mcal/kg). Early nutritional treatments (initiated on d 50 of gestation) were control (early-C; fed to NRC recommendations) and restricted (early-R; fed 60% of controls). Late gestation nutritional treatments were the same (late-C vs. late-R) as used during early gestation, but were initiated on d 92. On d 132 of gestation, ewes were slaughtered and tissues harvested. Supplementation of Se increased ( $P < 0.01$ ) Se concentration (ppm) of all maternal and fetal tissues tested. Selenium x late gestational nutrition interactive ( $P = 0.07$ ) means for liver Se concentration were greater ( $P < 0.01$ ) in ewes fed HSe-late-R compared with those fed HSe-late-C diets (14.7 vs.  $9.8 \pm 1.13$  ppm). Nutrition restriction during both early ( $P = 0.09$ ) and late ( $P = 0.01$ ) gestation decreased total maternal kidney Se content ( $\mu\text{g}$ ). Fetal heart Se concentrations (late nutrition x Se interaction;  $P = 0.03$ ) were greatest in HSe-late-R ( $P < 0.01$ ), intermediate in HSe-late-C ( $P < 0.01$ ), and least ( $P < 0.01$ ) in ASe-late-C and ASe-late-R fed ewes (1.79, 1.49, 0.35, and  $0.33 \pm 0.07$  ppm, respectively). Fetal skeletal muscle Se concentrations were greater ( $P = 0.09$ ) when ewes were early-R compared with early-C fed ewes. Dietary Se levels and maternal nutrient restriction alter maternal and fetal liver, kidney, and muscle, and fetal heart tissue Se concentrations.

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**Key Words:** Nutrient restriction, Pregnancy, Selenium

**T209 Effects of nutrient restriction during early or late gestation and dietary Se supply on maternal and fetal intestinal growth in sheep.** R. Reddy<sup>\*1</sup>, J. J. Reed<sup>1</sup>, T. L. Neville<sup>1</sup>, J. B. Taylor<sup>2</sup>, L. P. Reynolds<sup>1</sup>, D. A. Redmer<sup>1</sup>, K. A. Vonnahme<sup>1</sup>, and J. S. Caton<sup>1</sup>, <sup>1</sup>North Dakota State University, Fargo, <sup>2</sup>USDA-ARS, US Sheep Experiment Station, Dubois, ID.

Pregnant Targhee ewe lambs ( $n = 64$ ;  $50.7 \pm 2.8$  kg) were allotted randomly to one of eight treatments arranged in a  $2 \times 2 \times 2$  factorial design. Factors were Se level, early gestational nutrition, and late gestational nutrition. At breeding, ewes were assigned to two levels of Se, an adequate-Se (ASe;  $8.5 \mu\text{g Se/kg BW}$ ) or a high-Se (HSe;  $85 \mu\text{g Se/kg BW}$ ) diet, formulated using a Se-yeast product. Each diet was similar in CP (13.8%) and ME (2.66 Mcal/kg). Early nutritional treatments (initiated on d 50 of gestation) were control (C; fed to NRC recommendations) and restricted (R; fed 60% of controls). Late

gestation nutritional treatments were the same (C vs. R) as used during early gestation, but were initiated on d 92. On d 132 of gestation, ewes were slaughtered and tissues harvested. Maternal jejunal DNA concentrations (mg/g) and contents (g) were decreased ( $P < 0.04$ ) by HSe and R when fed during early gestation. Maternal jejunal RNA:DNA were not altered by treatment, while protein:DNA were increased ( $P = 0.03$ ; 23.92 vs. 16.70  $\pm$  2.43) by R during early and decreased ( $P = 0.05$ ; 17.01 vs. 23.61  $\pm$  2.37) by R during late gestation compared with C. Fetal intestinal DNA, RNA, and protein concentrations were unaltered by treatments, while RNA:DNA were increased ( $P = 0.09$ ) by nutrient restriction during early gestation. These results indicate that both nutrient restriction and dietary Se supply alter indices of hyperplasia and hypertrophy in sheep intestinal tissues. Supported by USDA CSREES NRI Competitive Grant no. 2005-35206-15281.

**Key Words:** Growth, Intestine, Sheep

**T210 Quality assessment of drinking water offered to dairy cows in central Iran.** A. A. Najafi<sup>1</sup>, G. R. Ghorbani<sup>1</sup>, M. Alikhani<sup>1</sup>, and A. Nikkhah\*<sup>2</sup>, <sup>1</sup>Isfahan University of Technology, Isfahan, Iran, <sup>2</sup>University of Manitoba, Winnipeg, MB, Canada.

As the largest portion of body and milk, water has a unique capacity to affect the cow production and longevity. Our objective was to measure cations and anions, nitrate, and total salts in drinking water used by dairy farms in Isfahan province. The province was divided into four regions of north, south, east, and west. At each region, 10 dairy farms with as similar health and nutritional conditions as possible were selected. The drinking water and milk were sampled monthly from each farm for 2 consecutive summer months. Data were analyzed with SAS to compare the chemical properties of water among different regions as a complete randomized block design. The water level of K<sup>+</sup> was highest ( $P < 0.05$ ) in north (4.58 mg/L) and lowest in west (2.38 mg/L). The Na<sup>+</sup> level in drinking water was lower ( $P < 0.05$ ) in western Isfahan (164 mg/L) compared to the province average (339 mg/L) and north (422 mg/L), south (395 mg/L), and east (363 mg/L) regions. Dairy farms in south had the highest (166 mg/L) and those in east had lowest (90 mg/L) levels of Ca<sup>++</sup> in drinking water ( $P < 0.05$ ). No differences ( $P > 0.05$ ) existed in water levels of Mg<sup>++</sup> and SO<sub>4</sub><sup>-</sup> among four regions. The water Cl<sup>-</sup> was lower in west than was in east, south, and north (249 vs. 481, 721, and 676 mg/L). Although water nitrate was greater in west than in east, south, and north (50 vs. 15.9, 13.1, and 16.2 ppm), the province average was significantly below the maximum allowance (23.9 vs. 100 ppm). The respective total levels of soluble salts in drinking water were 2075, 1960, 1797, and 1126 mg/L in north, south, east, and west. The average milk yields were 22.9, 20.8, 20.3, and 20.2 kg/d; and the average milk fat percents were 2.80, 2.79, 2.60, and 2.80 for dairy farms in north, south, east, and west. In summary, water supplies of K<sup>+</sup> and Ca<sup>++</sup> need to be complemented accurately by dietary sources to meet cow requirements. In contrast, the levels of Cl<sup>-</sup>, Mg<sup>++</sup>, and SO<sub>4</sub><sup>-</sup> in drinking water would potentially exceed the requirements, thus, needing care in their dietary provision. Overall, the western farms appeared to have a higher drinking water quality compared to farms in other regions of the province.

**Key Words:** Drinking water, Quality, Dairy cow

**T211 Silage to reduce dietary cation-anion difference.** E. Charbonneau\*<sup>1</sup>, P. Y. Chouinard<sup>1</sup>, G. F. Tremblay<sup>2</sup>, G. Allard<sup>1</sup>, A. Brégar<sup>1</sup>, and D. Pellerin<sup>1</sup>, <sup>1</sup>FSAA, Université Laval, Québec, QC, Canada, <sup>2</sup>Agriculture and Agri-Food Canada, Ste-Foy, QC, Canada.

Decreasing dietary cation-anion difference (DCAD) using anion sources before calving lowers hypocalcaemia of cows at calving. Reducing DCAD using CaCl<sub>2</sub> fertilized forage should achieve similar results as using anion sources. The objective of this study was to evaluate the impact of low DCAD silage on dry cows. Six non lactating and non pregnant Holstein cows were used in a replicated 3 x 3 latin square. Treatments were: 1) Control (Ctrl; DCAD= 232 meq/kg); low DCAD diet using silage (LS; DCAD= -21 meq/kg); low DCAD diet using Bio-Chlor<sup>®</sup> (LB; DCAD= -32 meq/kg). Treatments were considered statistically different at  $P < 0.05$  and a tendency was considered at  $P < 0.10$ . Compared to Ctrl, feeding LS tended to decrease DMI (10.6 vs. 12.5 kg/d;  $P = 0.06$ ) and decreased urinary pH (6.15 vs. 8.18;  $P < 0.001$ ) as well as digestibility of organic matter (67 vs. 69%;  $P = 0.04$ ). Blood pH (7.37 vs. 7.42;  $P = 0.02$ ), HCO<sub>3</sub> (25.3 vs. 27.5 mM;  $P < 0.01$ ) and base excess (0.4 vs. 3.1 mM;  $P < 0.001$ ) were decreased and blood ionized Cl (29.6 vs. 29.1 mg/dl;  $P < 0.01$ ) was increased with LS compared to Ctrl. There was a decrease in K intake, absorbed as well as retained and an increase in Cl intake as well as Na and Cl absorbed with LS compared to Ctrl. There was no difference in S, Mg and N absorption, and retention, but P and ADF had a lower digestibility, and P was less retained with LS compared to Ctrl. The DMI did not vary, but cow gained weight when fed LS compared to LB (0.8 vs. -0.6 kg/d;  $P = 0.05$ ). Urinary pH had a tendency to be higher (6.15 vs. 5.98;  $P = 0.06$ ) and digestibility of organic matter was lower (67 vs. 70%;  $P < 0.01$ ) with LS compared to LB. Blood ionized Ca (5.3 vs. 5.4 mg/dl;  $P = 0.06$ ) and Cl (29.6 vs. 30.1 mg/dl;  $P < 0.001$ ) tended and was lower respectively while blood pH (7.37 vs. 7.33;  $P = 0.02$ ), HCO<sub>3</sub> (25.3 vs. 21.5 mM;  $P < 0.001$ ) and base excess (0.4 vs. -3.8 mM;  $P < 0.001$ ) were higher with LS compared to LB. There was no difference for Ca absorbed or retained, but Na, Cl, S, P, ADF, NDF and N had lower digestibility and K, Cl, S, P, Mg and N were less retained with LS compared to LB. Results confirm that low DCAD silage can be used to decrease DCAD of rations served to transition dairy cows.

**Key Words:** DCAD, Non lactating cow, Silage

**T212 Hay to reduce dietary cation-anion difference (DCAD).** E. Charbonneau\*<sup>1</sup>, P. Y. Chouinard<sup>1</sup>, G. F. Tremblay<sup>2</sup>, G. Allard<sup>1</sup>, A. Brégar<sup>1</sup>, and D. Pellerin<sup>1</sup>, <sup>1</sup>FSAA, Université Laval, Québec, Québec, Canada, <sup>2</sup>Agriculture and Agri-Food Canada, Ste-Foy, Québec, Canada.

Studies have shown that timothy grass had the lowest DCAD [(Na + K) - (Cl + S)] compared to other grass species. Adding CaCl<sub>2</sub> to low potassium fields could decrease it further. The objective of this study was to evaluate the effect of low DCAD timothy hay on dry dairy cows. Six non pregnant and non lactating cows were used in a replicated 3 x 3 latin square. Treatments were: 1) Control diet (Ctrl; DCAD = 296 meq/kg DM); 2) low DCAD diet based on a low DCAD hay (L-HAY; DCAD = -24 meq/kg DM); and 3) low DCAD diet using HCl (L-HCl; DCAD = -19 meq/kg DM). Treatments were considered statistically different at  $P < 0.05$  and a tendency was considered at  $P < 0.10$ . Decreasing DCAD with L-HAY had no impact on DMI (11.8 kg/d) and digestibility of organic matter (71.5%). Urine pH decreased from 8.21 to 5.89 when L-HAY was fed instead of Ctrl. Compared to Ctrl, L-HAY resulted in more Ca in urine (13.4 vs. 1.2 g/d), less K intake

and K digested but similar K retained (18 g/d) as well as more Cl intake and Cl digested but similar Cl retained (12 g/d). Sodium, S, P, and Mg intake, digested and retained did not vary for L-HAY as compared to Ctrl. There was a tendency for higher ionized (i) Ca (5.3 vs. 5.1 mg/dl), lower HCO<sub>3</sub> (23 vs. 27 mM) and higher iNa (60.8 vs. 60.1 mg/dl), and there were lower base excess (-0.4 vs. 3.8 mM) and higher iCl (30.5 vs. 29.5) in blood with L-HAY compared to Ctrl. Cow DMI tended to be higher (11.5 vs. 9.8 kg) with L-HAY than with L-HCl. Urine pH, organic matter, Ca, K, P, Mg digested and Ca, K, Na, Cl, S, P, Mg retained were similar with L-HAY and L-HCl. Digestibility of Na and Cl were lower for L-HAY as compared to L-HCl but only a tendency was observed for S. Blood pH was higher for L-HAY (7.37) compared to L-HCl (7.31). In an EDTA-challenge test, cows fed L-HAY regained faster the initial level of blood iCa compared to Ctrl (339 vs. 708 mn), but there was no difference between L-HAY and L-HCl. This experiment confirmed that feeding low DCAD hay works as well as added HCl to decrease DCAD of rations served to dry dairy cows.

**Key Words:** DCAD, Non lactating cow, Hay

**T213 Effect of high-sulfate water on trace mineral status of beef steers.** C. L. Wright\* and H. H. Patterson, *South Dakota State University, Brookings.*

Two experiments were conducted to determine the effect of high-sulfate water on the trace mineral status of growing steers. In experiment 1 (Exp. 1; 7/20/01 to 9/12/01) 81 steers (initial BW = 317 kg) were stratified by weight and randomly assigned to 12 pens. Pens were then randomly assigned to one of three water quality treatments: 1) 404, 2) 3087, or 3) 3947 mg SO<sub>4</sub>/L. From 6/20/01 to 7/19/01, steers were fed a diet consisting of grass hay and wheat middlings (DM basis; 14.3% CP, 0.84 Mcal NEg/kg, 0.19% S). From 7/20/01 to 9/12/01, steers were fed a diet of grass hay and wheat middlings (DM basis; 14.9% CP, 0.93 Mcal NEg/kg, 0.19% S). In experiment 2 (Exp. 2; 5/23/02 to 9/4/02), 84 steers (initial BW = 290 kg) were stratified by weight and randomly assigned to 12 pens. Pens were then randomly assigned to one of four water quality treatments: 1) 441, 2) 1725, 3) 2919, or 4) 4654 mg SO<sub>4</sub>/L. Steers were fed a diet of grass hay and wheat middlings (DM basis; 15.7% CP, 0.97 Mcal NEg/kg, 0.17% S). In each experiment, white salt was offered *ad libitum*; however, supplemental trace minerals were not provided. Initial and final liver biopsy samples were collected from 10 randomly selected steers from each treatment (n=30 in Exp. 1; n=40 in Exp. 2). In Exp. 1, liver Cu was lower ( $P < 0.01$ ) in steers that received water containing 3087 or 3947 mg SO<sub>4</sub>/L than in those that received water containing 404 mg SO<sub>4</sub>/L (26.3, 35.2, and 84.8 mg Cu/kg DM, respectively). In Exp. 2, liver Cu was lower ( $P < 0.01$ ) in steers that received water containing 1725, 2919, or 4654 mg SO<sub>4</sub>/L than in those that received water containing 414 mg SO<sub>4</sub>/L (24.8, 7.7, 6.5, and 56.8 mg Cu/kg DM, respectively). In Exp. 1, liver Fe was greater ( $P < 0.01$ ) in steers that received water containing 3947 mg SO<sub>4</sub>/L than in those that received water containing 404 mg SO<sub>4</sub>/L (332 and 258 mg Fe/kg DM, respectively). Treatment did not affect liver Mn, Mo, and Zn concentrations. These results demonstrate the impact high-sulfate water can have on liver Cu stores in growing cattle.

**Key Words:** Sulfate, Water, Trace minerals

**T214 Effect of dried and ensiled sainfoin, a tanniferous temperate climate forage legume, on the mineral metabolism of lambs.** A. Scharenberg<sup>1</sup>, A. Gutzwiller<sup>1</sup>, Y. Arrigo<sup>1</sup>, U. Wyss<sup>1</sup>, H. D. Hess<sup>1</sup>, M. Kreuzer<sup>2</sup>, and F. Dohme\*<sup>1</sup>, <sup>1</sup>*Agroscope Liebefeld-Posieux, Swiss Federal Research Station for Animal Production and Dairy Products (ALP), Posieux, Switzerland*, <sup>2</sup>*Institute of Animal Sciences, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland.*

Condensed tannins (CT) are polyphenols with a broad variety of binding sites and properties with respect to nutrients including minerals thus influencing their digestibility. The experiment was carried out with 12 lambs in a cross-over design with each lamb being consecutively fed three different diets (n=6). Either dried or ensiled sainfoin (S) were tested against the same diets (SPEG) supplemented with polyethylene glycol (PEG) to inactivate the tannins and dried or ensiled CT-free ryegrass-clover mixtures (RC). Effects on apparent digestibility and retention of minerals were determined. The lambs received 66 g/d organic matter per kg metabolic live weight (LW<sup>0.75</sup>) as forage plus 20 g/d of a mineral supplement. Each experimental period consisted of a 14-d adaptation period and a 7-d balance period where feed intake was recorded daily and feces and urine were collected quantitatively. Lambs receiving S and SPEG had a lower ( $P < 0.001$ ) intake of Mg and P and a higher ( $P < 0.001$ ) intake of Ca compared to lambs offered RC. The apparent digestibilities of all minerals were increased when SPEG was fed instead of S (by 3.1, 2.1, 1.1 and 1.9 times for Ca, Mg, Na and P, respectively;  $P \leq 0.01$ ) and consequently their retention was elevated ( $P < 0.05$ ; not significant for Na). By contrast, when comparing treatment S with treatment RC, only the apparent digestibility of Na ( $P = 0.07$ ) and the retention of Mg and P ( $P \leq 0.07$ ) were higher with the CT-free forage. The influence of the forage conservation method on the mineral metabolism was not consistent. Apparent digestibility and retention were higher ( $P < 0.001$ ) with P and lower ( $P \leq 0.01$ ) with Mg when lambs were fed dried instead of ensiled forage. In conclusion, PEG seems to improve the digestibility and body retention of minerals possibly by binding the tannins. Since the differences between sainfoin and CT-free ryegrass-clover mixture were much smaller than the PEG effects, the question arises whether there is an impact of PEG on mineral digestion independent from that mediated by the binding of CT.

**Key Words:** Condensed tannins, Minerals, Polyethylene glycol

**T215 Mineral characterization of cattle in Juan Rodríguez Clara, Veracruz, México.** E. Martínez Cuevas, M. Huerta Bravo\*, J. G. García Muñiz, and R. Ramírez Valverde, *Universidad Autónoma Chapingo, Chapingo, México, México.*

Objective of this study was to determine the mineral content of pasture, soil, drinking water, and blood plasma samples from cows and calves taken from five farms of dual purpose cattle from the state of Veracruz, Mexico. Minerals determined in blood plasma samples were Zn, P, Ca, Mg, Na, K, Cu, and Fe. The same minerals, plus Mn, were determined for both pasture and soil samples. For drinking water, the concentrations of Zn, P, Ca, Mg, Na, K were determined. The mineral content of plasma blood samples was analyzed with a general linear model including the fixed effects of farm, animal type, and their interaction. A model including only the effect of farm was fit to analyze the mineral content of soil and pasture samples. The mineral content of drinking water did not differ between farms. The concentrations of Cu, Mn, Ca, and Mg in soil samples, and those of Mn, Zn, P, and the ratio Ca:P in pasture samples differed ( $P < 0.05$ ) between farms.

Concentrations of Cu, Fe, P, Ca, Na, K, and the ratio Ca:P in blood plasma samples depended of the farm by animal type interaction ( $P < 0.05$ ). The concentrations of Ca and P in pasture were adequate for the level of milk production of the cows used in this experiment. The concentrations of Fe, Mn, Mg, and K in both pasture and blood plasma samples were adequate. However, the concentrations of Cu, and Na in soil, pasture and blood plasma samples were below critical limits. Additionally, Zn was also deficient in soil and pasture samples. Therefore, it is recommended to supplement Cu, Na, and Zn to cattle from these farms.

**Key Words:** Tropics, Dual purpose cattle, Grazing

**T216 Supplementing grazing heifers with copper oxide needles in a tropical environment.** E. Martínez Cuevas, M. Huerta Bravo, J. G. García Muñoz\*, and R. Ramírez Valverde, *Universidad Autónoma Chapingo, Chapingo, México, México.*

Objective of this study was to evaluate the effectiveness of supplementing copper oxide needles on blood plasma concentrations of Cu, Se, Na, K, Mg, Zn, Fe, Ca, and P in grazing heifers. Twenty crossbred Zebu-Brown Swiss heifers grazing tropical pastures were used. The experiment lasted 98 days, and on day zero each of ten heifers was drenched with a capsule containing copper oxide needles ( $10\text{g } 100\text{kg}^{-1}$  BW), with the remaining heifers acting as a control group. Jugular blood samples were collected on days 0, 49, and 98 of the experiment. Mineral concentration on blood plasma were analyzed fitting a mixed linear model including the fixed effects of treatment, time, their interaction, and the random effect of animal nested within treatment. Orthogonal contrasts were obtained to evaluate the effect of sampling time on mineral blood plasma concentration. Drenching with copper oxide needles increased ( $P < 0.01$ ) blood plasma concentrations of Se and Na on day 49, and of Mg on day 98 of the experiment. Blood plasma concentrations of Cu, Zn, Fe, Ca, and P were not affected by copper supplementation. Blood plasma Cu concentration decreased ( $P < 0.05$ ) linearly after capsule insertion, whereas for Se, P, and Na the effect was quadratic ( $P < 0.05$ ). Time of sampling had linear ( $P < 0.05$ ) and quadratic ( $P < 0.05$ ) effects on the concentrations of Zn, Fe, Ca, K, and the ratio Ca:P. It is concluded that administering capsules containing  $10\text{ g } 100\text{kg}^{-1}$  BW of copper oxide needles were not capable of maintaining adequate levels of plasmatic Cu in the experimental animals.

**Key Words:** Cattle, Pastures, Minerals

**T217 Interaction of concentrate: Forage ratio and type of concentrate fed on growth performance and health of growing steers.** P. Walker<sup>1</sup>, D. Adams<sup>1</sup>, and R. Hall<sup>2</sup>, <sup>1</sup>*Illinois State University, Normal*, <sup>2</sup>*Cooperative Research Farms, Richmond, VA.*

An 84-d trial utilizing 192 Angus based steers (mean wt. =  $259 \pm 2.1$  kg) were assigned to 24 pens containing 6 or 10 steers per pen (6 dietary treatments in each of 4 blocks) to determine the value of soybean hulls and distillers dried grains/solubles (DGS) in low and high concentrate pre-finishing diets. The diets consisted of grass hay fed ad libitum and one of six pelleted supplements: shelled corn based fed at 1% BW (SC1) or 2% BW (SC2), soybean hull based fed at 1% BW (SH1) or 2% BW (SH2), shelled corn/DGS based fed at 1% BW (DGS1) or 2% BW (DGS2). More ( $P < 0.05$ ) cattle fed SC1 and SC2 required respiratory treatment than steers fed SH1, SH2, DGS1 and DGS2. During the first 12d SH2 fed steers had higher ( $P < 0.05$ ) and SC2 fed steers had lower ( $P < 0.05$ ) ADG than steers fed other treatments. Over

the 84d trial steers fed SC2, SH2 and DGS2 had greater ( $P < 0.05$ ) ADG and DMI than steers fed SC1, SH1 and DGS1. Steers fed supplement at 2% BW had higher ( $P < 0.05$ ) DMI than steers fed at 1% BW. Steers fed SH at 1% BW had the lowest ( $P < 0.05$ ) DMI. No significant differences in DMI were observed for steers fed the 1% SC or 1% DGS diets. Steers fed 2% SC and 2% SH had higher ( $P < 0.05$ ) DMI than steers fed 2% DGS and higher ( $P < 0.05$ ) G:F ratios than steers receiving other treatments. Over the 84d trial actual ADG exceeded NRC 2000 predicted ADG on all treatments except on the SC2 where actual ADG ( $1.18\text{ kg}$ ) was similar to predicted ADG ( $1.15\text{ kg}$ ). An adjusted predicted ADG was calculated based on the actual ADG relative to the SC1 and SC2 treatments. These ADG were used to estimate NEm and NEg that would be necessary in SH and DGS for these ADG to be achieved. Based on these calculations, soybean hulls have an energy value equal to 104 to 105% of corn grain, compared to current NRC values which are 79 to 83% of corn grain. This trial suggests an energy value for DGS of 110% of corn grain. Fecal grab samples found P concentrations in SH2 and DGS2 significantly lower than in SC2 grab samples. The data suggest that feeding SH or DGS at 2% BW results in similar to superior performance compared to feeding SC at 2% BW.

**Key Words:** Distillers grains, Soybean hulls, Steers

**T218 Effects of organic zinc, manganese and copper on mineral content of rumen bacteria and microbial fermentation in continuous culture.** P. W. Cardozo<sup>1</sup>, S. Calsamiglia\*<sup>1</sup>, and S. Andrieu<sup>2</sup>, <sup>1</sup>*Universitat Autònoma de Barcelona, Bellaterra, Spain*, <sup>2</sup>*Alltech, Lexington, KY.*

The objective of the study was to determine the fate of organic minerals (organic Zn, Cu and Mn; Bioplex<sup>®</sup>, Alltech, KY) in the liquid (LAB) and solid (SAB) associated rumen bacteria and their effects on rumen microbial fermentation. Eight 1,320-mL dual flow continuous culture fermenters were used in two replicated periods of 7 d. On the first day of each period, all fermenters were inoculated with rumen fluid. All fermenters were fed 95 g of DM/d of a diet (18.9% CP; 36.6% NDF) consisting of alfalfa hay (27%), dehydrated whole corn plant (20%), barley straw (5%), soybean meal (16%), ground corn grain (15%), ground barley grain (15%), and a vitamin and mineral mixture, in DM basis. Temperature ( $38.5^\circ\text{C}$ ), pH ( $6.4 \pm 0.05$ ) and liquid (10%/h) and solid (5%/h) dilution rates were maintained constant. Treatments were control (CTR: no substitution); substitution of inorganic Zn by organic Zn (BZn); substitution of inorganic Cu by organic Cu (BCu); and substitution of inorganic Mn by organic Mn (BMn). On days 1, 2, 3, 5 and 7, samples for volatile fatty acid (VFA) and ammonia N were taken, and liquid (LAB) and solid (SAB) associated bacteria were collected from effluents to determine the content of Zn, Cu and Mn. Data were analyzed using PROC MIXED of SAS (1996). Replacement of inorganic by organic trace elements did not affect total (average of  $108.6\text{ mM}$ ) or individual VFA. Ammonia N concentration ( $\text{mg N/dL}$ ) was lower ( $P < 0.05$ ) in Zn ( $9.91$ ) compared with CTR ( $11.9$ ). The use of organic minerals had no effect on mineral content of SAB (average of  $64.9 \pm 29.8$ ,  $52.1 \pm 4.9$ ,  $175.1 \pm 26.5$  ppm, for Cu, Mn and Zn, respectively) and LAB (averages of  $51.6 \pm 22.7$ ,  $53.7 \pm 6.54$ ,  $142.4 \pm 18.2$  ppm for Cu, Mn and Zn, respectively), except for the increase in Mn content of SAB from fermenter supplemented with organic Mn compared with CTR ( $59.1$  vs  $50.1$  ppm). This trial demonstrates that organic Zn, Cu or Mn do not interfere with normal rumen function.

**Key Words:** Organic minerals, Rumen fermentation

**T219 Effect of zinc source and level of on feedlot performance and carcass characteristics of finishing beef steers.** J. C. Silva<sup>\*1</sup>, M. S. Brown<sup>1</sup>, E. M. Cochran<sup>1</sup>, E. Lauterbach<sup>1</sup>, C. E. Smith Sr<sup>1</sup>, L. D. Mitchell<sup>1</sup>, C. K. Larson<sup>2</sup>, and T. Ward<sup>2</sup>, <sup>1</sup>West Texas A&M University, Canyon, <sup>2</sup>Zinpro Corporation, Eden Prairie, MN.

Two experiments were conducted to examine the effects of zinc source and concentration on feedlot performance and carcass characteristics of beef steers. In Exp. 1, 179 crossbred steers (325 kg initial BW) were blocked by BW, assigned to four treatments (5 pens/treatment), and fed for 152 d. Steers were fed a 92% concentrate diet based on whole corn and supplemented with 60 mg Zn from ZnSO<sub>4</sub>/kg DM (CT), 90 mg Zn from ZnSO<sub>4</sub>/kg DM (30S), CT plus 30 mg Zn from ZINPRO<sup>®</sup>/kg DM (30M), and CT plus 30 mg Zn from Availa<sup>®</sup>Zn/kg DM (30A). Steer DMI, carcass-adjusted ADG (1.67, 1.65, 1.66, and 1.72 ± 0.04 kg/d for CT, 30S, 30M, and 30A, respectively), and adjusted ADG:DMI (169, 168, 171, 174 ± 3.7 g/kg) were not altered ( $P > 0.10$ ) by additional dietary Zn above 60 mg/kg. Carcass characteristics were similar across treatments. In Exp. 2, 262 crossbred steers (281 kg initial BW) were blocked by BW, assigned to three treatments (10 pens/treatment), and fed for 176 d. Steers were fed a 90% concentrate diet based on steam-flaked corn without supplemental Zn (NC), NC plus 90 mg Zn/kg DM from ZnSO<sub>4</sub> (S), or NC plus 35 mg Zn/kg DM from Availa<sup>®</sup>Zn and 55 mg Zn/kg DM from ZnSO<sub>4</sub> (AS). Steer DMI (8.59, 8.45, 8.40 ± 0.12 kg/d for NC, S, AS, respectively) and adjusted ADG (1.74, 1.73, and 1.76 ± 0.03 kg/d) were similar. Adjusted ADG:DMI was improved by feeding Zn ( $P = 0.06$ ); ADG:DMI did not differ between NC and S ( $P > 0.15$ ; 203 vs 205 ± 2.9 g/kg), but ADG:DMI tended ( $P = 0.13$ ) to be greater for AS than for S (205 vs 209 ± 2.9 g/kg). Fewer carcasses graded at least low Choice when Zn was fed ( $P < 0.10$ ), but marbling score was at the juncture between Small and Slight marbling ( $P < 0.05$ ; 404, 385, and 387 ± 8 for CT, S, and AS, respectively) and net return was not affected. Hot carcass weight, fat thickness, Longissimus muscle area, and yield grade were similar ( $P > 0.10$ ) among treatments. Gain efficiency by feedlot cattle was improved by providing supplemental Zn, and efficiency tended to favor feeding a blend of Availa<sup>®</sup>Zn and zinc sulfate.

**Key Words:** Beef cattle, Feedlot performance, Zinc chelated

**T220 Effect of cobalt supplementation during late gestation and early lactation on performance and serum concentrations of cobalt and vitamin B<sub>12</sub>.** R. L. Kincaid<sup>\*1</sup> and M. T. Socha<sup>2</sup>, <sup>1</sup>Washington State University, Pullman, <sup>2</sup>Zinpro Corporation, Eden Prairie, MN.

Thirty-six multiparous cows were assigned to a study to determine the effects of dietary cobalt (Co) supplementation during late gestation and early lactation on milk yield, milk yield efficiency, concentrations of Co in serum and liver, and vitamin B<sub>12</sub> concentrations in serum. Cows received either 0, 12, or 25 mg added Co from cobalt glucoheptonate (CoPro<sup>®</sup>, Zinpro Corp., Eden Prairie, MN), from 55 d prior to expected parturition through 120 d postpartum. The basal dry and lactation diets contained 0.15 ppm and 0.19 ppm Co, respectively. Data were analyzed by general linear model of PROC MIXED procedures for a completely randomized design with repeated measures. There was no effect of Co supplementation ( $P > 0.15$ ) on dry matter intake (DMI) and milk yield and composition. Response to treatment was inconsistent during lactation (treatment by week interaction,  $P < 0.01$ ) for DMI and yields of fat, protein 3.5 fat-corrected milk (FCM) and energy corrected milk (ECM), with cows fed added Co consuming more DM and producing more fat, protein, 3.5 FCM and ECM with the progression of lactation. Cobalt supplementation tended to increase

efficiency of production (FCM/DMI) with progression of lactation (treatment by week interaction,  $P = 0.10$ ). Cobalt intake did not affect ( $P > 0.15$ ) concentrations of Co in liver or serum, but did increase Co concentration ( $P < 0.05$ ) of milk (0.089, 0.120, and 0.130 µg Co/mL) at 120 DIM. Serum vitamin B<sub>12</sub> concentrations, although not affected by Co intake ( $P > 0.15$ ), declined sharply in all cows between 55 and 20 d prepartum. In conclusion, added dietary Co increased FCM yield as lactation progressed but did not affect vitamin B<sub>12</sub> or Co concentrations in serum.

**Key Words:** Cows, Cobalt, Vitamin B<sub>12</sub>

**T221 Effects of supplementary folic acid and vitamin B<sub>12</sub> and rumen-protected methionine on lactational performance of multiparous dairy cows.** A. Preynat<sup>\*1,2</sup>, M. C. Thivierge<sup>2</sup>, H. Lapierre<sup>1</sup>, J. J. Matte<sup>1</sup>, A. Desrochers<sup>3</sup>, and C. L. Girard<sup>1</sup>, <sup>1</sup>Agriculture and Agri-Food Canada, Lennoxville, <sup>2</sup>Université Laval, Québec, <sup>3</sup>Université de Montréal, St-Hyacinthe, QC, Canada.

Separate previous findings (J. Dairy Sci. 1998. 81:1412; 2005. 88:660 and 88:671) showed that, in early lactation, either with low or adequate supply of methionine (M), a positive response of milk production and milk component yields to supplementary folic acid was observed in cows with a high vitamin B<sub>12</sub> status. In cows with a low vitamin B<sub>12</sub> status, milk production and milk protein yield were either unchanged or depressed following folic acid supplementation. The present experiment was conducted to precise the interactions between folic acid, vitamin B<sub>12</sub> and their link with the metabolic pathway involving methionine. Sixty multiparous cows were assigned to 10 blocks of 6 cows according to their previous milk production; treatments were tested according to a 2 x 3 factorial arrangement. From 3 wk before until 16 wk after calving, half the cows were fed diets calculated to cover 80% of the M requirement (M-; NRC, 2001) while the other half received rumen-protected M (M+: 9 and 18 g Mepron-85/d, pre and post-calving). Within each level of M, the cows received no vitamin supplement (C) or intramuscular injections of folic acid (160 mg/wk) alone (F) or with B<sub>12</sub> (10 mg/wk; FB<sub>12</sub>). Feed intake and milk production were recorded daily, milk composition was determined on 4 consecutive milkings at 2, 4, 8, 12 and 16 wk of lactation. Vitamin supplements modified milk production ( $P = 0.06$ ), averaging 37.7, 36.9 and 38.6 (SE 0.8) kg/d for C, F and FB<sub>12</sub> but did not alter DMI (21.9 ± 0.1 kg/d;  $P > 0.14$ ). Milk fat components were similar among treatments (36.7 ± 0.3 g/kg, 1380 ± 14 g/d;  $P > 0.12$ ). M supplements increased ( $P = 0.01$ ) milk protein concentration from 29.4 to 30.5 (SE 0.3) g/kg. Milk protein yield was higher with FB<sub>12</sub> during the first weeks of lactation but this effect faded out as lactation progressed (vitamin x time,  $P = 0.03$ ). As there was no interaction between vitamins and M, these preliminary results confirm the limitation of B<sub>12</sub> on folic acid action independently of the level of M.

**Key Words:** Folic acid, Vitamin B<sub>12</sub>, Methionine

**T222 Effects of rumen protected choline and dry propylene glycol supplements on plasma folates and vitamin B<sub>12</sub> in periparturient dairy cows.** C. L. Girard<sup>\*1</sup>, Y. H. Chung<sup>2</sup>, and G. A. Varga<sup>2</sup>, <sup>1</sup>Agriculture and Agri-Food Canada, Lennoxville, QC, Canada, <sup>2</sup>The Pennsylvania State University, University Park.

A factorial experiment was conducted using 82 cows fed 2 levels of rumen protected choline (RPC; 0 or 50 g) from 20d before until 21d after calving and 2 levels of dry propylene glycol (PG; 0 or 250 g) from 0 to 21d after calving. Production data has been partially reported

previously (J. Dairy Sci. 2004. 88(Suppl.1):61). In ruminant, choline requirements are generally supplied by endogenous synthesis which requires 3 methyl groups provided by folate metabolism through the action of methionine synthase, a vitamin B<sub>12</sub>-dependent enzyme. PG is partially transformed in propionate in rumen and a B<sub>12</sub>-dependent enzyme, methylmalonylCoA mutase, is essential to propionate metabolism and its use for gluconeogenesis in gastrointestinal walls and liver. The present experiment was undertaken to determine if plasma concentrations of folates and B<sub>12</sub>, 21, 14 and 1d before and 7, 14 and 21d after calving were influenced by RPC and PG supplements. Pre and postpartum data were analyzed separately (Mixed models with cow as random effect). A natural log transformation was used to correct for a lack of normality in the distribution of data which are then reported as antilog and confidence interval at 95%. Before calving, there was no RPC effect on the 2 vitamins (P>0.1). After calving, RPC increased plasma folates by 15%, from 8.0 to 9.2 ng/ml (SE 0.4; P=0.05). This increase could reflect a reduced utilization of folates in hepatic tissue because RPC decreased methylneogenesis both by providing pre-formed choline and as donor of methyl groups in liver. Without RPC, plasma B<sub>12</sub> was not influenced by PG supplements (208 pg/ml; 183-237) whereas with RPC, plasma B<sub>12</sub> was 23% lower with (181 pg/ml; 152-216) than without PG (234 pg/ml; 197-277)(RPCxPG, P=0.03). While supplementing RPC, adding PG probably increased the demand of B<sub>12</sub> for propionate metabolism and therefore, decreased plasma B<sub>12</sub>. The absence of response of plasma B<sub>12</sub> to PG in cows fed no RPC, along with their lower plasma folates, suggest an impairment of both the efficiency of gluconeogenesis in liver and the utilization of B<sub>12</sub> by methylmalonylCoA mutase.

**Key Words:** Choline, Propylene glycol, B Vitamins

**T223 Apparent ruminal synthesis and intestinal absorption of free and total biotin in dairy cows.** D. E. Santschi\* and C. L. Girard, *Agriculture and Agri-Food Canada, Lennoxville, QC, Canada.*

Biotin, a B vitamin, is present in nature in two forms: free and bound to the amino acid lysine (biocytin). Traditional assays used to measure biotin in various samples only accounted for its free form. Accordingly, these methods revealed higher flows at the ileal level than in the duodenum, resulting in an apparent biotin synthesis in the small intestine. Biocytin can not be degraded by proteases; it requires the activity of a specific enzyme, biotinidase, present in pancreatic secretions and intestinal mucosa. A new method for sample preparation using this enzyme was developed in our laboratory to release biotin from lysine before analysis by ELISA (J. Dairy Sci.2005.88:2043). Three cows equipped with duodenal and ileal cannulae were used to compare these two methods of sample preparation on apparent ruminal synthesis and intestinal absorption of free and total biotin (2 repetitions/cow). A paired t-test was performed to compare the mean values between the two methods of analysis used. Only a small proportion of total biotin was under a free form in the feed (5.8%) and duodenal digesta (6.6%). Daily ileal flows of biotin suggested that the vitamin was exclusively under a free form at this site. There seemed to be no apparent ruminal synthesis of biotin, and this observation was not influenced whether free or total biotin was measured (P=0.84). However, apparent intestinal absorption of biotin was greatly influenced by the sample preparation method (P=0.002). Analysis of free biotin suggested a synthesis of this vitamin in the small intestine, whereas analysis of total biotin concentration showed that absorption was taking place. Although detection of biotin analogues others than biocytin was not ascertained by our ELISA method, these results clearly indicate that the sample preparation method used has a great impact on the

levels of biotin detected and leads to contradictory results regarding apparent intestinal absorption.

**Table 1. Apparent Ruminal Synthesis and Intestinal Absorption of Free and Total Biotin (Mean ± SEM)**

	Feed	Duodenum	Ileum	Apparent ruminal synthesis	Apparent intestinal absorption
	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)
Free Biotin	8.0±0.4	9.3±1.1	105.6±8.8	1.3±1.1	-96.3±9.1
Total Biotin	137.0±6.1	140.1±10.0	87.3±5.9	3.1±11.4	52.8±12.4
P value	0.004	0.003	0.08	0.84	0.002

**Key Words:** Dairy cow, Apparent ruminal biotin synthesis, Apparent intestinal biotin absorption

**T224 Effect of biotin supplementation on enzyme activity and gene expression of biotin-dependent carboxylases in the liver of dairy cows.** G. Ferreira and W. P. Weiss\*, *The Ohio State University-OARDC, Wooster.*

The mechanism by which biotin supplementation increases milk production is not known. Biotin is a cofactor of the gluconeogenic enzymes, propionyl-CoA carboxylase (PCC) and pyruvate carboxylase (PC). We hypothesized that biotin supplementation increases the activity and the gene expression of PCC and PC, and the gene expression of phosphoenolpyruvate carboxykinase (PEPCK) in the liver of lactating dairy cows. Eight multiparous Holstein cows (40±2 kg/d milk yield and 162±35 days after parturition) were assigned randomly to two diet sequences (Control→Biotin and Biotin→Control) according to a cross-over design with two 22-d periods. Treatments consisted of a basal diet (60% concentrate) containing 0 or 0.96 mg/kg of supplemental biotin (approximately 20 mg/d of supplemental biotin). On d 21 of each period, liver tissue was collected by percutaneous liver biopsy. Activities of PCC and PC were determined by measuring the fixation of [<sup>14</sup>C]O<sub>2</sub> in liver homogenates. Abundance of mRNA for PCC, PC and PEPCK was determined by quantitative RT-PCR. Biotin supplementation tended (P < 0.12) to increase the activity of PC (11 vs. 15 nmol CO<sub>2</sub>•min<sup>-1</sup>•mg protein<sup>-1</sup>), but did not affect the activity of PCC (20 nmol CO<sub>2</sub>•min<sup>-1</sup>•mg protein<sup>-1</sup>). The differential response to biotin supplementation suggests that PCC may have a higher priority for biotin than PC. Biotin supplementation did not affect the gene expression of PCC, PC and PEPCK. We attributed the increased activity of PC without changes in mRNA abundance to an increased activation of the apoenzyme by holocarboxylase synthetase. In conclusion, biotin supplementation can affect the activity of biotin-dependent carboxylases in the liver of lactating dairy cows. Whether biotin supplementation increases glucose production in the liver still needs to be evaluated.

**Key Words:** Biotin, Pyruvate carboxylase, Propionyl-CoA carboxylase

**T225 Effect of supplemental biotin to dairy cows on in sacco forage NDF disappearance.** C. W. Cruywagen\* and G. Bunge, *Stellenbosch University, Stellenbosch, South Africa.*

Six non-lactating ruminally cannulated Holstein cows were used to determine the effect of supplemental biotin on in sacco NDF



disappearance. Cows were randomly assigned to two groups in a 2 x 3 cross-over experiment. All cows received oat hay ad libitum and one of two concentrate feeds at a level of 4 kg/cow daily to provide either 0 or 40 mg supplemental biotin/cow/day. The concentrate was provided twice daily as a top dressing at 2 kg per feeding and all the cows consumed all of the concentrate feed daily. Cows were adapted to the diet for 21 days before the onset of the in sacco trial. Samples of alfalfa hay (440 g NDF/kg DM), oat hay (680 g NDF/kg DM) and wheat straw (798 g NDF/kg DM) were incubated in the rumen for 0, 4, 8, 18, 24, 30, 48, 72 and 96 hours. Data were fitted to a non-linear model  $Y = a + b(1 - \exp^{-c})$  to obtain a-, b- and c-values that were subjected to an analysis of variance. Biotin supplementation had a significant effect ( $P < 0.05$ ) on rate of degradation (c-value) and effective degradability of NDF in oat hay and wheat straw, but not in alfalfa hay. Potential degradability of NDF (b-value) was not affected by treatment in any of the forages. For alfalfa hay, rates of NDF degradation were 2.6%/h (control) and 2.5%/h (biotin), while effective degradability values were 16.5% (control) and 16.4% (biotin). For oat hay, rates of NDF degradation were 1.3%/h (control) and 1.9%/h (biotin), while effective degradability values were 12.1 and 14.6%. For wheat straw, rates of NDF degradation were 1.6%/h (control) and 1.8%/h (biotin), while effective degradability values were 10.3% (control) and 11.6% (biotin). It was concluded that biotin supplementation to dairy cows may affect the rate of NDF degradation in certain forages.

**Key Words:** Biotin, In sacco, NDF degradation

**T226 Effect of feeding whole raw soybean and niacin to lactating cows in early lactation.** M. Sari, A. A. Naserian\*, R. Valizadeh, and S. Salari, *Ferdowsi University of Mashhad, Mashhad, Khorasan, Iran.*

Nine multiparous and primiparous Holstein cows were used in a 3x3 Latin square design; to investigate effect of whole raw soybeans and niacin on milk production and composition. The experimental treatments were 1) The control diet, 2) Diet with whole raw soybean, and 3) Diet with Whole raw soybean plus 12 g/d niacin. Cows were fed complete mixed rations consisting of 40% forage and 60% concentrate. The dry matter intake per cows per day did not differ among treatments. Dry matter, organic matter, NDF and ADF digestibilities were not affected by treatment. Protein and ether extract digestibility were decreased in cows receiving the whole raw soybean ( $p < 0.05$ ). No significant difference was found between treatments for ruminal pH, ruminal ammonia, plasma glucose, albumin, cholesterol and triglyceride concentrations. Blood urea nitrogen was significantly lower in cows fed whole raw soybeans with or without niacin ( $p < 0.05$ ). Milk, solids-corrected milk and 4% fat corrected milk production were not altered by treatment application. Milk production and its protein efficiency was not affected by treatments but energy efficiency of milk was decreased by whole raw soybeans. Results of this experiment indicated that whole raw soybeans with or without niacin did not improve milk production and composition in early lactation. More research with various particle size of raw soybeans are recommended.

**Key Words:** Dairy cattle, Full fat soybean, Niacin

**T227 The effects of nicotinic acid supplementation during late-gestation on lipolysis and feed intake during the transition period.** J. L. Chamberlain\* and P. D. French, *Oregon State University, Corvallis.*

The objective of this study was to determine if nicotinic acid (NA) supplementation during the transition period decreases lipolysis and

improves dry matter intake (DMI). Twenty seven multiparous Holstein cows and 27 multiparous Jersey cows were assigned at random to one of three prepartum dietary treatments in a 2 x 3 factorial plan. Prepartum dietary treatments were 0, 49, or 98 mg NA/kg BW. Cows were group housed in freestalls and fed individually via Calan® gates from 30 d prepartum to 21 d postpartum. Cows were offered a dry cow TMR twice daily and NA was hand mixed in the morning feeding. Following parturition all cows received the same lactation TMR. Data were analyzed as repeated measures using the MIXED procedure of SAS. Dry matter intake -3 wk prepartum was used as a covariate for analysis of prepartum and postpartum DMI. Prepartum and postpartum BW and BCS were similar for NA treatments. Prepartum DMI was similar for NA treatments (1.76, 1.64 and 1.75% of BW for 0, 49, or 98 mg NA/kg BW, respectively;  $P > 0.05$ ). Postpartum DMI differed among treatment groups (2.59, 2.78 and 2.46% of BW for 0, 49, or 98 mg NA/kg BW, respectively;  $P < 0.05$ ). Dietary treatment had no effect on prepartum or postpartum nonesterified fatty acids (NEFA),  $\beta$ -hydroxybutyrate, and glucose. Prepartum DMI depression was greater for Holsteins compared with Jerseys, 32 and 14%, respectively (breed x day interaction;  $P < 0.05$ ). The magnitude of increase of NEFA as parturition approached was greater for Holsteins compared with Jerseys (breed x day interaction;  $P < 0.05$ ). In addition, plasma NEFA of Jersey cows were lower than Holstein cows during the postpartum period (613 vs 862  $\mu$ Eq/L for Jersey and Holstein, respectively;  $P < 0.01$ ). In summary, supplemental NA during the last 3 wk of gestation did not affect DMI or plasma metabolites during the transition period. Lipid metabolism and prepartum feed intake depression does differ for the two major breeds of dairy cattle.

**Key Words:** Transition cows, Breed, Nicotinic acid

**T228 Comparative evaluation of the transfer of two forms of Vitamin A into milk of dairy cows.** S. Jurjanz\*<sup>1</sup>, Y. Le Roux<sup>1</sup>, F. Rouffineau<sup>2</sup>, and J. C. Robert<sup>2</sup>, <sup>1</sup>*Laboratoire de Sciences Animales, INRA-ENSALA, Vandoeuvre, France*, <sup>2</sup>*Adisseo France SAS, Commeny, France.*

Eight Holstein lactating dairy cows (6 primiparous and 2 multiparous) were assigned in a cross over design with two treatments and two periods. The two treatments consisted of spot supply of 2 different forms of Vitamin A containing 1 million IU Vitamin A per g (300 mg retinol): products A (Microvit A Supra™ 1000, Adisseo France SAS) and B (Rovimix™ A 1000, DSM) differed by their coating technology. Each period consisted of 3 weeks depletion (ration without Vitamin A supplementation) and one week measurements. A basal diet without Vitamin A supplementation, consisting of (%DM): corn silage (68.2), wheat straw (6.7), cracked wheat (9.5), SBM (14.2) and minerals (1.4), was supplied during all the trial. During the measurement week, control milk was collected during the 2 milking times on the first experimental day. The second day a spot dose of 1 Million IU of vitamin A was orally supplied and milk samples were collected for 8 consecutive milkings. Milk yield was individually recorded and retinol concentrations determined in milk samples. The variations of retinol concentrations and quantities were used to calculate the Area Under the Curves (AUC), which were statistically compared for the two treatments. Although large variations between cows, AUC values were respectively for products A and B, 4068 and 3068 for milk retinol concentrations, ( $p < 0.01$ ) (SED: 433) and 52.9 and 35.9 for milk retinol quantities ( $p < 0.01$ ) (SED: 4.8). The increases of retinol quantities passed into the milk (quantities in the milk after spot supply minus control values) were 68.2 mg and 41.5 mg respectively for products A and B ( $p < 0.01$ ) (SED: 7.2). The retinol transfer ratios

were: (%) 22.7 and 13.8 respectively for products A and B ( $p < 0.01$ ) (SED: 2.4). In conclusion, the higher transfer of retinol into milk with Microvit A Supra 1000 shows its better bioavailability in relation

with its specific coating technology preventing it from ruminal degradation.

**Key Words:** Dairy cow, Vitamin A, Milk

## Ruminant Nutrition: Rumen Fermentation Modifiers

**T229 Effects of high and low inclusion rate yeast culture products on in vitro batch culture ruminal fermentations.** H. M. Sullivan\* and R. A. Halalshah, *New Mexico State University, Las Cruces.*

In vitro mixed culture ruminal microorganism fermentations were conducted to determine the effects of two high (DVXP and WY2XP) and two low (WCC5 and YS) inclusion rate *Saccharomyces cerevisiae* cultures on batch fermentations of no substrate (NS), ground corn (GC), starch (S), high quality alfalfa hay (HA), low quality alfalfa hay (LA) and a dairy TMR (TMR). The TMR was formulated for a high producing cow to meet 2001 NRC requirements. Yeast products were included according to label directions for high and low dose products at 0.73 and 0.35 g/L. All substrates were fermented for 24 hours. Additional fermentations were conducted at 0, 24 and 48 hours using HA, LA and NS to determine in vitro DMD over time. Fermentations were done in duplicate over three days ( $n=6$ ). Data were analysed using the GLM procedure of SAS. There was no significant difference among treatments in pH. The addition of each of yeast cultures increased ammonia concentrations in the presence of NS ( $P < 0.05$ ). Ammonia concentrations were significantly lower for HA fermentations containing WCC5, DVXP and WY2XP ( $P < 0.05$ ). Conversely, LA fermentations with DVXP and WY2XP had significantly higher ammonia concentrations ( $P < 0.05$ ). Ammonia concentrations were numerically higher with yeast cultures for TMR; however, only WCC5, WY2XP and DVXP had significant increases. There was no difference among treatments in in vitro DMD of LA or HA. There was no significant difference among treatments in VFA concentrations of GC, LA, HA, S or TMR; however NS fermentations with yeast were significantly higher for all measured VFA. Lactate concentrations were not different among treatments. In conclusion, the incorporation of the high and low dose yeast culture products into mixed ruminal microorganism fermentations of GC, S, HA, LA and TMR had little effect on final pH and VFA products. Ammonia concentrations were lower in HA fermentations with yeast, especially for the high dose products, while the reverse was true for LA fermentations with yeast product added. The addition of yeast culture products to fermentations of alfalfa hay did not affect forage dry matter digestion in this study.

**Key Words:** In vitro, Yeast

**T230 Evaluation of the protective effect of probiotics given to dairy cows during a lactic acidosis challenge.** J. Chiquette\*, *Dairy and Swine Research & Development Centre, Lennoxville, Quebec, Canada.*

Sub-acute rumen acidosis can be extremely costly when it occurs in dairy cows. The use of probiotic supplements to stabilize the rumen during the transition period could attenuate the symptoms of this metabolic disorder. Four ruminally-fistulated Holstein dairy cows in mid-lactation were assigned to the following experimental treatments in a 4 x 4 Latin Square design: 1) control; 2) 0.6g per head, per day of a fermentation extract of *Aspergillus oryzae* (AO-0.6); 3) 3g per

head, per day of AO (AO-3.0); 4) a probiotic combination consisting of *Enterococcus faecium* and *Saccharomyces cerevisiae* (ES) at a level of  $1 \times 10^5$  cfu/ml of rumen fluid. Each period of the Latin Square consisted of 3 weeks of adaptation to the respective treatments followed by 4 days of lactic acidosis challenge and 3 days of resting period. During the week of induction of sub-acute ruminal acidosis (SARA), 30% of ad libitum intake of the TMR was replaced by pellets containing 50% ground wheat and 50% ground barley (WBP). Ruminal pH was recorded continuously using an indwelling pH probe, over a 24 h period for each week of the adaptation period and continuously over the 4 days of SARA induction. Average ruminal pH was lower during SARA than during the weeks of adaptation to the different treatments (5.6 vs 6.1) ( $P < 0.0001$ ). The difference in average pH recorded during the adaptation weeks and the week of SARA was greater when animals were controls (0.73) than when they received AO-0.6, AO-3.0 or ES (0.32, 0.51, 0.24, respectively) ( $P = 0.002$ ). The ES treatment tended to sustain a higher pH during the SARA period compared to the control (5.8 vs 5.4,  $P = 0.06$ ). Accordingly, minimum pH recorded during SARA was higher when animals were on ES than control (5.0 vs 4.4,  $P = 0.01$ ). Adding ES or AO-0.6 did not affect milk production compared to the control (average milk production = 26.6 kg per day) whereas milk production decreased (23.4 kg per day) ( $P = 0.04$ ) when cows received AO-3.0.

**Key Words:** Probiotics, Acidosis, Dairy cows

**T231 Effect of feeding Fermenten® to Holstein dairy cows on milk production, composition and blood metabolites.** C. M. Martinez\*<sup>1</sup>, Y-H. Chung<sup>1</sup>, M. E. White<sup>1</sup>, E. Block<sup>2</sup>, and G. A. Varga<sup>1</sup>, <sup>1</sup>*The Pennsylvania State University, University Park,* <sup>2</sup>*Church & Dwight Co., Inc., Princeton, NJ.*

The objective of this study was to evaluate the effects of feeding Fermenten to Holstein dairy cows on milk production, milk composition and blood metabolites. Thirty mature Holstein cows were assigned to either a control diet or to a diet formulated for the same nutrient specifications as the control diet but including FERMENTEN® based on ME305 and lactation number. FERMENTEN® feeding began the third week after calving and continued until week-8 of lactation. FERMENTEN® was fed at a rate of 0.37 kg/cow/day. Diets contained 15.5% CP, 34 % NDF and 1.64 Mcal NE<sub>L</sub>/kg of DM. Milk yield and dry matter intake (DMI) were recorded daily. Blood, milk and TMR samples were taken weekly. Blood samples were taken 3 h after morning feeding. Data were analyzed using MIXED procedure of SAS and cow nested in treatment was used as the random effect. There were no differences in DMI or milk yield ( $23.3 \pm 0.86$  and  $46.1 \pm 1.95$  kg/day, respectively). Cows supplemented with FERMENTEN® had numerically higher fat percentage (3.57%) compared to the unsupplemented group (3.39%). Protein percentage and protein yield were higher ( $P < 0.09$ ) for cows provided FERMENTEN®. Milk urea N concentration was higher (10.8 mg/dl,  $P < 0.04$ ) for the FERMENTEN® supplemented cows compared to the control group (9.67 mg/dl).