

# Ruminant Nutrition: Feed Additives, Minerals, and Vitamins I

**T1 Effect of supplementation with dehydrated molasses lick blocks on performance of growing dairy-beef steers grazing pasture.** J. B. Aveling<sup>1</sup>, M. R. Walton<sup>2</sup>, and K. Stelwagen<sup>\*3</sup>, <sup>1</sup>*Ballance Agri-Nutrients, Tauranga, New Zealand*, <sup>2</sup>*Kaitaringa Farms Ltd., Waiotira, New Zealand*, <sup>3</sup>*SciLactis Ltd, Hamilton, New Zealand*.

During late summer and in the fall, pasture quality tends to deteriorate. Molasses lick blocks (MLB) offer a convenient way to supplement grazing cattle. A study was conducted to investigate the effect of dehydrated MLB on the performance of growing Friesian cross (Hereford or Angus) steers kept on pasture. The control group (CON; n=25) and MLB group (n = 26) were randomly assigned to adjacent paddocks of similar botanical and nutritional quality (start of trial, CON vs. MLB pastures: DOMD, 65.9 vs. 70.2%; ME, 10.6 vs. 11.2 MJ/kg DM; end of trial: DOMD, 57.4% vs. 61.7%; ME 9.2 vs. 9.9 MJ/kg DM); pasture coverage and quality were at no time during the trial limiting. MLB-steers had ad libitum access to MLB tubs (Crystalyx Forage Plus: ME 12.0 MJ/kg DM, oil 6%, protein 12%, sugar, 35%, minerals and vitamin A, D, E). At the end of the trial a randomly chosen subset of steers (MLB, n = 6; CON, n=6) were subjected to blood sampling to measure plasma selenium, ferroxidase and vitamin B12 levels. The trial was conducted during late summer and fall (22 Jan to 2 May). MLB-steers consumed on average 102 g/d of MLB during the trial. No differences existed between crosses and data were subsequently pooled, with results shown in the Table. MLB-steers gained significantly more BW and faster than those without, resulting in an approximately 15 kg higher final live weight compared to CON steers. MLB steers had significantly higher selenium and vitamin B12 levels, but ferroxidase activity did not differ between groups (respectively, CON vs. MLB  $\pm$  pooled SE: 230 vs. 475  $\pm$  51 nmol/L,  $P < 0.001$ ; 84 vs. 118  $\pm$  10 pmol/L,  $P < 0.01$ ; 19 vs. 16  $\pm$  3 IU/L,  $P < 0.25$ ). In conclusion, MLB can improve performance in growing steers kept on pasture.

**Table 1.**

	CON	MLB	Pooled SEM	$P <$
Start BW (kg)	128.9	127.5	3.9	0.722
Final BW (kg)	178.8	192.6	5.0	0.001
Weight gain (kg)	49.9	65.1	2.7	0.001
ADG (g/d)	494	644	27	0.001

**Key Words:** dairy-beef steer, molasses lick block, pasture

**T2 Trace minerals: A new approach in nutritional requirements.** L. F. C. Silva\*, S. C. Valadares Filho, P. P. Rotta, M. I. Marcondes, F. A. Sales, E. C. Martins, A. T. Tokunaga, and D. F. T. Sathler, *Universidade Federal de Vicosa, Vicosa, Minas Gerais, Brazil*.

An experiment was conducted to estimate the trace minerals requirements: chromium (Cr), copper (Cu), manganese (Mn), iron (Fe) and zinc (Zn) in Nellore bulls. Thirty-seven Nellore bulls with initial shrunk body weight of 259  $\pm$  24.9 kg were used in a comparative slaughter technique. The bulls were randomly divided into 3 groups: 5 bulls to the reference group, whereas 4 were fed at maintenance level and 28 were fed ad libitum. The bulls fed ad libitum were separated into 4 groups, one of which was slaughtered every 42 days. The reference group was slaughtered at the start of the experiment. All the animals were fed with corn silage and concentrate (55:45). Before each slaughter, the digestibility trial was done during 3 d. In each slaughter, the

noncarcass components were weighted and a sample was collected for posterior analysis. After 18 hours of slaughter, the half-left carcass was dissected into muscle, fat and bone fractions and they were weighed. The samples were lyophilized, partially defatted and grounded. Feed, urinary, fecal and body trace mineral concentrations were evaluated by atomic absorption spectrophotometer. The net requirements for gain were calculated by the derivative of the allometric equation between body trace mineral concentrations and the empty body weight (EBW). Evaluation of the net requirements to maintenance was performed the regression between each absorbed trace mineral and its intake. After the sum of net requirements for maintenance and gain was divided by the absorption coefficient, the diet requirements were achieved. Data were analyzed using NLIN procedure of SAS. The net requirements for maintenance of Cr, Cu, Mn, Fe, and Zn were, respectively, 9.18; 90.5; 289.3; 856.1 and 266.3  $\mu$ g/kg of EBW/day. The absorption coefficients for Cr, Cu, Mn, Fe, Zn were, respectively, 0.68; 0.68; 0.45; 0.27 and 0.41. The net requirements for gain (mg/d) to Cr, Cu, Mn, Fe, and Zn were estimated by following equations: Cr = 14.56  $\times$  EBW-0.182; Cu = 75.86  $\times$  EBW-0.512; Mn = 3.43  $\times$  EBW-0.261; Fe = 424.31  $\times$  EBW-0.207; and Zn = 151.73  $\times$  EBW-0.045. In this study, as the animal gain weight, the trace mineral requirements increase.

**Key Words:** comparative slaughter, mineral, Nellore

**T3 Intake, duodenal flow, and intestinal digestibility of amino acids from canola meal or corn and wheat distillers grains in growing beef heifers.** C. Li<sup>1,2</sup>, L. Xu<sup>2,4</sup>, S. Ding<sup>\*2,3</sup>, K. A. Beauchemin<sup>2</sup>, and W. Z. Yang<sup>2</sup>, <sup>1</sup>*College of Animal Science and Technology, Inner Mongolia University for the Nationalities, Tongliao, Inner Mongolia, China*, <sup>2</sup>*Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada*, <sup>3</sup>*Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada*, <sup>4</sup>*College of Food Science and Engineering, Inner Mongolia Agricultural University, Hohhot, Inner Mongolia, China*.

The objective of this study was to evaluate the intake, duodenal flows, and intestinal digestibility of amino acid (AA) from canola meal (CM) or type of dried distillers grains with solubles (DDGS) in growing beef heifers. Five ruminally and duodenally cannulated Angus heifers (BW 386 kg) were assigned to a 5  $\times$  5 Latin square design. The diets consisted of 60% barley silage and 40% barley-based concentrate (DM basis) with differing protein supplements: control (CON; no protein supplement), CM, wheat DDGS (wDDGS), corn DDGS (cDDGS) or fractional corn DDGS (fDDGS). The fDDGS was produced by fractionation dry-grinding process where corn kernels are physically separated into high-fiber bran, germ and endosperm prior to mashing and fermentation of the endosperm. Contents of CP were 12.0, 14.1, 14.2, 14.1 and 14.2% (DM basis), respectively, for CON, CM, wDDGS, cDDGS and fDDGS diets. Intakes (g/d) of AA were lower ( $P < 0.05$ ) for CON (631) than the protein supplemented diets (averaged 895), which were not different. Flows (g/d) of EAA and total AA to the duodenum were greatest ( $P < 0.05$ ), respectively, for heifers fed wDDGS (521 and 1168) or fDDGS (534 and 1172), medium for CM (484 and 1069) or cDDGS (475 and 1059), and lowest for CON (385 and 846). The profiles of individual EAA (% of total AA) in duodenal flows were generally not different among treatments except for Lys (DDGS vs. CON and CM; 7.5 vs. 8.2%), Leu (corn DDGS vs. other diets; 9.2 vs. 8.1%), and Met (fDDGS vs. other diets; 1.2 vs. 1.6%). Digestibility of AA in the intestine (% of duodenal flow) generally did not differ (70 to 73% for EAA and 71 to

74% for total AA) except for Leu, Val, and Ala of which the digestibility was greater ( $P < 0.05$ ) for fDDGS than for CON. These results indicate that wDDGS and fDDGS supplemented diets delivered greater amount of AA at the small intestine compared to CM and cDDGS when the diets were formulated to be isonitrogen. Corn and wheat DDGS can be used to replace CM to meet the protein requirements of growing cattle fed diets based on barley grain.

**Key Words:** beef heifer, duodenal flow of AA, protein supplement

**T4 Effects of cottonseed meal and dried distillers grains supplementation on rice straw utilization by Brahman steers.** J. C. McCann\*, J. E. Sawyer, and T. A. Wickersham, *Texas A&M University, College Station.*

Seven ruminally cannulated Brahman steers were used in a  $7 \times 4$  incomplete block design to determine the effects of cottonseed meal (CSM; 43.9% CP, 82.9% degradable protein) or dried distiller's grain (DDG; 27.5% CP, 43.6% degradable protein) supplementation on rice straw utilization. Treatments consisted of a control (no supplement) and three levels (60, 120, and 180 mg N/kg BW) of either CSM or DDG. Periods were 14 d with 9 d for adaptation and 5 d for data collection. Steers had ad libitum access to rice straw (4.7% CP, 68% NDF) and were fed supplements at 0630 daily. Increased supplementation resulted in a linear increase ( $P \leq 0.06$ ) in forage OM intake from 13.5 g/kg BW (control) to 16.1 and 15.5 g/kg BW for 180 mg N/kg BW of CSM and DDG respectively, with no difference between sources ( $P = 0.84$ ). Total digestible OM intake was increased by supplementation (linear,  $P < 0.01$ ) from 8.0 g/kg BW (control) to 11.7 and 12.9 g/kg BW for 180 mg N/kg BW of CSM and DDG respectively. A greater response was observed for DDG ( $P = 0.05$ ) due to greater provision of supplement (g DM/d) to achieve isonitrogenous treatment levels. Total tract OM digestion was linearly increased ( $P < 0.01$ ) by CSM and DDG supplementation. Although CSM and DDG improved NDF digestibility (linear,  $P \leq 0.06$ ) from 49.6% (control) to 53.7% and 54.9% at 180 mg N/kg BW respectively, estimated forage NDF digestibility was not significantly increased ( $P > 0.10$ ). Ruminal ammonia concentrations peaked 4 h after supplementation with the greatest concentration (4.0 mM) observed for 180 mg N/kg BW of CSM and the lowest concentration observed in the control (0.8 mM). Provision of CSM resulted in a linear increase ( $P < 0.01$ ) in ruminal ammonia in contrast to the quadratic response ( $P = 0.02$ ) observed with DDG supplementation. Total VFA production followed a similar trend with a linear increase for CSM and DDG supplementation, respectively ( $P = 0.09$ ,  $P = 0.01$ ). Protein supplements containing high and low levels of degradable intake protein were effective at improving intake and utilization of rice straw.

**Key Words:** forage, protein, supplement

**T5 Impact of chromium supplementation on lactating beef cows.** M. J. Faulkner\*<sup>1</sup>, P. M. Walker<sup>1</sup>, A. L. Wagner<sup>2</sup>, R. E. Hall<sup>2</sup>, and R. L. Atkinson<sup>3</sup>, <sup>1</sup>*Illinois State University, Normal*, <sup>2</sup>*Cooperative Research Farms, Richmond, VA*, <sup>3</sup>*Southern Illinois University, Carbondale.*

The trace mineral, chromium (Cr), is required for digestion of carbohydrates, lipids and proteins. Recognized as the active component of the glucose tolerance factor, Cr aids in insulin signaling. When glucose metabolism is increased by production or other stressors, Cr deficiencies can occur. Because glucose metabolism is altered during gestation and lactation, Cr supplementation may be beneficial. Improved pregnancy rates and reduced postpartum BW have been demonstrated when beef

cows were supplemented with Cr. The objective of this study was to determine if providing supplemental Cr to lactating beef cows improves calf weaning weights and cow conception rates. Angus  $\times$  Simmental crossbred cows ( $n=119$ ) were limit-fed one of two dietary treatments beginning at the birth of the first calf through calf weaning ( $n = 190$  d). Cows were blocked by parity (first parity  $n = 32$ , second parity  $n = 26$  and multiparous  $n = 61$ ) and stratified within parity by BW subject to variation in BCS to 16 pens. Each block was equally represented within treatment. Cows were fed a base diet of corn silage and modified wet distiller's grains with solubles to provide 14.0% CP. Control cows were not fed supplemental Cr (T1) and treatment cows were fed supplemental Cr propionate [4 mg/(cow-d); T2]. All data, excluding reproduction, were analyzed using PROC MIXED of SAS,  $P=0.05$  and the experimental unit = pen. The model statement included TREATMENT and the RANDOM statement included pen within treatment. Pregnancy rates were analyzed using the PROC FREQ procedure with the  $\chi^2$  option. No differences ( $P > 0.05$ ) between treatments were observed for calf weaning weight or cow conception rates; mean weaning weight was 290 and 292 kg, and mean cow conception rates were 90 and 87%, for T1 and T2, respectively. No differences ( $P > 0.05$ ) between treatments were observed for mean cow BW change (-76 and -80 kg), mean BCS change (-0.2 and -0.2), mean birth weight (40.7 and 41.1 kg) and mean daily milk production (6.20 and 5.97 kg), for T1 and T2, respectively. Based on the results of this single study, there appears to be no added benefit for supplementing lactating beef cows in optimum BCS with chromium propionate.

**Key Words:** chromium, lactating beef cow

**T6 Effects of two experimental direct-fed microbial products on performance and carcass characteristics of finishing beef cattle.** E. M. Domby\*<sup>1</sup>, U. Y. Anele<sup>1</sup>, K. K. Gautam<sup>1</sup>, C. H. Ponce<sup>1</sup>, J. S. Schutz<sup>1</sup>, M. Garner<sup>2</sup>, and M. L. Galyean<sup>1</sup>, <sup>1</sup>*Texas Tech University, Lubbock*, <sup>2</sup>*MicroBios Inc., Ithaca, NY.*

Despite reported increases in ruminal pH and nutrient digestion, responses in feedlot performance with direct-fed microbial (DFM) products in small-pen research studies have generally been equivocal. Our objective was to evaluate performance and carcass characteristics of finishing beef cattle fed 2 experimental DFM products. One hundred forty-four single-source steers (average initial BW =  $311 \pm 2.6$  kg) were used in a randomized complete block design experiment. Steam-flaked corn was the basal grain, and treatment diets contained 25% (DM basis) wet corn gluten feed. The 3 treatments (12 pens/treatment) were (1) no DFM; (2) a *Lactobacillus acidophilus*-based DFM fed at a dose of  $1 \times 10^7$  cfu/(steer-d) during the entire feeding period; and (3) the *L. acidophilus*-based DFM at  $1 \times 10^7$  cfu/(steer-d) during the first 30 d, followed by a *Propionibacterium freudenreichii*-based DFM fed at a dose of  $1 \times 10^8$  cfu/(steer-d) for the remainder of the feeding period. Although the DFM treatments numerically increased performance during the first 140 d of the feeding period, no differences ( $P \geq 0.11$ ) for pen-based ADG, DMI, and G:F (averages of 1.52 kg, 8.49 kg/d, and 0.179, respectively) were detected for the overall (average = 187 d) feeding period. Carcass characteristics (HCW, dressing percent, 12th rib fat thickness, longissimus muscle area, calculated yield grade, and marbling score) did not differ ( $P \geq 0.36$ ) among treatments, nor was the distribution of quality grades affected ( $P = 0.950$ ) by treatments. Under the conditions of this study, results suggest neither positive nor negative effects on performance and carcass traits of beef steers associated with feeding the 2 DFM products evaluated.

**Key Words:** beef cattle, *Lactobacillus acidophilus*, *Propionibacterium freudenreichii*

**T7 Influence of organic chromium and tannins extract supplementation on performance of bull calves during the first 50 days in the feedlot.** A. Montoya<sup>1</sup>, J. J. Bermudez<sup>2</sup>, and R. Barajas\*<sup>1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Ganaderia Integral Vizur, S.A. de C.V., Culiacan, Sinaloa, Mexico.

Six hundred and seven bull calves ( $240.9 \pm 1.01$  kg) were utilized in an experiment to evaluate the influence of organic chromium and tannins extract supplementation on feedlot performance of bull calves during the first 50 d in the feedlot. Calves were individually weighed, and blocked by initial weight. Groups of 48 to 54 the calves were placed in 12 dirt floor pen ( $15 \times 45$  m). Pens within a block were randomly assigned to one of four treatments: (1) Basal diet with 87% concentrate (13.7% CP, 2.02 Mcal NE<sub>m</sub>/kg DM), formulated with steam-flaked corn and soybean meal (Control); (2) Control supplemented with 0.49 mg Cr/kg DM (CR); (3) Control supplemented with 0.37% (DM basis) tannins extract (TE); and (4) Control supplemented with 0.49 mg Cr/kg DM and 0.37% (DM basis) tannins extract (CRTE). Organic chromium was provided as chromium methionine (MiCroPlex, Zinpro Corporation) and tannins extract was supplied as condensed hydrolysable tannins extract blend (ByPro, Silvateam). Results were analyzed by ANOVA for a randomized complete block design with a  $2 \times 2$  factorial arrangement of treatments, using pen as the experimental unit. Chromium supplementation increased ( $P = 0.04$ ) final weight in 3% (319.86 vs. 310.55 kg), enhanced ( $P = 0.05$ ) ADG 12.3% (1.57 vs. 1.40 kg), and improved ( $P = 0.05$ ) feed/gain ratio 11.4% (4.085 vs. 4.613). Dry matter intake was not affected by treatments ( $P = 0.10$ ). The TE and CRTE treatments had no effect on any of measured variables ( $P = 0.18$ ). As a main factor, TE increased DMI ( $P = 0.05$ ). There was not observed CR  $\times$  TE interaction for any variables. Supplementation of chromium methionine 0.49 mg Cr/kg DM, is effective for improved performance of bull calves during their first 50 d in the feedlot. Adding TE to diets containing supplemental chromium did not show any additional performance response.

**Key Words:** bull calves, chromium, feedlot performance

**T8 Influence of tannins extract supplementation on feedlot performance and plasma urea nitrogen of nonimplanted growing heifers.** B. J. Cervantes<sup>1</sup>, A. Camacho<sup>2</sup>, J. A. Vazquez<sup>3</sup>, M. A. Espino<sup>2</sup>, T. J. Heras<sup>2</sup>, L. R. Flores<sup>2</sup>, J. J. Lomeli<sup>2</sup>, and R. Barajas\*<sup>2</sup>, <sup>1</sup>Ganaderia Los Migueles, S.A. de C.V., Culiacan, Sinaloa, Mexico, <sup>2</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>3</sup>CUALTOS, Universidad de Guadalajara, Tepatitlan, Jalisco, Mexico.

Forty nonimplanted Brahman heifers ( $195.8 \pm 0.66$  kg) were utilized in an 84-d experiment to evaluate the influence of tannins extract supplementation on feedlot performance and plasma urea nitrogen of nonimplanted growing heifers. Heifer were weighed individually, and in groups of five placed in dirt floor pens ( $6 \times 12$  m). In accord with initial weight, heifers were grouped in four weight-blocks. Within a block, pens were randomly assigned to one of two treatments: (1) Feeding a 56% roughage diet (15% CP, 1.37 Mcal NE<sub>m</sub>/kg DM) formulated with corn straw, corn silage without grain, ground sorghum grain and peanut meal (Control); or (2) Similar to control supplemented with 0.28% (DM basis) of tannins extract (TE). In pens assigned to Tannins treatment, daily were offered 87.7 g of tannin extract premix ByPro (Silvateam) premix that contains 72% of a condensed and hydrolysable tannins blend. TE was top-dressed on the diet in the feed bunk. Daily dose was equivalent to 14.54 g TE for each heifer inside the pen. Heifers were weighed on d 1 and d 84. On d 28 and 56, blood samples were taken from jugular vein. Experiment was analyzed by ANOVA for a randomized complete

block design. TE improved 2.5% ( $P = 0.03$ ) the final weight (279.2 vs. 272.3 kg), increased 8.88% ( $P < 0.01$ ) ADG (0.993 vs. 0.912 kg/d), and 3.37% ( $P < 0.01$ ) the dry matter intake (6.375 vs. 6.167 kg). TE supplementation enhanced ( $P < 0.01$ ) the gain/feed ratio in 5.4% (0.156 vs. 0.148 kg/kg), and improved 3% ( $P < 0.01$ ) observed/expected NEM and NEg ratio, with values of 1.01 vs. 0.98 for TE and Control heifers, respectively. In d 28, TE have no effect ( $P = 0.57$ ) on plasma urea nitrogen concentration (PUN); however in d 56 TE supplementation diminished 16% PUN value ( $P = 0.02$ ) with mean values of 14.00 and 11.75 mg/dL for TE and Control treatments, respectively. It is concluded; that tannins extract supplementation reduces N wastage measured as PUN and improve feedlot performance of nonimplanted growing heifers

**Key Words:** feedlot performance, heifer, tannin

**T9 Influence of tannins extract and organic chromium supplementation on carcass characteristics of finishing bulls.** A. Montoya<sup>1</sup>, M. A. Espino<sup>1</sup>, B. J. Cervantes<sup>2,1</sup>, M. Verdugo<sup>1</sup>, and R. Barajas\*<sup>1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Ganaderia Los Migueles, S.A. de C.V., Culiacan, Sinaloa, Mexico.

Eight hundred and fifty bulls ( $338.8 \pm 3.55$  kg) were involved in a 92-d experiment to evaluate the influence of tannins extract and organic chromium supplementation on carcass characteristics of finishing bulls. Bulls were individually weighed and blocked by initial weight. Groups of 51 to 56 bulls were placed in 16 dirt floor pen ( $15 \times 45$  m). Pens within a block were randomly assigned to one of four treatments: (1) Finishing diet with 88% of concentrate (14% CP, 1.98 Mcal NE<sub>m</sub>/kg DM), (Control); (2) Control supplemented with 0.24 mg of Cr/kg DM (CR); (3) Control supplemented with 0.3% (DM basis) of tannins extract (TE); and (4) Control supplemented with 0.24 mg of Cr/kg DM and 0.3% (DM basis) of tannins extract (CRTE). CR was provided as chromium methionine (MiCroPlex, Zinpro Corporation). TE was supplied as condensed hydrolysable tannins extract blend (ByPro, Silvateam). Bulls were harvested after finishing period and hot carcass weight obtained. After 24 h of chilling, carcass characteristics were measured. Results were analyzed by ANOVA for a randomized complete block design with a  $2 \times 2$  factorial arrangement of treatments. TE supplementation increased 2% ( $P = 0.05$ ) hot carcass weight compared with Control (299.8 vs. 293.8 kg). TE augmented ( $P = 0.02$ ) KPH-fat (2.66 vs. 2.30%). Hot carcass weight and KPH-fat of bulls in CR and CRTE treatments exhibits intermediate values and were not different ( $P > 0.10$ ) of Control and TE. Back fat thickness, marbling score, and LM area were not affected by treatments ( $P > 0.10$ ). An interaction CR  $\times$  TE was observed in KPH-fat ( $P = 0.02$ ). In muscle colorimetric measurements, L values were not affected by treatments ( $P > 0.10$ ). Intensity of color measured as "a" and "b" were increased ( $P = 0.01$ ) by TE supplementation. Interactions CR  $\times$  TE were detected for "a" and "b" values. It is concluded that supplementation of 0.3% of tannins extract improves hot carcass weight and muscle color intensity, but additional organic chromium supplementation to finishing bulls consuming tannins extract did not produces any additional benefices.

**Key Words:** bulls, carcass, tannins

**T10 Influence of tannins extract and organic chromium supplementation on feedlot performance.** A. Montoya\*<sup>1</sup>, J. J. Bermudez<sup>2</sup>, and R. Barajas<sup>1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Ganaderia Integral Vizur, S.A. de C.V., Culiacan, Sinaloa, Mexico.

Eight hundred and fifty bulls ( $338.8 \pm 3.6$  kg) were utilized in a 92 d experiment to evaluate the influence of tannins extract and organic chromium supplementation on feedlot performance. Bulls were individually weighed and blocked by initial weight. Groups of 51 to 56 bulls were placed in 16 dirt floor pen ( $15 \times 45$  m). Pens within a block were randomly assigned to one of four treatments: 1) Finishing diet with 88% of concentrate (14% CP, 1.98 Mcal NEm/kg DM), formulated with steam-flaked wheat and soybean meal (Control); 2) Control supplemented with 0.24 mg of Cr/kg DM (CR); 3) Control supplemented with 0.3% (DM basis) of tannins extract (TE); and 4) Control supplemented with 0.24 mg of Cr/kg DM and 0.3% (DM basis) of tannins extract (CRTE). Chromium was provided as chromium methionine (MiCroPlex, Zinpro Corporation) and TE was supplied as condensed hydrolysable tannins extract blend (ByPro, Silvateam). Results were analyzed by ANOVA for a randomized complete block design with a  $2 \times 2$  factorial arrangement of treatments. At the end of experiment, bulls in TE were 2.8% heavier ( $P = 0.05$ ), and gained 8.4% more weight ( $P = 0.02$ ) than those in the Control group. Final weight and ADG of bulls in CR and CRTE treatments exhibits intermediate values and were not different ( $P > 0.10$ ) of Control and TE. An interaction  $CR \times TE$  was observed for ADG ( $P = 0.04$ ). Bulls supplemented with Cr and TE gained less than those fed Cr or TE separately (1.36, 1.41, 1.47 and 1.40 kg/d for Control, CR, TE, and CRTE treatments, respectively). TE supplementation increased HCW by 2% ( $P = 0.05$ ) compared with Control (299.8 vs. 293.8 kg). As a main factor, bulls fed TE ate 3% more DM ( $P = 0.05$ ) than animals that no received tannins (7.8 vs. 8.0 kg/day). Feed/gain ratio was not affected by treatments ( $P > 0.10$ ). It is concluded that supplementation of 0.3% of tannins extract could improves weight gain and carcass weight, but organic chromium supplementation to bulls consuming tannins extract did not produces any additional benefices.

**Key Words:** bull, feedlot, tannin

**T11 Interaction of tannin extract and zilpaterol hydrochloride supplementation on feedlot performance of bulls.** R. Barajas<sup>\*1</sup>, B. J. Cervantes<sup>2</sup>, M. A. Espino<sup>1</sup>, A. Camacho<sup>1</sup>, M. Verdugo<sup>1</sup>, L. R. Flores<sup>1</sup>, and J. A. Romo<sup>1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Ganadera Los Migueles, S.A. de C.V., Culiacan, Sinaloa, Mexico.

Eighty bulls ( $341.7 \pm 10.1$  kg) were utilized in a 108 d experiment to evaluate the interaction of tannin extract and zilpaterol hydrochloride supplementation on feedlot performance of bulls. Bulls were individually weighed and blocked by weight. Groups of five bulls were placed in 16 dirt-floor pens ( $6 \times 12$  m). Pens within a block were randomly assigned to treatments follows: (1) Finishing diet (14% CP, 1.83 Mcal NEm/kg) formulated with ground sorghum grain (Control); (2) Control added with zilpaterol hydrochloride (ZH); (3) Control supplemented with 0.3% (DM basis) of tannin extract (TE); and (4) Control added with ZH and TE (ZHTE). Both, ZH and TE treatments were top-dress on the diet in the feed bunk. Zilpaterol hydrochloride was supplied daily as 1.63 g of Zilmax (Merck Animal Health)/bull (which equate to 0.15 mg ZH/kg BW). Zilmax contains 4.8% zilpaterol hydrochloride. Zilmax was withdrawn three days prior harvest. TE was provided feeding daily 35.5 g of condensed hydrolysable tannin blend (ByPro, Silvateam). The experiment was analyzed by ANOVA for a completely randomized design with  $2 \times 2$  factorial arrangement of treatments. Orthogonal contrasts were used to compare ZHTE vs. each one of remainder treatments. TE supplementation increased ( $P < 0.05$ ) final weight, ADG, and hot carcass weight. ZH decreased ( $P < 0.05$ ) DMI as percentage of BW, improved feed/gain ratio, hot carcass weight, and carcass dressing. An interaction ( $P < 0.05$ )  $TE \times ZH$  was observed in DMI mean values were 2.8,

2.5, 2.7 and 2.73% of BW for Control, ZH, TE, and ZHTE treatments, respectively. Contrasts indicated that carcass of bulls in ZHTE extract treatment were heavier ( $P < 0.05$ ) than remainder treatments, with means of 324.6, 330.5, 329.8 and 345.4 kg for Control, ZH, TE, and ZHTE treatments, respectively. Results suggest that coupled supplementation of Zilmax and tannin extract contributes to increases in weight gain, final weight, and heavier carcass in finishing bulls.

**Key Words:** finishing-bulls, tannins, zilpaterol

**T12 Influence of zinc methionine and zilpaterol hydrochloride supplementation on feedlot performance and carcass characteristics of yearling-finishing bulls.** M. Verdugo<sup>1</sup>, B. J. Cervantes<sup>2</sup>, M. A. Espino<sup>1</sup>, J. A. Romo<sup>1</sup>, and R. Barajas<sup>\*1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Ganadera Los Migueles, S.A. de C.V., Culiacan, Sinaloa, Mexico.

Eighty yearling-bulls ( $488.8 \pm 4.17$  kg) were utilized in a 32-d experiment to evaluate the influence of zinc methionine and zilpaterol hydrochloride supplementation on feedlot performance and carcass characteristics of yearling-bulls fed a finishing diet. Cattle were individually weighed, and groups of 5 were placed in 16 pens ( $6 \times 12$  m). Pens were randomly assigned to one of four treatments: (1) Basal diet (CTRL); (2) CTRL plus zilpaterol hydrochloride (ZH); (3) CTRL plus 40 mg Zn/kg DM (ZN); or (4) CTRL plus zilpaterol hydrochloride and zinc-methionine (40 mg Zn/kg DM; ZHZN). The basal diet (14% CP; 1.86 Mcal of NEm/kg and 60 mg Zn/kg of DM) was supplemented with 57 mg of Zn/kg using zinc sulfate. Both, ZH and ZN were top-dress on the diet in the feed bunk. The ZH was supplied daily as 1.63 g of Zilmax (Merck Animal Health)/bull (which equate to 0.15 mg ZH/kg BW). Zilmax was withdrawn 3 d prior to harvest. The ZN was daily supplemented as 4.6 g Zinpro (Zinpro Corporation)/per bull. The ZINPRO product contains 10% Zn as zinc-methionine complex. The experiment was analyzed by co-variance as a completely randomized design with  $2 \times 2$  factorial arrangement of treatments. Initial weight was the associate co-variable. Feeding ZH increased ( $P < 0.05$ ) final weight (1.9%) and ADG (29.9%), improved ( $P < 0.05$ ) feed/gain ratio 31%, and augmented ( $P < 0.01$ ) hot carcass weight 14.3 kg, and dressing percentage by 1.4%. The ZN has no effect on the measured variables ( $P > 0.20$ ). A tendency ( $P = 0.11$ ) was observed for  $ZH \times ZN$  interaction on carcass weight, with mean values of 328, 337, 323, and 342 kg for CTRL, ZH, ZN and ZHZN, respectively. A  $ZH \times ZN$  interaction ( $P < 0.05$ ) was detected for dressing percentage with mean values of 62.8, 63.2, 61.5 and 64.0 for CTRL, ZH, ZN and ZHZN, respectively. Treatments had no effect on carcass characteristics ( $P > 0.20$ ). Results suggest that the ZN supplementation to diets that contains ZH could contribute to increased dressing percentage and heavier hot carcass weight of yearling finishing bulls.

**Key Words:** yearling bull, zilpaterol hydrochloride, zinc

**T13 Effect of direct-fed microbials on ruminal fermentation and lactate utilization in steers consuming a high concentrate diet.** N. M. Kenney<sup>\*</sup>, S. M. Wingard, E. S. Vanzant, D. L. Harmon, and K. R. McLeod, University of Kentucky, Lexington.

Direct-fed microbials (DFM) have been shown to alter ruminal fermentation and may modulate fermentation during transition to high concentrate diets. To test this hypothesis, 12 ruminally cannulated Angus steers ( $385 \pm 35$  kg) were used in split-plot design with the whole plot consisting of control or DFM, and the sub-plot consisting of week of

dietary adaptation. The DFM was a mixed bacterial culture, primarily *Lactobacillus acidophilus* and *Enterococcus faecium*, fed at 1 billion cfu/d. A 90:10 concentrate to forage, corn-based diet was fed twice daily and top-dressed with DFM or lactose carrier. Rumen fluid was sampled on d 14 and 28 at 0, 3, 6, 9 and 12 h post-feeding. Steers were ruminally pulse dosed with a 2 L solution of neutralized DL lactate (0.56 M) and CrEDTA 3 h post-feeding on d 15 and 29. Ruminal samples were collected at 10- and 20-min intervals for the first and second hour post-dosing. Total VFA concentration and molar proportions of butyrate were unaffected by DFM ( $P \geq 0.19$ ) or week ( $P \geq 0.24$ ). Molar proportions of acetate exhibited a DFM by hour interaction ( $P = 0.04$ ); however, on average, molar proportion of acetate was 4.4% greater for DFM. Conversely, DFM did not affect propionate ( $P = 0.39$ ). On average, molar proportions of propionate and acetate increased ( $P = 0.07$ ) and decreased ( $P = 0.07$ ), respectively, across weeks. Mean daily ruminal pH was similar for control on d 14 (6.04) and 28 (6.09), whereas mean pH increased from d 14 (6.05) to d 28 (6.35) for DFM (DFM  $\times$  week;  $P = 0.08$ ). Minimum pH remained unchanged for control over time but increased from d 14 (5.70) to d 28 (6.16) for DFM (DFM  $\times$  week;  $P = 0.10$ ). Maximum pH decreased from d 14 to 28 in control but increased over time with DFM from 6.31 to 6.53 (DFM  $\times$  week;  $P = 0.05$ ). Total and L-lactate utilization were unaffected by DFM ( $P \geq 0.33$ ) or week ( $P \geq 0.50$ ). These data indicate that DFM may be beneficial during dietary adaptation, as evidenced by shifts in ruminal VFA profile and pH; however, DFM did not appear to influence ruminal lactate utilization.

**Key Words:** direct-fed microbial, pH, lactate

**T14 Influence of feeding chelated chromium and enzymatically hydrolyzed yeast on growth performance, dietary energetics, and carcass characteristics in feedlot cattle.** B. Sánchez-Mendoza\*<sup>1</sup>, A. Montelongo<sup>1</sup>, A. Plascencia<sup>1</sup>, R. Ware<sup>2</sup>, and R. Zinn<sup>3</sup>, <sup>1</sup>UABC, Mexicali, BC, Mexico, <sup>2</sup>Varied Industries Corporation, Mason City, IA, <sup>3</sup>University of California, Davis.

Forty crossbred steers (245  $\pm$  0.95 kg) were used in a 222-d feeding trial to assess the effects of a chelated chromium enriched extract of enzymatically hydrolyzed yeast cell wall (EHY) on growth performance, dietary energetics and carcass characteristics. Treatments consisted of a steam-flaked corn-based finishing diet supplemented with 0 or 500 ppb of chelated chromium (Cr) enriched EHY (TruMax, Vi-COR, Mason City, IA). Steers were blocked by weight and randomly assigned to 8 pens (5 steers/pen, 4 pens/treatment). Pens were 43 m<sup>2</sup>, with 22 m<sup>2</sup> of shade, automatic waterers, and 2.4-m fence-line feed bunks. Supplemental Cr intake average 4.3 mg/d. During the initial 112-d period, Cr supplementation increased ADG (6.8%,  $P = 0.03$ ) and tended to increase (5.9%,  $P = 0.07$ ) DM intake. However, Cr supplementation did not affect overall (222-d feeding period) growth performance. Nevertheless, Cr supplementation increased LM area (6.8%,  $P < 0.01$ ) and tended to increase retail yield (1.6%,  $P = 0.07$ ), and decrease carcass fat thickness (10%,  $P = 0.09$ ). Results indicate that Cr supplementation has a modulating effect on carcass quality, and may enhance DMI and corresponding ADG of feedlot cattle.

**Key Words:** chromium chelate, finishing, steer

**T15 Influence of feeding yeast cell wall extract on growth performance of feedlot cattle during periods of elevated ambient temperature.** M. Montano\*<sup>1</sup>, A. Plascencia<sup>1</sup>, N. Torrentera<sup>1</sup>, R. Ware<sup>2</sup>, and R. Zinn<sup>3</sup>, <sup>1</sup>UABC, Mexicali, BC, Mexico, <sup>2</sup>Varied Industries Corporation, Mason City, IA, <sup>3</sup>University of California, Davis.

Eighty crossbred steers (235  $\pm$  0.59 kg) were used in a 229-d feeding trial to assess the effects of an enzymatically hydrolyzed yeast cell wall (EHY) on growth performance and carcass characteristics. Treatments consisted of a steam-flaked corn-based finishing diet supplemented with 0, 1, 2, or 3 g/hd/d of EHY (Celmanax, Vi-COR, Mason City, IA). Steers were blocked by weight and randomly assigned to 16 pens (5 steers/pen). Pens were 78 m<sup>2</sup>, with 27 m<sup>2</sup> of shade, automatic waterers, and 4.3-m fence-line feed bunks. There were no effects on growth performance during the initial 84-d period. However, from d 84 to harvest, EHY supplementation increased ADG (10.7%,  $P = 0.08$ ) and gain efficiency (8.6%,  $P = 0.09$ ). From 139-d to harvest, when 24-h temperature humidity index averaged 80, EHY increased DMI (4.8%,  $P = 0.03$ ). Supplementation with EHY had a quadratic effect ( $P = 0.02$ ) on KPH. Otherwise, there were no treatment effects on carcass composition. Enhancements in DMI and ADG during periods of high ambient temperature indicate a potential role of EHY in association with heat stress.

**Key Words:** cattle, performance, yeast

**T16 Effect of level and source of supplemental tannin on growth-performance of Holstein steers during the late finishing phase.** C. Rivera\*<sup>1</sup>, A. Plascencia<sup>1</sup>, N. Torrentera<sup>1</sup>, and R. Zinn<sup>2</sup>, <sup>1</sup>UABC, Mexicali, BC, Mexico, <sup>2</sup>University of California, Davis.

Two trials were conducted to evaluate the effects of tannin source and level on feedlot cattle performance during the late finishing phase, when metabolizable protein intake is not limiting requirements for growth. In Trial 1, 96 calf-fed Holstein steers (476  $\pm$  6 kg) were used in a randomized complete block design experiment (4 pens/ treatment) to evaluate level of tannin supplementation. Treatments consisted of a steam-flaked corn-based finishing diet supplemented with 0, 0.2, 0.4, and 0.6% condensed tannin. Across the 84-d feeding period, tannin supplementation increased ADG (1.37, 1.42, 1.48, and 1.50  $\pm$  0.04 kg/d, respectively;  $P = 0.05$ ), gain efficiency (0.122, 0.128, 0.128, and 0.129  $\pm$  0.002, respectively;  $P = 0.04$ ) and observed/expected diet NEm (0.92, 0.95, 0.94 and 0.95  $\pm$  0.01, respectively;  $P = 0.06$ ). In Trial 2, 96 calf-fed Holstein steers (392  $\pm$  4 kg) were used in a randomized complete block design experiment (4 pens/ treatment) to compare the influence of tannin source (condensed vs. hydrolysable) on cattle performance during the late finishing phase. Dietary treatments consisted of a steam-flaked corn-based finishing diet supplemented with 0% supplemental tannin, 0.6% condensed tannin, 0.6% hydrolysable tannin, and a mixture of 0.3% condensed and 0.3% hydrolysable tannin (DM basis). Across the 84-d feeding period, tannin supplementation tended to increase ADG (1.53, 1.64, 1.61, and 1.65  $\pm$  0.06 kg/d, respectively;  $P = 0.08$ ) and DMI (10.0, 10.3, 10.2, and 10.7  $\pm$  0.15 kg/d, respectively;  $P = 0.06$ ). There were no treatment effects on gain efficiency (0.152, 0.159, 0.157, 0.155  $\pm$  0.005, respectively;  $P = 0.42$ ), and observed/expected diet NEm (0.97, 0.99, 0.99 and 0.97  $\pm$  0.02, respectively;  $P = 0.38$ ). It is concluded tannin supplementation may enhance feedlot cattle growth performance during the late finishing phase independently of effects on ruminal metabolism protein (metabolizable protein supply from the basal unsupplemented diet already in excess of requirements for growth).

**Key Words:** cattle, performance, tannin

**T17 Influence of supplemental urea withdrawal during the late finishing phase on growth performance and digestive function in feedlot cattle.** D. May\*<sup>1</sup>, J. Calderon<sup>1</sup>, M. Montano<sup>1</sup>, A. Plascencia<sup>1</sup>, and R. Zinn<sup>2</sup>, <sup>1</sup>UABC, Mexicali, BC, Mexico, <sup>2</sup>University of California, Davis.

Two trials were conducted to evaluate the influence of supplemental urea withdrawal on characteristics of digestion (Trial 1) and growth performance during the late finishing phase (trial 2). In Trial 1, 6 Holstein steers (160 kg) with cannulas in the rumen and proximal duodenum were used in a replicated 3 × 3 Latin square experiment. Treatments consisted of a steam-flaked based finishing diet, where dietary urea supplementation was adjusted to provide 100, 80 and 60% of expected urea fermentation potential. Daily DMI was restricted to 2.5% of BW. Decreasing supplemental urea decreased (linear effect) ruminal digestion of OM ( $P = 0.04$ ) and NDF ( $P = 0.05$ ), and nonammonia N flow to the small intestine ( $P = 0.04$ ), and tended to decrease ( $P = 0.06$ ) ruminal microbial protein synthesis. There were no treatment effects on total tract digestion of OM, NDF and starch digestion. Decreasing supplemental urea tended to decrease (linear effect) total tract digestion of OM ( $P = 0.06$ ) and NDF ( $P = 0.06$ ), and decreased (linear effect) total tract digestion of N ( $P = 0.04$ ), and DE ( $P = 0.05$ ). Ruminal and total tract starch digestion were unaffected by treatments. There were no treatments effects on ruminal pH. However, decreasing urea supplementation decreased (linear effect,  $P = 0.007$ ) ruminal ammonia N, and increased (linear effect,  $P = 0.04$ ) ruminal acetate:propionate molar ratio and estimated methane production. In Trial 2, 90 crossbred steers (468 kg), were used in a 40 d feeding trial (5 steers/pen, 6 pens/ treatment) to evaluate treatment effects on final-phase growth performance. Decreasing urea supplementation did not affect DMI, but decreased (linear effect,  $P < 0.01$ ) ADG, gain efficiency, and dietary NE ( $P = 0.03$ ). There were no treatment effects on carcass characteristics. In addition to effects on net protein flow to the small intestine, depriving cattle of otherwise ruminally degradable N during the late finishing phase may negatively impact site and extent of digestion of OM digestion and NE value of the diet, as well as ADG.

**Key Words:** cattle, performance, urea

**T18 Evaluation of maternal trace mineral source on cow/calf performance and the subsequent feedlot performance of beef calves.** R. L. Stewart Jr.\*<sup>1</sup>, T. J. Wistuba<sup>2</sup>, G. I. Zanton<sup>2</sup>, and A. L. Jones<sup>3</sup>, <sup>1</sup>The University of Georgia, Athens, <sup>2</sup>Novus International, St. Charles, MO, <sup>3</sup>The University of Georgia, Tifton.

A 2-yr study was conducted to assess the effect of trace mineral source (15 ppm Cu, 30 ppm Zn, and 40 ppm Mn; based on a 4-oz mineral intake) on performance of cows and calves and the subsequent feedlot performance and carcass characteristics of beef calves. Each year, the 216 cow herd (BW = 623 ± 21 kg) at the University of Georgia Northwest Georgia Research and Education center was blocked by age (senior cows, junior cows, and first calf heifers) and randomly assigned to receive trace minerals from an inorganic (INORG) or chelated (CHEL; Mintrex, Novus International Inc.) (n=6). A methionine supplement was added to the inorganic source to balance the 2-hydroxy-4-methylthio butanoic acid provided by the Mintrex. Minerals were offered as a component of a free choice mineral, and were offered starting 30 d prior to calving of yr-1 and continuing through weaning of yr-2. Calves were maintained with the dam through weaning. After weaning in yr-1, steers were grouped by treatment and backgrounded for 45 d prior to shipping to a finishing facility. All steers were commingled and fed a common finishing diet for 107 or 142 d, based on estimated final back fat thickness of 1.27 cm. Cow BW at weaning (598 and 610 kg, respectively) and BW change from prepartum to weaning (-20.3 and -9.3) kg, respectively) did not differ ( $P \geq 0.15$ ) between INORG and CHEL treatments. Calf birth weight (34.3 and 34.4 kg, respectively) and adjusted 205-d weaning weight (242 and 249 kg, respectively) did not differ ( $P \geq 0.25$ ) between INORG and CHEL treatments. However,

kg of calf weaned per cow exposed to breeding was greater ( $P < 0.01$ ) for CHEL compared to INORG (240 and 228 kg, respectively). During the finishing period, average daily gain was similar ( $P = 0.75$ ) between INORG and CHEL (1.18 and 1.20 kg, respectively). Carcass characteristics were similar between treatments ( $P \geq 0.40$ ), however CHEL tended ( $P = 0.07$ ) to yield more carcasses grading low choice or higher (87.5 and 79.3%, respectively). These data indicate chelated minerals can improve calf production per cow and subsequently improve carcass quality of beef calves.

**Key Words:** beef, chelated, trace mineral

**T19 Influence of abomasal infusion of phenylalanine on characteristics of digestion of a steam-flaked wheat-based finishing diet fed to Holstein steers.** A. A. Vite<sup>1</sup>, A. G. Alvarez\*<sup>1</sup>, A. P. Marquez<sup>1</sup>, M. F. Montano<sup>1</sup>, N. G. Torrentera<sup>1</sup>, and R. Zinn<sup>2</sup>, <sup>1</sup>UABC, Mexicali, BC, Mexico, <sup>2</sup>University of California, Davis.

Four Holstein steers with cannulas in the rumen, abomasum, and proximal duodenum, were used in a 4 × 4 Latin square design experiment to evaluate the influence of abomasal infusion of phenylalanine (PHE, 0, 5, 10 or 15 g/hd/d) on feed intake and digestive function. Steers were allowed ad libitum access to a steam-flaked wheat-based diet (DM basis; 72% steam-flaked wheat, 12% sudangrass hay, 9% sugarcane molasses, 3% yellow grease, 1.9% limestone, 1.3% urea, and 0.5% minerals and vitamins). Chromic oxide was added (0.3% as DM basis) as internal digesta marker. There were no treatment effects ( $P > 0.10$ ) ruminal OM digestion or ruminal microbial efficiency (microbial N/kg OM fermented). However, PHE infusion increased rumen pH (linear component,  $P = 0.07$ ), and ruminal NDF digestion (linear component,  $P = 0.09$ ). There were no treatment effects ( $P > 0.10$ ) on total tract OM and N digestion. However, PHE infusion increased (linear component,  $P = 0.03$ ) total tract NDF digestion (largely attributable to the increased ruminal NDF digestion). Changes in ruminal NDF digestion due to PHE infusion were associated with increased ( $P = 0.06$ ; linear component) rate of ruminal NDF digestion (KdNDF) and decreased rate of ruminal NDF passage (KpNDF). This latter effect may evidence a role for PHE in regulation ruminal emptying and passage of chyme to the small intestine.

**Key Words:** cattle, digestion, phenylalanine

**T20 Effects of postruminal amino acid supply on dietary protein flow from the rumen in forage based diet using a continuous culture system.** M. M. Masiero\*, J. H. Porter, M. S. Kerley, and W. J. Sexten, University of Missouri, Columbia.

Three diets with increasing ruminal undegraded AA, 80% (LO), 100% (MD) and 120% (HI) of the requirements for a 200 kg steer, were fed (50g/d) to continuous culture fermenters (FER) to characterize RUP supplementation (porcine blood meal and Aminoplus) in forage-based diet. We hypothesized increasing diet RUP concentration would increase RUP flow from the rumen without influencing microbial fermentation. Diets were randomly distributed over FER (n = 24), acclimated for 4 d, and sampled over 3 d. FER content was monitored at 0h and 4 h post feeding for pH and analyzed for VFA (mM) and ammonia concentration (AM) (mM/dL). The pH was greater ( $P = 0.005$  and  $0.0008$ ) for HI, 6.46 and 6.42, compared to MD, 6.34 and 6.27, and LO, 6.32 and 6.24, for 0 and 4 h, respectively. AM increased as RUP increased (LO 3.18; MD 5.30; HI 8.79) at 0 h, however at 4 h, AM was greater ( $P < 0.0001$ ) for HI (10.58) compared to MD (6.10) and LO (4.26). Acetic, propionic, valeric, total VFA and acetic:propionic did not differ ( $P = 0.44$ ) at 0 and

4 h. Butyric did not differ ( $P = 0.37$ ) at 0 h. At 4 h butyric was greater ( $P = 0.036$ ) for LO (16.9) compared to HI (15.4), however MD (16.5) did not differ between treatments. Isobutyric was greater ( $P < 0.0001$ ) for HI (1.5) compared to MD (1.2) and LO (1.1) at 0 h. At 4 h, isobutyric increased as RUP increased (LO 1.2; MD 1.4; HI 1.6;  $P < 0.0001$ ). Isovaleric was greater ( $P < 0.0001$ ) for HI, 2.9 and 3.0, compared to MD, 2.5 and 2.6, and LO, 2.2 and 2.4, for 0 and 4 h, respectively. OM, NDF and ADF digestibility, microbial efficiency and g of bacterial N/d did not differ ( $P = 0.4$ ). Protein digestibility (%) was greater ( $P = 0.042$ ) for LO (47.2) and HI (46.0) compared to MD (38.3). At the lower RUP inclusion levels RUP was recovered in effluent flow however at greater RUP inclusion levels 34% of added RUP was recovered in effluent flow. In conclusion, RUP supplementation in forage-based diets increased RUP flow from the rumen without influencing microbial fermentation. Reduced RUP for HI compared to MD may be due to microbial adaptation to greater RUP levels.

**Key Words:** digestibility, fermentation, RUP

**T21 Phosphorus excretion in beef steers as affected by increasing levels of corn gluten feed supplementation.** D. D. Harmon<sup>\*1</sup>, E. A. Riley<sup>1</sup>, A. L. Zezeski<sup>1</sup>, J. K. Smith<sup>1</sup>, H. L. M. Tucker<sup>2</sup>, S. J. Neil<sup>1</sup>, B. D. Dalton<sup>1</sup>, and M. A. McCann<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Department of Animal and Poultry Sciences, Blacksburg, <sup>2</sup>Virginia Polytechnic Institute and State University, Department of Dairy Science, Blacksburg.

Overfeeding of phosphorus (P) is a contributing factor to P levels in the Chesapeake Bay. The objective of this study was to determine the impact of increasing levels of corn gluten feed as a supplemental organic source of P. Eight Hereford steers (427 ± 79 kg) were randomly assigned to one of four dietary treatments in a 4 × 4 replicated Latin square design. Steers were fed a basal diet of chopped grass hay (0.13% P) and 0, 0.5, 1.0 or 1.5 kg/d of dried corn gluten feed pellets. All steers were supplemented with 0.91 kg/d beet pulp, 0.45 kg/d rumen-inert fat supplement and 18 g/d trace mineral salt. Urea was added to the respective diets at levels of 95.34, 72.64, 49.94, and 31.78 g/d to ensure equal dietary protein across treatments. Steers were housed individually and fitted with total fecal collection bags. Steers were adjusted to each diet for 9 d followed by a 5-d collection period. Following the final collection of each period, a 10 ml jugular blood sample was collected and analyzed to determine serum inorganic P. Feed and fecal samples were dried, ground, subsampled and analyzed for inorganic and total P. Dietary P increased ( $P < 0.05$ ) as level of corn gluten feed increased: 10.14, 14.19, 18.26 and 22.30 g/d. Dry matter digestibility increased linearly ( $P < 0.05$ ) as dietary P increased: 51.15, 52.25, 52.72 and 54.10%. Total P excretion increased linearly ( $P < 0.05$ ) with increasing dietary P content: 9.42, 10.76, 15.51, 16.40 g/d. Inorganic P excretion increased linearly ( $P < 0.05$ ) with increasing dietary P content: 4.26, 6.17, 8.68 and 10.25 g/d. Total P excretion was highly correlated ( $P < 0.05$ ;  $r = 0.81$ ) with inorganic P excretion. Serum inorganic P increased linearly ( $P < 0.05$ ) with increasing dietary P content: 5.61, 5.87, 6.64 and 6.80 mg/dL. Fecal P increased as dietary P increased in steers fed varying dietary levels of P from organic sources. Prevention of overfeeding of P on beef cattle operations is a strategic, managerial practice that can reduce P levels.

**Key Words:** beef cattle, byproduct feedstuffs, phosphorus

**T22 Effect of Bovamine on lactation performance by dairy cows.** L. F. Ferraretto<sup>\*</sup> and R. D. Shaver, *University of Wisconsin-Madison, Madison.*

The objective of this study was to evaluate the effect of direct-fed microbial (Bovamine) addition to a TMR on lactation performance by mid-lactation dairy cows. One hundred and twelve Holstein cows (28 primiparous and 84 multiparous; 139 ± 47 DIM at trial initiation) were stratified by parity and DIM and randomly assigned to 14 pens of 8 cows each. Pens were then randomly assigned to 1 of 2 treatments in a continuous-lactation trial consisting of a 2-wk covariate adjustment period with cows fed the basal TMR followed by a 10-wk treatment period with cows fed their assigned treatment diets. The two treatments were: basal TMR plus either 1 g/cow/d Bovamine (BOV, 1 × 10<sup>9</sup> cfu/g *Lactobacillus acidophilus* NP51 and 2 × 10<sup>9</sup> cfu/g *Propionibacterium freudenreichii* NP24) or placebo (CON). Data were analyzed as a completely-randomized design with the data from the preliminary period as a covariate using PROC MIXED in SAS. The model included treatment, week and treatment × week interaction as Fixed effects, and pen within treatment as a Random effect. Milk yield was similar ( $P > 0.10$ ) between treatments and averaged 44.9 kg/d. There was a trend ( $P < 0.08$ ) for DMI to be decreased by 0.4 kg/d per cow for BOV overall, and DMI was lower ( $P < 0.05$ ) for BOV than CON during wk 2, 3, 6, 9 and 10 ( $P < 0.001$  for week × treatment). However, measures of feed conversion (milk or component-corrected milk yields per unit DMI) were unaffected ( $P > 0.10$ ) by treatment. Milk fat, protein and urea nitrogen concentrations were unaffected ( $P > 0.10$ ) by treatment and averaged 3.75%, 3.11% and 15.2 mg/dL, respectively. Likewise, body weight change and condition score were unaffected ( $P > 0.10$ ) by treatment. Under the conditions of this study, with mid-lactation cows fed a 54% forage TMR (DM basis), there was no improvement in lactation performance from the inclusion of Bovamine in the diet.

**Key Words:** direct-fed microbial, dairy cow, milk production

**T23 Use of plasma lysine to assess post-ruminal amino acid bio-availability in rumen bypass lysine from Megamine-L.** E. Evans<sup>\*1</sup>, N. Clark<sup>2</sup>, and E. Block<sup>3</sup>, <sup>1</sup>Essi Evans Technical Advisory Services Inc., Bowmansville, ON, Canada, <sup>2</sup>Atlantic Dairy and Forage Institute, Fredericton Junction, NB, Canada, <sup>3</sup>Arm & Hammer Animal Nutrition, Princeton, NJ.

An experiment was conducted to assess the use of plasma Lys to determine post-ruminal absorption. Rumen cannulated, post-peak production cows were housed in stanchion stalls. Cows had ad libitum access to a TMR that met their Lys needs based on CPM Dairy. Four treatments were evaluated in a Latin square design with periods of 14 d. Control was 50g of abomasally infused Lys (63.4g of Lys HCl) and was compared to 37.5, 50 and 62.5 g of abomasally Lys from cows receiving a single rumen dose of Megamine-L (Church & Dwight Co., Inc.). Actual amounts of Megamine-L were calculated to deliver the desired abomasal Lys based on predetermination of soluble protein at 28.6%, a degradation rate of 2.02%/hr, an assumed escape of 50% of the Lys, and 16% free Lys the product. One day prior to application (d 13 of each period) of the test article, blood was drawn via jugular catheter at 0800, 1200, 1600, 2400 and 0400 h to determine baseline plasma Lys levels. At 0800 h on the day of the experiment (d 14 of each period) the Megamine-L treatments were administered as a single dose through a rumen cannula. The control Lys infusion consisted of 63.4g of Lys-HCl (50 g of Lys) dissolved in 3 L of water and was administered over a 2-h period. Blood was drawn at 0745, 1200, 1600, 2400 and 0400 h. Lysine availability was calculated from the area under the curve (AUC). AUC for the control treatment was assumed to represent a digestibility of 98%. Lys bioavailability from Megamine-L increased ( $P < 0.05$ ) with the amount of Lys supplied (57.7, 67.2 and 70.2% calculated absorption

at 37.5, 50.0 and 62.5 g of abomasal Lys). Previously reported trials (digestibility-metabolism trial design) estimated metabolizable Lys in Megamine-L at 46% which is lower than the results in this trial design. Use of plasma Lys to assess Lys status is not accurate, and likely varies with gut and hepatic uptake and utilization. It is likely that compounds exiting the rumen more gradually in normal feeding situations would be disadvantaged relative to the single bolus doses of Lys administered in this trial.

**Key Words:** metabolizable lysine, rumen bypass lysine, dairy cows

**T24 Lactational performance and ruminal fermentation profiles of dairy cows fed different corn silage hybrids ensilaged with-out or with microbial inoculant.** M. N. McDonald<sup>1</sup>, M. S. Holt<sup>1</sup>, A. J. Young<sup>1</sup>, J.-S. Eun<sup>\*1</sup>, and K. E. Nestor<sup>2</sup>, <sup>1</sup>Department of Animal, Dairy, and Veterinary Sciences, Utah State University, Logan, <sup>2</sup>Mycogen Seeds, Indianapolis, IN.

A lactation study was conducted to examine the effects of a silage inoculant (SI) applied onto conventional (CCS) or brown midrib corn silage (BMRCS) in lactation diets on lactational performance and ruminal fermentation of dairy cows. Forty multiparous Holstein cows were used starting at 20-58 DIM in a completely randomized design with a 2 × 2 factorial arrangement of treatments. Cows were randomly assigned to 1 of 4 diets: CCS TMR without SI, CCS TMR with SI (CCS+SI), BMRCS without SI, and BMRCS with SI (BMRCS+SI). The experiment lasted a total of 10 wk (2 wk of adaptation and 8 wk of data and sample collection). The SI (Agmaster XV, DuPont, Waukesha, WI) was applied at 1.25 × 10<sup>5</sup> cfu/g of corn crop to the CCS+SI and the BMRCS+SI. Cows fed BMRCS increased DMI compared to those fed CCS (27.9 vs. 25.6 kg/d; *P* = 0.05), but SI did not affect DMI. Milk yield averaged 45.8 kg/d across treatments, and it was not affected by dietary treatments. In contrast, milk fat concentration and yield increased (*P* < 0.05) due to feeding BMRCS, leading to an increase in ECM yield by feeding BMRCS (47.5 vs. 43.2 kg/d; *P* = 0.03). Dietary treatments did not influence concentrations of milk protein and MUN. Digestibility of DM was similar among treatments, whereas feeding BMRCS increased (*P* = 0.05) digestibilities of NDF and ADF. Ruminal pH averaged 6.29 across treatments and did not differ. Concentration of VFA was not affected by dietary treatments. While feeding BMRCS increased (*P* = 0.05) molar proportion of acetate, it decreased (*P* = 0.05) molar proportion of propionate, resulting in an increase in acetate-to-propionate ratio (*P* = 0.05). Applying SI did not influence VFA profiles. Ammonia-N concentration was similar in response to dietary treatments. The SI tested in this study did not affect lactational performance and ruminal fermentation. However, cows fed BMRCS increased yields of milk fat and ECM due to increased fiber digestion and ruminal acetate production.

**Key Words:** brown midrib corn silage, silage inoculant, lactating dairy cows

**T25 Efficacy of various adsorbents to reduce aflatoxin M<sub>1</sub> levels in milk of lactation cows fed aflatoxin B<sub>1</sub>.** M. Savari<sup>1</sup>, M. Dehghan-Banadaky<sup>\*1</sup>, K. Rezayazdi<sup>1</sup>, and M. Javan-Nikkah<sup>2</sup>, <sup>1</sup>Department of Animal Science, University College of Agriculture and Natural Resources, University of Tehran, Karaj, Tehran, Iran, <sup>2</sup>Plant Protection Department, University College of Agriculture and Natural Resources, University of Tehran, Karaj, Tehran, Iran.

The aim of this study was to comparison of various adsorbents including Bentonite, Zeolite, Mycosorb (Alltech) and Biotox (Biochem)

on their ability to reduce aflatoxin in milk of Holstein cows. Thirty-five Holstein cows divided into 5 groups (with average 37.3 kg/day milk yield and 114 DIM). Experimental groups were included these treatments: (1) Aflatoxin B<sub>1</sub> (300 µg aflatoxin B<sub>1</sub> dissolved in water) + 40 g Bentonite; (2) Aflatoxin B<sub>1</sub> + 20 g Zeolite; (3) Aflatoxin B<sub>1</sub> + 20 g Mycosorb; (4) Aflatoxin B<sub>1</sub> + 20 g Biotox; and (5) aflatoxin B<sub>1</sub> without adsorbent. Milk sampling was performed 4 days (1 day before of treatment and 3 days after that). Data were analyzed using the mixed procedure of the SAS in a completely randomized design with 7 replications. The results of this study showed that milk production was not affected by treatments. In case of milk fat percentage on the second day after treatment, the difference between treatments was significant (*P* < 0.05). As follows the second treatment and the control treatment showed the highest (3.8%) and lowest (3%) percentage of milk fat. On the third day after treatment, respectively treatment 1 and treatment 3 showed the highest (4%) and the lowest (3.2%) percentage of milk fat (*P* < 0.05). In case of the percentage of protein and lactose in milk at the second day after treatment, the second treatment had the highest value (*P* < 0.01). After analysis of the data from ELISA test of AFM<sub>1</sub> in milk was determined that most of aflatoxin contamination was observed on the day of treatment and it was related to the control treatment (400.49 ppt) and the lowest contamination in the same day belonged to the first group of cows means consuming 40 g of bentonite (253.89 ppt). According to the results of this experiment the excretion aflatoxin in milk immediately after consumption of toxin by animal in the first milking time was the maximum amount and this amount decreases gradually in the next milking. The sort ascending of efficiency absorption of toxin by adsorbent was as follows: Mycosorb, Zeolite, Biotox, and Bentonite.

**Key Words:** aflatoxin B<sub>1</sub>, aflatoxin M<sub>1</sub>, mineral and organic adsorbents

**T26 Effect of yeast probiotic (*Saccharomyces cerevisiae*) in milk or starter on growth performance, fecal score and rumen parameters of dairy calves.** M. Hoseinabadi, M. Dehghan-Banadaky\*, and A. Zali, Department of Animal Science, University College of Agriculture and Natural Resources, University of Tehran, Karaj, Tehran, Iran.

The objective of this study was to determine how yeast probiotic in milk or starter affects growth performance, fecal score and rumen parameters of dairy calves. Thirty Holstein female calves (14 ± 1 d old) divided to 3 groups, using a completely randomized design with 51-d periods. The treatments included: (1) 2 g yeast probiotic in milk (PM); (2) 2 g yeast probiotic in starter (top dress, PS); (3) control, without probiotic (CON). Animal were individually housed and had free access to water and starter concentrate (21.6% CP and 80% TDN). All calves were offered 6 L/d of milk replacer (22% CP, 19% EE) from birth, which was incrementally reduced after 6 wk to enable weaning by the end of wk 8. The study finished at 65 days old. Fecal scores (fecal scoring: fluidity, 1 = normal, 2 = soft, 3 = runny, 4 = watery) and starter intake were evaluated daily. Calves were weighted at 28, 42, 56, 65 days of age. At 65 d of age, ruminal fluid samples were collected using an oro-ruminal probe and a suction pump for pH and N-NH<sub>3</sub> determination. The results exhibited that experimental diets had not affected body weight changes, average daily gain, and feed efficiency (*P* > 0.05), but dry matter intake was significantly lower in treatment 2 than treatment 3 (*P* < 0.01). pH, N-NH<sub>3</sub> concentration of rumen fluid and blood parameters was not affected by treatments (*P* > 0.05). Fecal score and health in treatments 1 and 2 were significantly lower than control. Generally using yeast probiotic in milk appeared to be an acceptable alternative than yeast probiotic in starter.

**Table 1.** Effect of yeast probiotic in milk or starter of Holstein calves

Item	PM	PS	CON	P-value	SEM
DMI, g/d	1145 <sup>ab</sup>	998 <sup>b</sup>	1219 <sup>a</sup>	0.006	79.3
ADG, kg/d	0.67	0.65	0.67	NS	0.07
ADG/DMI	0.41	0.44	0.39	NS	0.044
BW, kg	64.7	63.0	64.7	NS	1.27
pH	7.20	6.73	7.10	NS	0.225
N-NH <sub>3</sub> , mg/dL	8.25	10.84	7.53	NS	1.937
Fecal score	1.28 <sup>b</sup>	1.37 <sup>b</sup>	1.51 <sup>a</sup>	0.01	0.06

<sup>a,b</sup>In the same row, means with different letter has significant difference ( $P < 0.5$ ).

**Key Words:** milk, starter, yeast probiotic

**T27 Effects of rare earth-chitosan chelate on blood biochemical parameters in lactating dairy cows.** R. X. Hu<sup>1,2</sup>, J. Q. Wang<sup>\*1</sup>, D. P. Bu<sup>1</sup>, J. B. Cheng<sup>1</sup>, F. D. Li<sup>2</sup>, H. Y. Zhao<sup>1</sup>, S. H. Dong<sup>1</sup>, and C. Y. Ren<sup>1,2</sup>, <sup>1</sup>State Key Lab of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agriculture Sciences, Beijing, China, <sup>2</sup>College of Animal Science and Technology, Gansu Agricultural University, Lanzhou, Gansu, China.

This study examined the effects of different proportion of rare earth-chitosan chelate on blood biochemical parameters in lactating Chinese Holstein dairy cows. Forty-eight lactating cows (days in milk = 130 ± 5; average milk yield = 33.2 ± 5.1 kg/d) were blocked based on days in milk, milk production, and parity and were randomly assigned to 1 of 4 treatments. Dietary treatments were 4 adding levels of RECC (rare earth-chitosan chelate): 0 (control), 0.15%, 0.75%, and 1.5%, respectively. The experiment lasted 9 wk including the first week for adaptation. Blood was collected in evacuated tubes via caudal venipuncture at 0, 2, 4, 6, 8 week and placed on ice immediately following collection. In the present study the mean corpuscular hemoglobin and mean corpuscular volume were significantly ( $P < 0.05$ ) affected of the entire hematological indices measured in the 0.15% RECC group vs. control and other groups. Feeding 0.75% or 1.5% RECC resulted in lower white blood cell count and hemoglobin vs. 0.15% RECC group ( $P < 0.01$ ). 0.15% RECC-added in animals thrombocytocrit and platelet were higher than control and 0.75% group ( $P < 0.05$ ). No significant difference in the serum hematocrit, intermediate cell, amylase, alkaline phosphatase and blood urea nitrogen were detected among groups ( $P > 0.23$ ). In general the red blood cell, lymphocyte and neutrophilic granulocyte were consistently enhanced in cows with 0.15% RECC supplemented vs. control, and while the different counts did not follow a particular trend ( $P > 0.06$ ). However, greater intake of RECC (0.75% or 1.5%) decreased red blood cell, lymphocyte and neutrophilic granulocyte vs. control ( $P > 0.06$ ). This suggested that greater intake of RECC have a possible adverse effect of dairy cows, and further confirmed that the tolerable level of RECC adding in dairy cow diet could be 0.75% or 1.5%.

**Key Words:** rare earth-chitosan chelate, dairy cow, blood biochemical parameter

**T28 Effects of rare earth-chitosan chelate on performance and milk composition in dairy cows.** R. X. Hu<sup>1,2</sup>, J. Q. Wang<sup>\*1</sup>, D. P. Bu<sup>1</sup>, J. B. Cheng<sup>1</sup>, F. D. Li<sup>2</sup>, H. Y. Zhao<sup>1</sup>, S. H. Dong<sup>1</sup>, and C. Y. Ren<sup>1,2</sup>, <sup>1</sup>State Key Lab of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agriculture Sciences, Beijing, China, <sup>2</sup>College of

*Animal Science and Technology, Gansu Agricultural University, Lanzhou, Gansu, China.*

Rare earth-chitosan chelate could improve animal performance supplemented low amount, while increased high level may have a inhibition of production. This study examined the effects of different proportion of rare earth-chitosan chelate on performance and milk content in lactating Chinese Holstein dairy cows. Forty-eight lactating cows (days in milk = 130 ± 5; average milk yield = 33.2 ± 5.1 kg/d) were blocked based on days in milk yield, lactation day, and parity and were randomly assigned to one of 4 treatments. Four dietary treatments were adding levels of RECC (rare earth-chitosan chelate): 0 (control), 0.15%, 0.75% and 1.5% of concentrate feed, respectively. The experimental period was 8 weeks. DMI (dry matter intake), milk yield were recorded daily, and milk composition (fat, protein, and lactose) were analyzed weekly. Data were analyzed by mixed or GLM procedure of SAS software. Feeding 0.15% RECC resulted in greater DMI and milk yield vs. Control and other groups ( $P < 0.01$ ), but greater intake of RECC decreased DMI and milk yield ( $P < 0.01$ ). Milk protein rate was significantly decreased to 3.07% and 2.97% in 0.15% or 1.5% RECC groups vs. control (3.2%) and 0.75% RECC group (3.18%;  $P < 0.01$ ). Compared with control, milk fat was lower while 0.15% or 1.5% of RECC were supplemented, but there was no difference between control and 0.75% RECC-added animals ( $P = 0.078$ ). Adding 1.5% RECC significantly lower total milk solid vs. control and 0.75% RECC group ( $P = 0.017$ ), and the reduction depended on intake of RECC. In addition, feeding RECC have no significant effect on lactose, milk urea nitrogen and milk SCC ( $P > 0.31$ ). It was concluded that add 0.15% RECC could increase milk yield and milk content in dairy cows, but greater intake of RECC (1.5%) have a negative effect of production.

**Key Words:** rare earth-chitosan chelate, dairy cow, performance and milk composition

**T29 Effect of dietary N-carbamoyl glutamate on milk production and nitrogen utilization in high yielding dairy cows.** B. Chacher<sup>1,2</sup>, W. Zhu<sup>\*1,2</sup>, J. A. Ye<sup>1,2</sup>, D. M. Wang<sup>1,2</sup>, and J. X. Liu<sup>1,2</sup>, <sup>1</sup>Institute of Dairy Science, College of Animal Sciences, <sup>2</sup>MoE Key Laboratory of Molecular Animal Nutrition, Zhejiang University, Hangzhou, China.

High-yielding cows fed diet rich in protein impaired the ureagenesis and decreased feed intake and milk production. Arginine (Arg) played a key role in urea cycle regulation. Due to the high rumen degradation, feeding rumen-protected Arg seemed to be uneconomical. Alternatively, N-carbamoyl glutamate (NCG) was of relatively lower rumen degradation rate and known as a potential Arg raiser, but the effect of NCG in dairy cows has not been determined. Thus, the objective of the current study was to determine the effect of NCG on milk production and nitrogen utilization in high yielding dairy cows. Sixty multiparous cows [DIM = 78 (SD 17.3), milk yield = 41.9 (SD 7.90) kg/d] were blocked based on milk yield and DIM, and randomly allocated to receive each of 4 dietary treatments supplemented with 0 (control), 10, 20 or 30 g/d NCG, respectively, for 7 weeks. Milk yield was recorded weekly. Dry matter intake, milk composition, plasma variables and urea N content (plasma, urine and milk) were determined every other week. Data were analyzed using the MIXED procedure of SAS. A statistically significant difference was defined at  $P < 0.05$ , and trends were declared at  $0.05 \leq P \leq 0.10$ . Dry matter intake did not change by NCG supplementation of NCG. Compared to the control, cows fed 20 g/d NCG tended to have higher milk yield and milk protein yield (40.01 and 1.12 kg/d vs. 38.09 and 1.04 kg/d). Contents of milk protein and lactose linearly increased ( $P < 0.01$ ) with the supplementing NCG. Cow fed 20 or 30 g/d NCG

enhanced ( $P < 0.01$ ) plasma nitric oxide and decreased ammonia N compared with the control. Plasma Arg concentration increased ( $P < 0.01$ ) by 3.5 and 8.5% in cows fed 20 or 30 g/d NCG, respectively. Supplementation of 20 g/d NCG linearly decreased ( $P < 0.01$ ) the urea N in milk, plasma and urine, while the N utilization (0.283 vs. 0.263) tended to be improved. In summary, supplementation of 20 g/d NCG may alter the plasma metabolite and milk contents, and hence improve lactation performance of high yielding dairy cows.

**Key Words:** N-carbamoyl glutamate, lactation performance, nitrogen utilization

### **T30 Predicting prolamin and ruminal starch digestibility in corn silage and high moisture corn using near infrared spectroscopy.** K. Foerder\* and J. Horst, *Agri-King Inc., Fulton, IL.*

Prolamin levels in corn have been shown to be negatively correlated to starch digestibility in dairy cows. Current analysis methods for prolamin and ruminal in vitro starch digestibility (IVSD) are costly and time consuming. Therefore, it would benefit producers to have a rapid, economic method to more effectively predict prolamin and IVSD of available feedstuffs. The objective was to determine if the use of near infrared spectroscopy (NIRS) could effectively predict prolamin and/or IVSD in corn silage (CS) or high moisture corn (HMC). Samples of CS and HMC were selected to represent regions across the United States and a variety of hybrids. Samples ranged from fresh, unfermented to well fermented and included a wide range of moisture levels. The samples were selected by spectra using WINISI software. A modified turbidimetric zein method developed by Larson and Hoffman (2008) was used to determine the prolamin concentration of each sample. The coefficient of variation (CV) in the prolamin assay is 6.5% using a ground shell corn standard across multiple assays and the results were used to create NIRS calibrations using a 5000 Foss Instrument. The wet chemistry results correlated to the NIRS calibration resulting in an  $R^2$  of 0.91 for CS and 0.78 for HMC. The IVSD was determined on the same set of samples using a standardized 7-h in vitro method with rumen fluid from continuous cultures. The CV across multiple assays for the IVSD assay was 1.89% using a corn silage standard. The NIR spectra were collected and used to determine if NIRS could also predict IVSD. The resultant IVSD calibration resulted in an  $R^2$  of 0.80 for CS and 0.82 for HMC. The development of NIRS calibrations for prolamin and IVSD in both CS and HMC would allow for rapid and economical predictions of starch utilization and better usage of feedstuffs by dairy producers.

**Key Words:** prolamin, starch digestibility, near infrared spectroscopy

### **T31 Mineral containing dehydrated molasses lick blocks pre-calving provide a viable alternative for addressing mineral imbalances during calving in pasture-based New Zealand dairy cows.** M. H. Oliver\*<sup>1,2</sup>, S. Rossenrode<sup>1</sup>, and J. B. Aveling<sup>3</sup>, <sup>1</sup>*UniServices Ltd., University of Auckland, Auckland, New Zealand*, <sup>2</sup>*Liggins Institute, University of Auckland, Auckland, New Zealand*, <sup>3</sup>*Ballance Agri-Nutrients, Tauranga, Bay of Plenty, Tauranga, New Zealand.*

Milk fever and associated conditions occurring in NZ dairy cows around calving are often prevented by dusting pasture or supplementary feed with MgO and also by adding minerals (Mg, Co, Se, Cu, Zn, I) to drinking water up to 2 months before calving. An integrated approach to pre-calving supplementation using mineral containing dehydrated molasses-based lick blocks (Dry Cow) was evaluated in a trial beside traditional mineral supplementation in a typical NZ Friesian herd with a previous history of milk fever. Cows were recruited in their second or later pregnancy and randomly assigned to traditional mineral supple-

mentation (TM, n = 290) or Dry Cow blocks (DC, n = 207). TM cows had MgO dusted on feed at a rate of 50 g/cow/day and minerals added to water. Dry Cow was provided at a minimum of one 22.5 kg block/20 cows, intake was estimated at 230 g/cow/day. Swedes and silage were fed pre-calving. Cows entered calving areas 1 week before calving; TM had a mineral additive added to feed at 120 g/cow/day, while DC had continued access to Dry Cow and both treatment groups had minerals added to their shared water supply. Thirty cows per group were blood sampled at the start of the trial before mineral provision, again 6 weeks later and then within 2 weeks following calving. Incidence of milk fever in all cows was low (2.6%) while mastitis (6.2%), retained placenta (8.1%) and assisted calving (8.9%) were moderate. Incident occurrence was not different between treatment groups. Body condition score was slightly higher in DC than TM before the trial ( $4.6 \pm 0.1/6$  vs.  $4.8 \pm 0.1/6$ ,  $P < 0.05$ ), but was identical following calving ( $4.5 \pm 0.1/6$ ). Serum Mg and B<sub>12</sub> were not different at any stage while Ca was higher in DC after supplementation and calving ( $P < 0.05$ ). Serum Se and Zn were higher after 6 weeks of supplementation in DC ( $P < 0.001$ ) but not different after calving. In conclusion, mineral containing dehydrated molasses lick blocks offer a convenient method to supply minerals to pregnant cows on pasture, yielding comparable results to traditional methods in common use in NZ.

**Key Words:** mineral, calving, hypomagnesemia

### **T33 Milk and milk quality evaluated on a commercial Holstein dairy following an OmniGen-AF dry cow and early lactation feeding strategy.** A. E. Holland\*<sup>1</sup>, J. D. Chapman<sup>1</sup>, and L. O. Ely<sup>2</sup>, <sup>1</sup>*Prince Agri Products Inc., Quincy, IL*, <sup>2</sup>*University of Georgia, Athens.*

The goal of this study was to evaluate milk production in multiparous Holstein cows fed OmniGen-AF (OG) during the dry period and into 30 d in milk (DIM). An 8,000 cow dairy farm consisting of 2-4,000 cow side-by-side mirror image units, identified as U1 and U2 were used. Each unit maintained separate dry and lactating herds and both fed the same dry and milk cow diets delivered as TMR. Cows were milked 2x and housed in open free-stall barns. To assess the effect of OG feeding (56 g/h/d) to dry and fresh cows on milk production, 4-90 d periods (P1 to P4) were used. In P1, both U1 and U2 cows received the control diet (no OG). In P2, U2 cows were fed OG and U1 were controls. In P3, both units were fed the control diet, and in P4, U1 cows were fed OG and U2 were controls. Cow groups within period by unit were balanced on parity, previous 305ME, total milk and predicted calving date using Dairycomp305 resulting in 2,337 enrolled cows. Other inclusion criteria were d in the dry period (>45 d) and 3 consecutive test-day milk weights. PROC GLM (SAS) was used to test for differences in first-test (FT), week 4 (W4) and peak (PK) milks and first test log score (LS). In P1, no differences were detected between U1 and U2 for FT (37 kg, 38.3 kg), W4 (39.7 kg, 40.4 kg) and PK (44.2 kg, 44.5 kg) milks. Similar results were observed at U1 and U2 in P3 (FT: 37.2 kg, 37.9 kg, W4: 39.2 kg, 40.6 kg, PK: 42.8 kg, 43.4 kg). In P2, OG was fed to U2 cows and milk yields differed from U1 for FT (37.2 kg, 32.7 kg,  $P < 0.001$ ), W4 (41.5 kg, 38.2 kg,  $P < 0.001$ ), and PK (47.0 kg, 44.6 kg,  $P < 0.01$ ) milks. A similar trend was observed when units fed OG were reversed in P4. Milk yields for cows at U1 were different from U2 cows for FT (36.2 kg, 33.5 kg,  $P < 0.01$ ), W4 (39.6 kg, 37.1 kg,  $P < 0.001$ ), and PK (45.7 kg, 42.8 kg,  $P < 0.01$ ) milks. No differences in LS were observed between U1 and U2 in P1-3; however, differences were detected ( $P < 0.01$ ) in P4 (U1: 4.17, U2: 3.44). In this study the feeding of OmniGen-AF to multiparous Holstein cows during the dry period and into 30 DIM enhanced early lactation.

**Key Words:** cow, milk, OmniGen-AF

**T34 Interaction between forage source and monensin on the formation of biohydrogenation intermediates in continuous cultures.** Y. Sun\*<sup>1</sup>, T. C. Jenkins<sup>2</sup>, and A. L. Lock<sup>1</sup>, <sup>1</sup>Michigan State University, East Lansing, <sup>2</sup>Clemson University, Clemson, SC.

A dual-flow continuous fermenter study with a 2 × 2 factorial arrangement of treatments examined the interaction between forage source and monensin on the formation of biohydrogenation intermediates (BHI). Cultures (4 per treatment) were fed diets (50:50 forage:concentrate ratio) for 10 d with the last 3 d for sample collection for fatty acid analysis and samples taken on d 10 at 0, 2, and 4 h after the morning feeding for VFA determination. Treatments were two forage sources: 100% corn silage (100CS) vs. a 1:1 ratio of corn silage and alfalfa haylage (50CS) in combination with two levels of monensin (0 and the equivalent to 350 mg/cow/d). Corn oil was included in all treatments at 2% dietary DM. Data were analyzed as a randomized complete block design. The 100CS diet had higher ( $P < 0.05$ ) propionate and lower ( $P < 0.05$ ) acetate concentrations and acetate/propionate at all sampling times. Monensin did not affect VFA concentrations at the 0 or 2 h sampling times; at 4 h after feeding monensin decreased ( $P < 0.05$ ) acetate/propionate from 1.76 to 1.51. Compared to 50CS, the 100CS diet had a higher ( $P < 0.05$ ) extent of biohydrogenation (BH) for oleic acid (30.6 vs. 44.1%) but lower ( $P < 0.05$ ) BH of linolenic acid (48.7 vs. 34.9%); treatments did not affect extent of linoleic BH. Monensin did not affect extent of BH of oleic, linoleic, or linolenic acid. The 100CS diet had lower ( $P < 0.05$ ) total fatty acid output from cultures than the 50CS diet. Total *trans* 18:1 production was higher ( $P < 0.05$ ) for 100CS than for 50CS (383 vs. 195 mg/d), accounted for mostly by an increase ( $P < 0.05$ ) in the daily production of *trans*-10 18:1 (326 vs. 130 mg/d). There were no differences between the two forage sources on daily production of *trans*-10, *cis*-12 18:2. Monensin had no effect on the formation of BHI. In conclusion, monensin supplementation to continuous cultures caused an expected drop in acetate/propionate but did not increase the production of BHI. Corn silage as the only forage source increased the formation of BHI, particularly *trans*-10 18:1 that is normally associated with increased risk of milk fat depression.

**Key Words:** continuous culture, fatty acid, monensin

**T35 Lysine loss during aerobic exposure of a corn silage based ration with mechanical extracted soybean meal with gums and various rumen-protected lysine products.** D. A. Sapienza\*<sup>1</sup> and C. A. Macgregor Jr.<sup>2</sup>, <sup>1</sup>Sapienza Analytica LLC, Slater, IA, <sup>2</sup>Grain States Soy Inc., West Point, N.

Lysine loss was evaluated during in vitro aerobic exposure of a ration mixed with either nothing (B, ration blank), mechanical extracted soybean meal (MES) with gums (MESG) (P1), MESG with rumen-protected lysine (RPL) (MESGL) first production run (P2), MESGL second production run (P3), RPL (P4), or MESGL third production run (P5). MESGL was manufactured by inserting RPL into soy gums and drying the gums onto MES. RPL comprised lysine monohydrochloride embedded in a rumen-inert fat matrix. Two ration moisture (M) levels were evaluated: 48% M (L) (as fed 45% corn silage, 55% grain mix) and 58% M (H) (as fed 40% corn silage, 42% grain mix and 18% added water). Free lysine was quantified in water extracts taken from treatments at 0, 6, 18 and 24 hours. Eight replicates were taken for each treatment at each exposure time and lysine reported as microgram lysine per gram of water. Quadratic (orthogonal) polynomials were fitted to characterize the lysine concentration time trends separately for data acquired at L and H. Time trends for MESG runs with (P2, P3, P5) or without (P1) RPL were best characterized as linear trends. Trends for P2, P3, and P5 were not significantly different ( $F = 0.29$  on 6 and 11 df,  $P = 0.92$

at 48% M;  $F = 0.05$  on 3 and 11 df,  $P > 0.99$  at 58% M). The trend for P1 showed a significantly lower mean concentration at 48% M ( $t = -2.52$  on 11 df,  $P = 0.03$ ). Overall linear trends for P2, P3 and P5 were not significantly different from P1 ( $P = 0.25$  at L;  $P = 0.81$  at H). The concentration time trend for RPL alone (P4) was clearly significantly different from the MESG runs with a highly significant ( $P < 1e-10$ ) quadratic coefficient, much higher average slope and higher mean concentration (or intercept). The overall linear trend of lysine release from RPL, when RPL was inserted into gums under the conditions of this study, was not different from the linear trend of lysine release from native lysine in MES and was different from the linear trend of lysine release from RPL when it was not in gums.

**Key Words:** rumen-protected lysine, mechanical extracted soybean meal, soy gum

**T36 Consequences of supplementing lactating Holstein cows with an exogenous amylase on milk performance and rumen fermentation.** A. Bach\*<sup>1,2</sup>, E. Azem<sup>3</sup>, W. Steinberg<sup>3</sup>, and V. Glitsø<sup>4</sup>, <sup>1</sup>ICREA, Institut de Recerca i Estudis Avançats, Barcelona, Spain, <sup>2</sup>Department of Ruminant Production, IRTA, Caldes de Montbui, Spain, <sup>3</sup>DSM Nutritional Products, Basel, Switzerland, <sup>4</sup>Novozymes, Bagsvaerd, Denmark.

Improving feed efficiency and digestion may increase the economic profitability of dairy herds and minimize the environmental impact of milk production. To evaluate the effects of supplementing cows with an exogenous amylase, 240 lactating Holstein cows (BW = 653 ± 80 kg, DIM = 225 ± 112 kg, and milk yield = 39.2 ± 8.5 kg/d) distributed in 3 pens consuming exactly the same TMR (15.1% CP, 31.4% NDF, 1.69 Mcal of NEI/kg on DM basis) participated in a truncated Latin square experiment with three 29-d periods and 2 treatments: unsupplemented (CTR) and supplemented with 300 Kilo Novo Units of Ronozyme RumiStar CT per kg of TMR dry matter (RS). Within each pen, there were 5 rumen-cannulated cows that were used to determine ruminal degradation kinetics of corn and corn silage. Feed consumption, BW, and milk yield were recorded daily. In addition, during the second period, 2 rumen-cannulated cows from each treatment were used to place in situ bags containing: corn or corn silage to determine DM, NDF, and starch rumen degradation kinetics. The experimental unit for intake and performance data was pen. Data were analyzed using a mixed effects model. Overall, milk production was not affected by treatment. However, there was a significant interaction ( $P < 0.001$ ) between treatment, parity, and stage of lactation. Cows on RS produced more milk ( $P < 0.05$ ) than CTR cows in early stages of lactation (DIM < 150 d), and this increase was more pronounced ( $P < 0.05$ ) in multiparous (42.5 vs. 41.0 ± 1.47 kg/d, respectively) than in primiparous cows (35.1 vs. 34.0 ± 1.52 kg/d, respectively). Primiparous cows on RS gained more BW (16 ± 2.1 kg per period) than CTR cows (12.1 ± 2.1 kg per period), and multiparous cows on RS also recovered more BW than CTR cows after 150 DIM (13.5 vs. 9 ± 1.9 kg per period after 150 DIM, respectively). There was a tendency ( $P = 0.07$ ) for the rate of DM and starch degradation for corn, and NDF for corn silage to increase with RS supplementation. These results suggest that RS supplementation may have increased nutrient availability to cows.

**Key Words:** digestibility, enzyme, yield

**T37 Apparent synthesis of riboflavin and niacin in rumen of lactating dairy cows fed alfalfa or orchardgrass silages.** D. S. Castagnino\*<sup>1,3</sup>, K. L. Kammes<sup>2</sup>, M. S. Allen<sup>2</sup>, R. Gervais<sup>3</sup>, P. Y. Chouinard<sup>3</sup>, D. E. Santschi<sup>4</sup>, and C. L. Girard<sup>1</sup>, <sup>1</sup>Agriculture and Agri-Food

Canada, Sherbrooke, Quebec, Canada, <sup>2</sup>Department of Animal Science, Michigan State University, East Lansing, <sup>3</sup>Departement de Sciences Animales, Université Laval, Quebec, Quebec, Canada, <sup>4</sup>Valacta, Dairy Production Centre of Expertise in Quebec and the Atlantic regions, Ste-Anne-de-Bellevue, Quebec, Canada.

Effects of forage family (legume vs. grass) on apparent ruminal synthesis and post-ruminal supply of riboflavin and niacin were evaluated using 13 ruminally and duodenally cannulated lactating Holstein cows. The experiment was a crossover design with two 18-d treatment periods following a preliminary period during which all cows were fed a diet intermediate in composition between the treatment diets. Treatment diets were formulated to contain 25% forage NDF, 30% total NDF and contained as sole forage, alfalfa (AL, 42.3% NDF) or orchardgrass (OG, 58.2% NDF) silages. Intakes of riboflavin and niacin were greater ( $P < 0.05$ ) for AL than OG (riboflavin: 1179 vs. 372 ± 32 mg/d; niacin: 1253 vs. 1106 ± 61 mg/d). Alfalfa tended to increase the duodenal flow of riboflavin compared with OG ( $P = 0.07$ ; 1131 vs. 902 ± 85 mg/d) but the duodenal flow of niacin was not affected by treatment ( $P > 0.61$ ; 1993 vs. 1879 ± 154 mg/d for AL and OG respectively). Alfalfa decreased apparent ruminal synthesis of riboflavin compared with OG ( $P < 0.01$ ; -47 vs. 530 ± 79 mg/d) but the apparent ruminal synthesis of niacin was not affected by treatment ( $P = 0.87$ ; 739 vs. 773 ± 144 mg/d for AL and OG respectively). Riboflavin intake was correlated positively with its duodenal flow ( $r = 0.44$ ,  $P = 0.02$ ) but negatively with apparent ruminal synthesis of the vitamin ( $r = -0.71$ ,  $P < 0.01$ ). On the other hand, apparent ruminal synthesis of niacin was correlated positively with its duodenal flow ( $r = 0.95$ ,  $P < 0.01$ ). Forage family affected the apparent ruminal synthesis of riboflavin but had limited effects on the amounts of riboflavin and niacin reaching the sites of absorption.

**Key Words:** dairy cow, riboflavin, niacin

**T38 The effect of a feed additive on the feeding value of a silage-based TMR exposed to air.** M. Windle\* and L. Kung Jr., *University of Delaware, Newark.*

The objective of this study was to evaluate the effect of feeding a fresh or aerobically spoiling silage-based TMR with or without Omnigen WYC (OWYC, Prince Agri Products Inc., Quincy, IL) on intake and rumen fermentation parameters in heifers. Four Holstein heifers with ruminal cannula were fed 1 of 4 treatments, in a 4 × 4 Latin square design utilizing 14-d periods. The four specific treatments were (A) fresh TMR fed for d 1 to 14, (B) fresh TMR fed for d 1 to 7, spoiled TMR for d 8 to 14, (C) fresh TMR for d 1 to 7, spoiled TMR plus OWYC for d 8 to 14, or (D) fresh TMR plus OWYC for d 1 to 7, spoiled TMR plus OWYC for d 8 to 14. Freshly mixed TMR was prepared daily and fed immediately for all treatments during the first 7 d of each period. To prepare aerobically spoiled feed for the second 7 d of each period, fresh TMR was allowed to spoil for several (2 to 5) d prior to feeding. The TMR exposed to air had a greater pH ( $P < 0.01$ ), more yeasts ( $P < 0.01$ ), and lower concentrations of lactic acid ( $P < 0.01$ ), acetic acid ( $P < 0.01$ ), and ethanol ( $P < 0.01$ ) than fresh TMR, and had temperatures 5 to 30°C above ambient (20-22°C) temperatures, indicating that it was spoiling. Feeding spoiled TMR alone during d 8 to 14 resulted in a lower DM intake (treatment B) when compared to feeding fresh TMR

alone (treatment A) ( $P < 0.05$ ). Heifers fed OWYC (treatments C and D) had DM intakes that were numerically but not statistically greater than heifers fed treatment B. Heifers consuming spoiled TMR (treatments B, C, D on d 8 to 14 of each period) had more yeasts in their rumen fluid than heifers fed fresh TMR (treatment A) ( $P < 0.05$ ). There was a trend ( $P = 0.14$ ) for heifers that were fed spoiled TMR and who received OWYC for the entire 14 d of each period (treatment D) to have a greater average rumen pH and maximum rumen pH than cows fed fresh TMR (treatment A). There were no differences among treatments in ruminal VFA. Relative to cows fed the fresh TMR, digestion of DM was not affected by feeding spoiled TMR. Feeding a spoiled TMR to heifers reduced intake and supplementing spoiled TMR with OWYC tended to moderate this effect.

**Key Words:** aerobic stability, spoilage, yeast

**T39 Effects of treatment with propylene glycol in fat transition cows.** V. Bjerre-Harpoth\*, A. C. Storm, T. Larsen, and M. Larsen, *Department of Animal Science, Aarhus University, Foulum, Tjele, Denmark.*

The aim was to investigate the capability of propylene glycol supplementation to impact on the metabolic adaptation to lactation in fat transition cows with the object to reduce the risk of fatty liver and ketosis. The experiment was a completely randomized design. Ten ruminal cannulated and intercostal artery catheterized fat Holstein cows (body condition score 2 wk prepartum: mean ± SD = 3.8 ± 0.3) were at parturition randomly assigned to a ruminal pulse dose of 500 g propylene glycol (PGG) or of 500 g water (CON) once a day (at morning feeding) for 4 wk postpartum (pp). All cows were fed the same diet. Milk samples were taken at every milking, 3/d. Two sets of blood samples were collected; weekly blood samples were taken from the tail vein, whereas daily blood sample was collected from the artery ±7 days from parturition. Data were analyzed using PROC MIXED in SAS with treatment (trt), day/week, and the interaction as fixed effects. Cow was considered as random effect, and day/week within cow as repeated measurement. Dry matter intake, body condition score and milk yield were not affected by propylene glycol ( $P > 0.38$ ). The PGG resulted in decreased milk fat concentration ( $P = 0.04$ ). The trt × day interaction revealed higher concentration of milk lactose ( $P < 0.01$ ) and lower concentration of milk protein ( $P < 0.01$ ) with PGG. In d 13-28 pp, the concentration of milk BHBA with PGG was below the concentration with CON (interaction:  $P = 0.05$ ). In the first 4 wk pp, there was a smaller decline in body weights with PGG (interaction:  $P = 0.02$ ). The PGG displayed highest plasma concentration of glucose during 1 to 7 d pp ( $P = 0.05$ ) and in the entire 4 wk of allocation ( $P < 0.01$ ). In d 1 to 7 pp, the plasma concentration of non-esterified fatty acids was decreased with PGG compared to CON ( $P = 0.03$ ). The trt × week/day interactions revealed lower concentration of BHBA in plasma with PGG in d 1 to 7 pp ( $P = 0.05$ ) and in the entire allocation period ( $P = 0.01$ ). In conclusion, allocation of propylene glycol to fat transition cows depicted amendments in body weights, metabolism and milk composition suggesting decreased fat mobilization in the fatty cows pp, and thereby implying a reduced risk of fatty liver and ketosis.

**Key Words:** propylene glycol, transition cow