

## Ruminant Nutrition: Beef II

**T351 Effect of monensin inclusion on intake and digestion in *Bos indicus* and *Bos taurus* steers consuming bermudagrass hay.** Natasha L. Bell\*<sup>1,2</sup>, Todd R. Callaway<sup>3</sup>, Robin C. Anderson<sup>3</sup>, Marcia O. Franco<sup>4</sup>, and Tryon A. Wickersham<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, TX, <sup>2</sup>Texas A&M University-Kingsville, Kingsville, TX, <sup>3</sup>Southern Plains Agricultural Research Center, Agricultural Research Service, USDA, College Station, TX, <sup>4</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.

Effects of monensin inclusion and the subspecies of cattle on utilization of bermudagrass hay (13.7% CP) were evaluated using ruminally cannulated steers (5 *Bos indicus*, BI and 5 *Bos taurus*, BT; 398 kg BW). Subspecies were concurrently subjected to a 2 period, 2 treatment cross-over design. Treatments consisted of 0 (CON) or 200 (MON) mg·hd<sup>-1</sup> monensin (Rumensin 90; Elanco Animal Health, Greenfield, IN) fed daily in 0.91 kg DDGS. Steers were group housed during adaptation periods and moved to individual covered pens to facilitate sampling. Periods were 70 d in length: 20 d adaptation, 5 d sample collection, 17 d continuation of treatment application (for ruminal sampling), and 28 d withdrawal between periods. Hay, ort, and fecal grab samples were collected d 21–25 for determination of intake and digestion. Data were analyzed using the MIXED procedure of SAS 9.3 (SAS Inst. Inc., Cary, NC) with terms in the model including treatment, subspecies, subspecies × treatment and period, with animal as a random effect. No subspecies × treatment interactions were observed ( $P \geq 0.21$ ). Monensin tended to increase forage OM intake (FOMI;  $P = 0.08$ ) from 19.5 to 20.3 g/kg BW and total OM intake (TOMI;  $P = 0.07$ ) from 21.3 to 22.2 g/kg BW. No effect of subspecies ( $P \geq 0.16$ ) was observed for FOMI or TOMI. Organic matter digestibility was not affected by monensin ( $P = 0.97$ ; 60.6 and 60.7 for CON and MON, respectively) and was not different ( $P = 0.28$ ) between subspecies (58.0 and 63.3% for BI and BT, respectively). When the combined effects of TOMI and OMD were evaluated as total digestible OM intake (TDOMI), no response ( $P = 0.71$ ) was observed from monensin supplementation. *Bos taurus* steers had greater ( $P = 0.04$ ) TDOMI than BI steers (14.3 vs 12.2 g/kg BW). Monensin tended to increase forage NDF intake (FNDFI;  $P = 0.07$ ) from 16.5 to 17.2 g/kg BW and total NDF intake (TNDFI;  $P = 0.08$ ) from 17.4 to 18.1 g/kg BW, but had no effect ( $P \geq 0.73$ ) on NDF digestibility (NDFD; 66.4 and 66.0% for CON and MON, respectively) or total digestible NDF intake (TDNDFI; 11.7 and 11.9 g/kg BW for CON and MON, respectively). Although FNDFI, TNDFI, and NDFD were not different ( $P \geq 0.16$ ) between subspecies, total digestible NDF intake was greater ( $P = 0.02$ ) for BT than BI steers (12.7 vs 10.9 g/kg BW). Overall, monensin increased FOMI and FNDFI and had no effect on OMD or NDFD. *Bos taurus* had greater TDOMI and TDNDFI compared with BI steers.

**Key Words:** cattle subspecies, ionophore, digestibility

**T352 Effect of rumen protected B vitamins supplementation during the receiving period on the productive performance of beef cattle.** Helene Leclerc\*<sup>1</sup>, Diana A. Espinosa<sup>2</sup>, Essi Evans<sup>3</sup>, Roberto Zambrano Gaytan<sup>2</sup>, and Juan de Dios Garza Flores<sup>2</sup>, <sup>1</sup>Jefo Nutrition, St-Hyacinthe, QC, Canada, <sup>2</sup>Rancho El 17, Hermosillo, Sonora, Mexico, <sup>3</sup>Technical Advisory Services, Bowmanville, ON, Canada.

A study was conducted to evaluate the performance of beef cattle given a rumen protected B vitamins blend during a 21-d receiving period.

Twelve loads of cattle (899 head) were equally split based on weight and shrink and were assigned to 15 pens/treatment. The test treatment consisted of 2g/head/day of rumen protected B vitamins (folic acid, pyridoxine, pantothenic acid and biotin; Jefo Nutrition, St-Hyacinthe, Quebec, Canada). No added B vitamins were given to control cattle, and a common diet was provided to both groups. Receiving ration consisted of 38% alfalfa hay, 30% steam flaked corn, 10% corn distillers grain, 2% soybean meal, 11% sugar cane molasses, 3% wheat straw and 6% minerals and vitamins. Animals were weighted individually on d 1 and d 21 of the trial to calculate total and daily gain weights. Animals were fed twice daily. Daily pen feed intakes were measured. All data were analyzed as a randomized complete block, using pens as experimental units. The general linear model included treatment as fixed and block as random effects. Days to recover shrink were reduced (15.36 vs. 16.63 d;  $P < 0.05$ ), for the group of cattle fed the protected B vitamins blend. No significant difference was observed between the control and treatment group, for morbidity status (2.16 vs. 1.52%) and mortality rate (0.43 vs. 0.87%). The inclusion of the protected B vitamins blend in the diet significantly improved total gain weight (46.26 vs. 42.40 kg;  $P < 0.05$ ), average daily gain (2.20 vs. 2.01 kg;  $P < 0.05$ ), and feed/gain (3.90 vs. 4.33;  $P < 0.05$ ); without affecting average daily feed intake. It is concluded that addition of the protected B vitamins blend in the diet improves the productivity of beef cattle during the receiving period, without affecting feed intake and the morbidity rate.

**Key Words:** protected B vitamins, beef cattle, receiving

**T353 Effects of including virginiamycin in feedlot diets containing monensin under commercial conditions in Mexico.** Jorge R. Kawas<sup>2</sup>, Rene Alvarado<sup>2</sup>, Milton A. Gorocica-Buenfil\*<sup>1</sup>, and Francis L. Fluharty<sup>3</sup>, <sup>1</sup>Phibro Animal Health de Mexico, Queretaro, Qro. Mexico, <sup>2</sup>MNA de Mexico, San Nicolas de los Garza, NL, Mexico, <sup>3</sup>The Ohio State University, Wooster, OH.

A trial was conducted in a commercial feedlot in northeastern Mexico to determine the effects of supplemental virginiamycin (Vm) in combination with monensin (Mn) on finishing cattle performance. Upon arrival, 2,256 crossbred heifers (BW = 276.0 ± 3.33 kg) were dewormed, vaccinated against respiratory and clostridial pathogens and implanted with a trenbolone acetate (TBA) implant (200 mg TBA + 20 mg estradiol benzoate). At processing, animals were allotted to 22 pens (approx. 100/pen) using a randomized complete block design. Two treatment groups were evaluated, both receiving a high-concentrate (+90%) diet. One treatment group (MN) had the basal diet supplemented with 400 mg/hd/d of Mn; the other treatment group (VM) diet was supplemented with 250 mg/hd/d of Vm and 300 mg/hd/d of Mn. Cattle were gradually adapted to their final diet (15.5% protein, 1.51 Mcal NEg/kg) over a 21–28 d period. When cattle had 44 d on feed (DOF), they were reimplanted with the same TBA implant. Zilpaterol chlorhydrate was provided to all cattle at 0.15 mg/kg BW for 30 d and was withdrawn 4 d before harvest. Cattle were harvested after 100 DOF. At harvest, HCW was recorded. Data were analyzed using the PROC MIXED analysis of SAS for a randomized complete block design. Pen was used as the experimental unit and block was included in the model as a random factor. After 44 DOF when cattle were reimplanted, the VM group had greater ADG (1.51 vs. 1.38;  $P < 0.05$ ). At harvest, total ADG was 6% greater in the VM group (1.40 vs. 1.32;  $P < 0.05$ ), and G:F was improved 7% in the VM group (0.179 vs. 0.167;  $P < 0.05$ ). Hot carcass weight was 4.9 kg greater ( $P < 0.01$ ) in the VM group than in the MN group (251.7 kg vs.

246.8 kg). These results agree with previous research in commercial feedlots in Mexico and Brazil. Under the parameters of this study, virginiamycin inclusion in a feedlot diet containing monensin improved feedlot performance and carcass weight.

**Key Words:** feedlot, virginiamycin, performance

**T354 Growth performance of yellow cattle in southern China weaned at different ages.** C. Wang\*<sup>1</sup>, Y. F. Xia<sup>1</sup>, H. L. Mao<sup>1</sup>, Y. Tu<sup>2</sup>, C. G. Jiang<sup>2</sup>, H. F. Wang<sup>1</sup>, Q. Y. Diao<sup>2</sup>, and D. X. Ren<sup>3</sup>, <sup>1</sup>College of Animal Science and Technology, Zhejiang A & F University, Hangzhou-Lin'an, Zhejiang Province, China, <sup>2</sup>Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, China, <sup>3</sup>Institute of Dairy Science, Zhejiang University, Hangzhou, Zhejiang Province, China.

This study was conducted to examine the effects of weaning ages on performance of a small-type yellow cattle in southern China. Thirty female calves were selected according to birth weight, and stratified into 10 blocks of 3 and allocated within block to 3 treatments that the calf was considered weaned when it consumed 1000 (W1000), 750 (W750), or 500 (W500) g of starter for 2 consecutive days. All calves had colostrum within 4 h after born, and then were fed milk up to 3 L/d until d 7. Liquid feed composed of half whole milk and half milk replacer (MR, 93.2% DM, 23.9% CP, and 13.1% EE) were fed to calves at 3L/d until d 13 and 3 L/d MR for the remainder of the study. Starter (17.9% CP, 10.9 MJ/kg ME) was fed ad libitum from d 10, and grass hay and water were available ad libitum. Milk, MR, starter, and hay intakes were recorded daily. All Calves were weighted and body height, body length, circumference of cannon bone were measured after birth and every 30 d until d 150. Data except for weaning age and BW change were analyzed using the Proc MIXED of SAS while weaning age and BW change were analyzed using the Proc GLM of SAS. The results showed that average weaning age was  $49 \pm 4.8$ ,  $58 \pm 4.4$ , and  $63 \pm 4.6$  for W500, W750, and W1000, respectively. Calves in W500 and W750 had higher starter intake than that of W1000 ( $P < 0.05$ ). The body measurements were not significant different between groups ( $P > 0.05$ ), however, calves in W1000 tend to have a low body height and body length ( $0.05 < P < 0.15$ ). There was no significant difference in BW and ADG on d 30 when any of the calves was weaned ( $P > 0.05$ ). On d 60, BW of calves in W1000 was higher than that of W500 ( $P < 0.05$ ) and tend to be higher than that of W750 ( $P = 0.10$ ). However, calves in W1000 lost their BW advantage on d 90. Calves in W750 and W500 had higher ADG from 1 to 150 d compared with that of W1000. It is concluded that starter-dependent weaning can help to enhance the adaptation to the solid feed with advantages on weight gain and feed intake.

**Key Words:** weaning, yellow cattle, growth performance

**T355 Decreasing the frequency of energy supplementation to beef steers impairs growth and antibody production against bovine viral diarrhea virus 1b.** Luis F. Artioli\*<sup>1</sup>, Philippe Moriel<sup>1</sup>, Rodrigo S. Marques<sup>2</sup>, and Reinaldo Cooke<sup>2</sup>, <sup>1</sup>North Carolina State University, Waynesville, NC, <sup>2</sup>Oregon State University, Burns, OR.

We evaluated the effects of decreasing the frequency of energy supplementation on growth performance and measurements of innate and humoral immune response of preconditioning beef steers. At weaning (d -7), Angus steers (n = 24; BW =  $221 \pm 31$  kg; age =  $177 \pm 19$  d) were allocated to a single drylot pen with free-choice access to fescue hay. On d 0, steers were stratified by BW and age, and randomly assigned to 1 of 8 drylot pens (3 steers/pen). Steers were provided daily ad libitum access

to ground fescue hay (17% CP and 58% TDN; DM basis) and similar weekly concentrate offer (12 kg/steer) from d 0 to 42. Treatments were randomly assigned to pens (4 pens/treatment) and consisted of dividing and providing the weekly concentrate offer either 3 (S3; 3.8 kg on Mondays, Wednesdays and Fridays) or 7 times (S7; 1.7 kg daily) per week. Supplements included 50% soyhulls and 50% corn gluten feed (17% CP and 72% TDN; DM basis). Steers were vaccinated using the SelectVAC protocol (Zoetis) on d 7 and 21. Shrunken BW was obtained on d 0 and 42, and blood samples from jugular vein collected on d -7, 0, 7, 8, 9, 10, 14, 21, 22, 23, 24, 28, 35 and 42. Although BW did not differ from d 0 to 42 ( $P \geq 0.33$ ), S7 steers had greater mean ADG ( $1.3$  vs.  $1.0 \pm 0.07$  kg/d;  $P = 0.01$ ), mean hay DMI ( $2.8$  vs.  $2.2 \pm 0.08$  kg/d;  $P < 0.01$ ) and total DMI from d 0 to 42 ( $190$  vs.  $165 \pm 4$  kg;  $P = 0.02$ ), but similar G:F compared with S3 steers ( $P = 0.14$ ;  $0.29$  vs.  $0.26$ ). Plasma concentrations of glucose, insulin, cortisol and ceruloplasmin did not differ ( $P \geq 0.33$ ) between treatments. However, S3 steers had greater plasma haptoglobin concentrations on d 8 ( $1.95$  vs.  $1.20 \pm 0.13$  mg/mL;  $P < 0.01$ ) and 10 ( $1.39$  vs.  $0.84 \pm 0.13$  mg/mL;  $P < 0.01$ ), and less mean serum bovine viral diarrhea virus-1b (BVDV1b) titers than S7 steers ( $1.5$  vs.  $2.5 \pm 0.31$  log<sub>2</sub> base;  $P = 0.03$ ). Therefore, decreasing the frequency of energy supplementation from 7 to 3 times weekly during a 42-d preconditioning period decreased hay and total DMI, growth and antibody production against serum BVDV-1b, and increased plasma haptoglobin concentrations of beef steers.

**Key Words:** supplementation frequency, immune, steer

**T356 Pre- and postpartum herbage allowances of grasslands affected productive and reproductive performances of primiparous beef cows.** Mariana Carriquiry\*<sup>1</sup>, Martín Claramunt<sup>2</sup>, Ana L. Astessiano<sup>1</sup>, and Pablo M. Soca<sup>3</sup>, <sup>1</sup>Facultad de Agronomía, Montevideo, Uruguay, <sup>2</sup>Facultad de Veterinaria, Paysandú, Uruguay, <sup>3</sup>Facultad de Agronomía, Paysandú, Uruguay.

The aim of this work was to evaluate the effect of herbage allowance of grasslands (Campo biome) during the prepartum and postpartum on productive and reproductive responses of primiparous beef cows. Fifty-four Hereford cows ( $5.9 \pm 0.5$  BCS in a 1–8 scale and  $472 \pm 35$  kg BW) were used in a randomized block design with 2 spatial replications and a factorial arrangement of prepartum (fall; high vs. low, PREH vs. PREL) and postpartum (spring-summer; high vs. low, POSTH vs. POSTL) herbage allowance (4 vs. 2.5 kgDM/kgBW of annual mean for high vs. low). Cows were in a continuous grazing system. Cow BW, BCS, and calf BW were determined monthly and at calving and milk production and composition were determined using a milking machine at 130 d postpartum. Calving to conception interval (CCI) and early (during first month of mating period) and total pregnancy were registered using ultrasound. Means from a mixed model were considered to differ when  $P \leq 0.05$ . Cow BW and BCS were greater from mid-winter to the end of summer (last third of gestation to weaning) for PREH than PREL cows and during the postpartum for POSTH than POSTL cows. Milk energy output was between 1.2 and  $1.6 \pm 0.8$  Mcal NEL/d greater for PREH than PREL cows and for POSTH than POSTL cows. Calf BW did not differ at birth but at weaning was  $30 \pm 5$  kg greater for POSTH than POSTL cows. The CCI tended ( $P = 0.10$ ) to be shorter for PREH than PREL cows ( $129$  vs.  $139 \pm 6$  d) and was shorter for POSTH than POSTL cows ( $126$  vs.  $141 \pm 6$  d). Early pregnancy was greater for POSTH than POSTL cows ( $54$  vs.  $39\%$ ) while total pregnancy did not differ among treatments (averaged 77%). Cow BCS at calving affected CCI, early and total pregnancy (1 unit of BCS at calving decreased CCI by 21 d and increased early and total pregnancy by 50%). Effects of PRE and

POST herbage allowances had an additive effect on productive and/or reproductive responses of primiparous beef cows grazing native pastures.

**Key Words:** beef cattle, rangeland, forage allowance

**T357 The effects of adding 3-nitrooxypropanol and monensin to a finishing diet on methane production using the rumen simulation technique (Rusitec).** A. Romero-Perez<sup>1,2</sup>, E. K. Okine<sup>2</sup>, L. L. Guan<sup>2</sup>, S. M. Duval<sup>3</sup>, M. Kindermann<sup>4</sup>, and K. A. Beauchemin<sup>1</sup>, <sup>1</sup>Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB, Canada, <sup>2</sup>Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada, <sup>3</sup>DSM Nutritional Products France, Research Centre for Animal Nutrition and Health, Saint Louis Cedex, France, <sup>4</sup>DSM Nutritional Products, Basel, Switzerland.

3-Nitrooxypropanol (NOP), an enzymatic inhibitor that has consistently reduced methane (CH<sub>4</sub>) emissions in sheep, dairy and beef cattle (up to 59% reduction on a long-term basis), and monensin (MON), an ionophore that has a moderate, and sometimes transitory, effect on CH<sub>4</sub> reduction were used in this study. The objective was to evaluate the effect of NOP, MON and the combination of both on CH<sub>4</sub> production when added to a finishing diet (85% barley grain, 10% barley silage, and 5% vitamin-mineral supplement; DM basis) using Rusitec fermenters. Two Rusitec apparatuses each equipped with 8 fermenters were used in a completely randomized block design with 2 blocks (apparatus) and 4 treatments: Control, NOP (2 mg), MON (2 mg) and NOP+MON (2 mg+2 mg). Within each apparatus, 2 fermenters were randomly assigned to a treatment. Treatments were supplied daily with 10 g of diet. The experiment included an adaptation period without treatment supplementation (8 d), a treatment period (7 d), and a recovery period where treatments were discontinued (3 d). During the treatment period, DM digestibility was not affected. Total VFA and molar proportion of propionate and butyrate were not affected ( $P > 0.05$ ) but acetate was reduced ( $P < 0.01$ ) with addition of NOP (8.3%) and NOP+MON (14.9%). Methane production was reduced ( $P < 0.01$ ) by 69.4 and 68.2% with NOP and NOP+MON respectively, while H<sub>2</sub> production was increased ( $P < 0.01$ ) by 76.7 and 75.2% respectively for the same treatments compared with Control. Treatments had no effect on the copy number of the 16S rRNA gene for total bacteria ( $P > 0.21$ ); however, that for methanogens was reduced ( $P < 0.01$ ) with NOP and NOP+MON treatments. During the recovery period on d 18, no effect ( $P > 0.20$ ) was observed for CH<sub>4</sub> and H<sub>2</sub> production; however, a trend for lower acetate concentration with NOP and NOP+MON was still observed ( $P = 0.08$ ). Treatments including NOP were effective in reducing CH<sub>4</sub> production in vitro using a finishing diet with a concomitant increase in H<sub>2</sub> production; however, the combination of NOP and MON did not lead to greater CH<sub>4</sub> reduction than NOP alone.

**Key Words:** 3-nitrooxypropanol, monensin, methane

**T358 Nutritional performance and metabolic characteristics of cattle fed tropical forage with nitrogen and starch supplementation.** Marcia de Oliveira Franco\*, Edenio Detmann, Alexandre Ribeiro Lopes, Luana Marta de Almeida Rufino, and Erick Darlison Batista, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

Effects of nitrogen supplementation with and without starch supplementation on nutritional performance and metabolic characteristics of cattle fed low and medium-quality tropical forages were evaluated using ruminal and abomasal cannulated steers. Four European × Zebu

bulls (381 kg BW) were distributed according to a 4 × 4 Latin square. Each experimental period of 28 d was divided into 2 sub-periods: in the first sub-period 2 animals received low-quality hay and 2 animals received medium-quality hay (*Brachiaria decumbens*); the following supplementation schemes were evaluated in the second sub-period: low-quality hay with nitrogen supplementation (300 g CP/d); low-quality hay with nitrogen (300 g CP/d) and starch (225 g/d) supplementation; medium-quality hay with nitrogen supplementation (300 g CP/d); and medium-quality hay with nitrogen (300 g CP/d) and starch (225 g/d) supplementation. In the absence of supplementation, the medium-quality forage provided higher ( $P < 0.05$ ) intake, digestibility, nitrogen balance (NB), and efficiency of nitrogen utilization (EFNU). The greater performance of animals fed medium-quality forage was attributed to anabolic stimuli, supported by higher ( $P < 0.05$ ) serum concentration of IGF1. Comparing sub-periods, the supply of supplements depressed ( $P < 0.05$ ) medium-quality forage intake, but did not affect ( $P > 0.05$ ) low-quality forage intake. There was no effect ( $P > 0.05$ ) of supplementation on NDF digestibility as compared with the sub-period without supplementation. However, comparison between supplements indicated depression ( $P < 0.05$ ) in NDF digestibility when starch was included. Supplementation increased ( $P < 0.05$ ) NB, EFNU, and serum concentration of IGF1 in animals fed low-quality forage. Nitrogen supplementation increases nitrogen retention in animals, an effect attributed mainly to anabolic stimuli. However, this effect is more prominent when animals are fed low-quality forages. No positive impact on animal metabolism was obtained with the combination of supplemental nitrogen and starch.

**Key Words:** *Brachiaria decumbens*, digestibility, nitrogen balance

**T359 Nutritional performance and metabolic characteristics of cattle fed low-quality tropical forage and supplemented with nitrogen associated with different starch proportions.** Marcia de Oliveira Franco\*, Edenio Detmann, Marcilia Medrado Barbosa, Gabriel Cipriano Rocha, and Claudia Batista Sampaio, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.*

Effects of nitrogen supplementation associated with different starch proportions on nutritional performance and metabolic characteristics of cattle fed low-quality tropical forage (*Brachiaria decumbens* hay, 7.4% CP) were evaluated using ruminal and abomasal cannulated steers. Five European × Zebu young bulls (186 kg BW) were distributed according to a 5 × 5 Latin square. The following treatments were evaluated: control (only forage), supplementation with 300 g CP/d (0:1), supplementation with 300 g starch/d and 300 g CP/d (1:1), supplementation with 600 g starch/d and 300 g CP/d (2:1), and supplementation with 900 g starch/d and 300 g CP/d (3:1). Supplements increased ( $P < 0.05$ ) DM intake, but did not affect ( $P > 0.05$ ) forage intake. There was a cubic effect ( $P < 0.05$ ) of starch, which was attributed to the highest forage intake (g/kg BW) when using the 2:1 starch:CP ratio. Supplements increased ( $P < 0.05$ ) OM digestibility, but did not affect ( $P > 0.05$ ) NDF digestibility. There was a positive linear effect ( $P < 0.05$ ) of the amount of starch supplemented on OM digestibility. Total NDF digestibility was not affected ( $P > 0.05$ ) by the amount of starch supplemented. Ruminal ammonia nitrogen concentrations were higher ( $P < 0.05$ ) in supplemented animals, however, a negative linear effect ( $P < 0.05$ ) of amount of starch was observed. Supplements increased ( $P < 0.05$ ) the nitrogen balance (NB) and efficiency of nitrogen utilization. These effects were attributed to increased body anabolism, supported by higher ( $P < 0.05$ ) serum concentration of IGF1. Increasing the amount of starch tended to linearly increase the NB ( $P < 0.06$ ) and serum concentration of IGF1 ( $P < 0.05$ ). However, comparison of NB means between treatments with supplementation showed a higher value for the 2:1 starch:CP ratio.



Nitrogen supplementation in cattle fed low-quality tropical forage increases nitrogen retention in the animal body. Additional supply of starch increases nitrogen retention by increasing energy availability for both rumen and animal metabolism.

**Key Words:** fiber, nitrogen balance, Zebu

**T360 Effect of rumen protected carbohydrate supplementation on performance in feedlot finishing steers during heat stress.** Juan P. Russi<sup>1,3</sup>, Patricio Davies<sup>4</sup>, Nicolas DiLorenzo<sup>2</sup>, and Alejandro E. Relling<sup>1</sup>, <sup>1</sup>Facultad de Cs Veterinarias, UNLP, La Plata, Buenos Aires, Argentina, <sup>2</sup>University of Florida, Mariana, FL, <sup>3</sup>RUPCA LLC, Merced, CA, <sup>4</sup>INTA, Gral Villegas, Buenos Aires, Argentina.

Finishing steers during the summer can be challenging due to the effects of high temperatures and humidity on DMI. The objective of this study was to evaluate the inclusion of a rumen-protected carbohydrate (RUPCA; US Patent # 8,507,025) on performance of finishing steers during heat stress. Temperature-humidity index average measured every day during the experiment was  $72 \pm 4.9$ . Crossbred steers ( $n = 135$ ;  $355 \pm 20$ kg) were used in a 62-d experiment. Steers were blocked by initial BW and placed into 15 pens. Steers within blocks were randomly assigned to 3 treatments: T0 = fed 91.4% of a basal diet (% DM), 22.3% corn silage, 65.9% dry corn, 0.6% sunflower meal, 0.5% urea, 2% minerals and vitamins and 8.6% of a supplement containing (% DM) 58.1% soybean meal, 38.9% soluble carbohydrates, 2% urea and 1% minerals salts; T1 = fed the basal diet plus 4.3% supplement and 4.3% RUPCA; and T2 = fed basal diet plus 8.6% RUPCA. The supplement and RUPCA consisted of the same ingredients, differing on the processing of the carbohydrate (i.e., protected or not from ruminal degradation). Body weight was measured on d 0, 15, 39 and 62 relative to the beginning of treatments feeding (d 0). Pen DMI was measured on d 10, 18, 25, 31, 35, 46, 51, 56, 60 and 62. Back-fat on the 12th rib (BF) and LM area were measured on d 1 and 62. Data were analyzed as a randomized complete block design with repeated measures using a mixed model of SAS. Initial BW was used as a covariate. There were no differences between treatments on final BW, BF or LM area on d 62 ( $P > 0.10$ ). Treatment  $\times$  day interactions were observed for G:F, ADG and DMI ( $P < 0.05$ ) suggesting a different response to treatments during periods of heat stress (Table 1). Feeding RUPCA may be beneficial for finishing steers under heat stress.

**Table 1 (Abstr. T360).**

Item	Treatment			SEM	P-value		
	T0	T1	T2		Trt	Day	Trt $\times$ Day
DMI, kg/d	9.9 <sup>ab</sup>	9.8 <sup>a</sup>	10.0 <sup>b</sup>	0.07	0.04	<0.001	0.001
Initial BW, kg	287	285	285	0.6	0.23	—	—
Final BW, kg	352	357	353	3.1	0.51	—	—
ADG, kg	1.00	1.11	1.07	0.065	0.38	<0.001	0.039
G:F	0.105	0.116	0.109	0.0051	0.32	<0.001	0.004
Backfat 12th rib (62 d), mm	0.58	0.61	0.60	0.017	0.68	—	—
LM area (62 d), cm <sup>2</sup>	57.6	54.9	56.1	0.97	0.30	—	—

<sup>ab</sup>Means without common superscript differ ( $P < 0.05$ ).

**Key Words:** carbohydrate, rumen, bypass energy

**T361 Partially replacing corn with glycerin increases total VFA, propionate, and ruminal NH<sub>3</sub>-N concentrations in finish-ing beef diets evaluated in a dual-flow continuous culture system.** Pedro Del Bianco Benedeti<sup>1,2</sup>, Lorryny Galoro da Silva<sup>1</sup>, Eduardo Marostegan de Paula<sup>1</sup>, Teshome Shenkoru<sup>1</sup>, Hugo Monteiro<sup>1</sup>, Brad Amorati<sup>1</sup>, Yehling Yeah<sup>1</sup>, Marcos Marcondes<sup>2</sup>, and Antonio Faciola<sup>1</sup>, <sup>1</sup>University of Nevada, Reno, NV, <sup>2</sup>Federal University of Viçosa, Viçosa, MG, Brazil.

Glycerin, the main biodiesel production by-product, has the potential to partially replace corn as an energy source for cattle. The objective of this study was to evaluate the effects of partially replacing dry ground corn (DGC) with glycerin on ruminal fermentation using a dual-flow continuous culture system. Six fermenters were used in a replicated 3x3 latin square arrangement with 3 periods of 10 d each, with 7 d for diet adaptation and 3-d for sample collections. Three dietary inclusion levels of glycerin were tested (0, 15, and 30% on DM basis). All diets contained 75% concentrate and were formulated to meet NRC (2000) recommendations. Fermenters were fed 72 g of DM/d equally divided in 2 meals per day. Liquid and solid dilution rates were adjusted to 11 and 5.5%/h, respectively. On d 8, 9, and 10, samples of digesta effluent were collected for ruminal NH<sub>3</sub>-N and VFA analyses. Nutrient flow and digestibility, N balance, and microbial growth were also measured. Data were analyzed using the MIXED procedure in SAS. Ruminal traits are presented in Table 1. Concentrations of total VFA, propionate, and NH<sub>3</sub>-N increased linearly ( $P < 0.05$ ) and concentrations of acetate, butyrate, *iso*-valerate, and BCVFA, as well as the acetate: propionate ratio decreased linearly ( $P < 0.05$ ) as glycerin replaced DGC. These results suggest that partially replacing DGC with glycerin may change ruminal fermentation, increasing total VFA, propionate, and NH<sub>3</sub>-N concentrations, which may increase energy status and microbial yield in beef cattle.

**Table 1 (Abstr. T361).** Ruminal traits

Item	Glycerin (%)			SEM	P-value	
	0	15	30		L	Q
NH <sub>3</sub> -N, mg/100 mL	8.7	10.6	17.6	1.22	<0.01	NS
Total VFA, mM	113.0	122.9	124.8	1.76	<0.01	NS
Acetate, % of total VFA	59.0	49.0	40.1	2.13	<0.01	NS
Propionate, % of total VFA	22.3	35.4	47.8	2.54	<0.01	NS
Butyrate, % of total VFA	15.7	13.4	10.1	0.68	<0.01	NS
Valerate, % of total VFA	1.18	0.96	1.02	0.05	NS	NS
Isovalerate, % of total VFA	1.43	0.97	0.58	0.10	<0.01	NS
Acetate:propionate	2.65	1.41	0.84	0.19	<0.01	NS
BCVFA, % of total VFA	2.98	2.62	2.03	0.31	<0.01	NS

**Key Words:** ammonia, glycerin, volatile fatty acids

**T362 Herbage allowance of grasslands during calf fetal and early life: Effects on body weight and composition.** Mariana Carriquiry<sup>1</sup>, Martín Claramunt<sup>2</sup>, Alberto Casal<sup>1</sup>, Ana L. Astessiano<sup>1</sup>, and Pablo M. Soca<sup>3</sup>, <sup>1</sup>Facultad de Agronomía, UdelaR, Montevideo, Uruguay, <sup>2</sup>Facultad de Veterinaria, UdelaR, Paysandú, Uruguay, <sup>3</sup>Facultad de Agronomía, Paysandú, Uruguay.

Fifty-four Hereford calves (31 males, 23 females) were used in a randomized block design (2 spatial replications) to evaluate the effect of herbage allowance of grasslands during their fetal and early life (130 d of gestation to weaning) on calf BW and body composition during the first year of age. Their dams (primiparous,  $5.9 \pm 0.5$  BCS 1–8 scale,  $472 \pm 35$  kg BW) were allocated in a factorial arrangement of parturum

(fall,  $130 \pm 12$  d of gestation to calving; high vs. low, PREH vs. PREL) and postpartum (spring-summer, birth to weaning; high vs. low, POSTH vs. POSTL) herbage allowance (4 vs. 2.5 kgDM/kgBW of annual mean). Males were castrated at birth. Calf BW was determined at birth and monthly thereafter until the first year of age ( $390 \pm 12$  d). Body composition was determined at 200 (weaning) and 390 d using the urea dilution technique. Means from a mixed model repeated analysis were considered to differ when  $P \leq 0.05$ . Calf birth weight was not affected by PRE and was greater in male than female calves ( $33.7$  vs.  $32.5 \pm 0.2$  kg). Calf BW at 200 and 390 d or pre and postweaning average daily gains (ADG) were not affected by PRE but calf BW at 200 and 390 d was  $30 \pm 3$  kg greater in POSTH than POSTL calves due to a greater preweaning ADG ( $+152 \pm 0.02$  g/d). Carcass fat increased ( $10.7$  vs.  $14.2 \pm 1.2\%$ ) while water ( $62.4$  vs.  $60.1 \pm 0.7\%$ ) and protein ( $19.1$  vs.  $18.3 \pm 0.3\%$ ) decreased from 200 to 390 d. Body composition was affected by the interaction between PRE and POST as carcass fat was greater while water and protein percentages were less in PREL-POSTH than PREL-POSTL calves, being intermediate in PREH-POSTL and PREH-POSTH calves ( $10.3, 15.2, 12.2$  and  $12.6 \pm 1.2\%$  for fat,  $62.7, 59.6, 61.6$  and  $61.0 \pm 0.7\%$  for water and  $19.2, 18.2, 18.8$  and  $18.8 \pm 0.3\%$  for protein for PREL-POSTL, PREL-POSTH, POSTH-PREL, and POSTH-POSTH, respectively). Improve forage allowance during calf lactation period modified body composition of calves born from cows grazing low herbage allowance during gestation, as the increase in calf BW was associated with increased fat in detriment of protein deposition.

**Key Words:** beef cattle, rangeland, developmental programming

**T363 Effects of a standardized blend of phytochemicals on performance of beef cattle in two distinct dietary contexts using multiple trial analysis method.** Clementine Oguey<sup>1</sup> and Christian Bruneau<sup>\*2</sup>, <sup>1</sup>Pancosma SA, Le Grand Saconnex, GE, Switzerland, <sup>2</sup>Pancosma, St Hyacinthe, QC, Canada.

The optimization of performance of naturally fed beef cattle and the replacement of monensin (MON) are concerns constantly looked after by producers. Many phytochemicals have been reported to influence production efficiency of dairy and beef animals. Objective was to assess the effect of a standardized protected blend of cinnamaldehyde, eugenol and capsaicin oleoresin (XT, XTRACT Ruminant, code X60-7065, Pancosma) on performance of beef cattle in 2 distinct commercial contexts: on top of a blank diet or as a substitute to MON, by 2 multiple trial analyses. A first set of data regrouped 10 trials organized in 7 studies (1290 growing cattle; mean initial BW of 276 kg; mean duration of 88 d, mean XT dose of 1.1 g/hd/d). All trials reported side by side comparisons of an unsupplemented control void of ionophore to the inclusion of XT in beef cattle. A second set of data regrouped 4 trials organized in 4 studies, all reporting side-by-side comparisons of the use of MON vs. XT (1004 growing cattle; mean initial BW of 215 kg; mean duration of 85 d, mean XT dose of 950 mg/hd/d; mean MON dose of 265 mg/hd/d). Outcomes selected were DMI, ADG and feed to gain ration (F:G). For each set of data, data were analyzed using a mixed model with the TRIAL variable as a random effect and the TRT variable as a fixed effect. Mean values were calculated using the LSMEANS procedure of XLstat, weighting the data for the variance among trials. Results showed that when added on top to a blank diet, XT did not affect DMI of beef cattle (mean: 7.18 kg/hd/d,  $P = 1.0$ ), but increased ADG by 108 g/hd/d ( $P < 0.05$ ) and reduced F:G by 7.5% ( $P < 0.05$ ). The second analysis showed that XT numerically increased ADG and DMI compared with MON by respectively 2.4 and 4.7% ( $P = 0.2$ ) without altering F:G (mean 4.82 g/g,  $P = 0.7$ ). These findings are in line with available data on MON, and suggest that the addition

of XT on top of a basal diet improves performance of beef cattle and can be safely used to replace MON.

**Key Words:** phytochemical, beef cattle performance, multiple analysis

**T364 Nutrient intake and productive performance of beef cattle fed diets containing soybean, corn, or sorghum silages.**

Lilian Oliveira Rosa<sup>\*1</sup>, Odilon Gomes Pereira<sup>1</sup>, Karina Guimarães Ribeiro<sup>1</sup>, Sebastião de Campos Valadares Filho<sup>1</sup>, Stefanie Alvarenga Santos<sup>2</sup>, Rilene Ferreira Diniz Valadares<sup>2</sup>, and Andressa Fernanda Campos<sup>3</sup>, <sup>1</sup>Viçosa Federal University, Viçosa, Minas Gerais, Brazil, <sup>2</sup>Bahia Federal University, Salvador, Bahia, Brazil, <sup>3</sup>Sao Paulo State University, Jaboticabal, Sao Paulo, Brazil.

The aim of this work was to evaluate the nutrient intake and productive performance of Nelore cattle fed with diets containing soybean, corn, or sorghum silages as forage sources. The experimental diets was composed for: 1 - soybean silage (SS); 2 - corn silage (CS); 3 - sorghum silage (SOS); 4 - 50% SS:50% CS; and 5 - 50% SS:50% SOS, on dry matter basis. Diets consisted of 60% silage and 40% concentrate (corn, soybean meal, urea, and mineral mixture), formulated to be isonitrogenous (12% CP, DM basis). Forty-five crossbred Holstein-Zebu bulls none castrated, with initial live weight of 360 kg were allotted in a randomized blocks design with 5 treatments and 9 replicates. The animals were kept in individual pens of approximately 10 m<sup>2</sup>, with protected feeders and waterier. The experiment lasted 99 d, divided in 15 d of initial adaptation plus 3 periods of 28 d each. All data were analyzed using MIXED procedure of SAS and differences between means were determined using the DIFF, which differentiates means based on Tukey's test. Significance was declared at  $P < 0.05$ . The dry matter (DM) intake was affected by the silages ( $P < 0.01$ ), being SS silage that got lowest value among silages. The soybean silage (SS silage) provided lowest values of organic matter (OM), crude protein (CP), neutral detergent fiber (NDF) and non-fibrous carbohydrate (NFC) intakes, kg/d. The ether extract (EE) intake was highest in soybean silage, as only forage source or associated with CS or SOS. The maximum NDF intake, in % BW, was found to animals fed diets with sorghum silage as only forage source (0.88% BW) or associated with soybean silage (0.74% BW). The average daily gain (ADG) was lower in animals fed diets with soybean silage (0.433 kg/d) compared the others diets, that were not different statistically, with average to 1.163 kg/d. However, no effect of different silages ( $P > 0.05$ ) was observed on dressing percentage, on average 54.5%. Our results suggest that soybean silage, as only forage source, results in lower animal performance. However, when this silage was associated with corn and sorghum silages, it has similar animal performance that of animals fed corn and sorghum silages as only forage sources.

**Key Words:** average daily gain, carcass dressing, forage source

**T365 Nutrient intake, total digestibility, ruminal pH, and ammonia concentration of beef cattle fed diets containing soybean, corn, or sorghum silages.**

Lilian Oliveira Rosa<sup>\*1</sup>, Odilon Gomes Pereira<sup>1</sup>, Karina Guimarães Ribeiro<sup>1</sup>, Sebastião de Campos Valadares Filho<sup>1</sup>, Stefanie Alvarenga Santos<sup>2</sup>, Rilene Ferreira Diniz Valadares<sup>2</sup>, and Andressa Fernanda Campos<sup>3</sup>, <sup>1</sup>Viçosa Federal University, Viçosa, Minas Gerais, Brazil, <sup>2</sup>Bahia Federal University, Salvador, Bahia, Brazil, <sup>3</sup>Sao Paulo State University, Jaboticabal, Sao Paulo, Brazil.

The aim of this work was to evaluate the nutrient intake, total digestibility and ruminal pH and ammonia concentration of beef cattle fed

diets containing soybean, corn, or sorghum silages as forage sources. The experimental diets was composed for: 1 - soybean silage (SS); 2 - corn silage (CS); 3 - sorghum silage (SOS); 4 - 50% SS:50% CS; and 5 - 50% SS:50% SOS, on dry matter basis. Diets consisted of 60% silage and 40% concentrate (corn, soybean meal, urea, and mineral mixture), formulated to be isonitrogenous (12% CP, DM basis). Five adult crossbred Holstein-Zebu bulls, male no castrated, rumen-cannulated with an initial weight of 442 kg were distributed in a 5 × 5 Latin square design. The animals were kept in individual pens of approximately 10 m<sup>2</sup>, with protected feeders and waterier. Effects of diets ( $P < 0.01$ ) were observed on the intakes of all nutrients, with the lowest intakes ( $P < 0.05$ ) of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF) and neutral detergent fiber corrected to ash and protein (NDFap) being observed in the animals fed with soybean silage as only forage source. For TDN intake, the highest values were found for diets containing corn silage and it associated with soybean silage. For most nutrients, the highest digestibilities values were found with the diets containing corn silage as only forage source or when it was associated with soybean silage. There was effect to collection time ( $P < 0.05$ ) for ruminal pH (T, hours), adjusting quadratic model ( $Y = 6.0452 + 0.2648 \times T - 0.09955 \times T^2$ ,  $r^2 = 83.4\%$ ), but no effects were observed to diets (D) and collection times and diets interaction ( $T \times D$ ) for the same parameter. However, no effects were detected to diets (D), collection time (T) and collection time and diets interaction ( $T \times D$ ) for ruminal ammonia concentration, with average of 6.25 mg/dL. Our results suggest that soybean silage, as only forage source, results in lower nutrients intake. However, animals fed with this silage had similar ruminal parameters compared the others diets.

**Key Words:** dry matter intake, forage source, ruminal parameter

**T366 Enteric methane emissions in cattle fed diets containing sugar cane or corn silage.** Lays Mariz<sup>1,4</sup>, Stefanie Alvarenga Santos<sup>2</sup>, Laura Franco Prados<sup>1</sup>, Paloma de Melo Amaral<sup>\*1,4</sup>, Diego Zanetti<sup>1</sup>, Gustavo Chamon de Castro Menezes<sup>1</sup>, Sebastiao Valadares Filho<sup>1</sup>, Antonio Faciola<sup>4</sup>, and Luiz Gustavo Pereira<sup>3</sup>, <sup>1</sup>Federal University of Vicosa, Vicosa, MG, Brazil, <sup>2</sup>School of Veterinary Medicine and Animal Science of the Federal University of Bahia (UFBA), Salvador, BA, Brazil, <sup>3</sup>Embrapa Dairy Cattle, Juiz de Fora, MG, Brazil, <sup>4</sup>University of Nevada, Reno, NV.

The objective of this study was to evaluate enteric methane emissions in cattle fed diets containing sugar cane or corn silage. Five rumen-cannulated steers ( $336 \pm 16.6$  kg of initial BW) were used in a 5 × 5 Latin square arrangement. The study lasted 105 d and consisted of 5 periods of 21-d each. Animals were housed and fed individually. The 5 experimental diets contained 60% forage and 40% concentrate. Treatments consisted of 5 different forage sources: corn silage (CS), fresh sugar cane (FSC), regular sugar cane silage (SCS0%), sugar cane silage treated with 0.4% calcium oxide (SCS0.4%), and sugar cane silage treated with 0.8% calcium oxide (SCS0.8%). Forage CP levels were adjusted to 11% using a mixture of urea/ammonium sulfate (9:1). Sulfur hexafluoride tracer gas technique was used to measure methane emissions. Feed intake and refusals were measured daily and methane emissions were measured for 5 consecutive days. Data were analyzed using the MIXED procedure in SAS. Data is presented in Table 1. Animals fed CS had higher DMI ( $P < 0.01$ ) than animals fed sugar cane. Methane emissions when expressed in g/d or in g/kg of DMI did not change among treatments. However, when expressed in g/kg of digestible NDF (DNDF) was lower for CS diet ( $P = 0.05$ ). Methane energy loss did not change among diets; however, it was numerically lower for the CS diet. Treated SCS did not improve intake and did not reduce

methane emissions. The results from this study suggest that compared with sugar cane diets, corn silage diets may reduce methane emissions per unit of DNDF, which may lead to higher energy efficiency.

**Table 1 (Abstr. T366).** Mean values for intake and enteric methane emissions in steers

Item	Treatment					SEM	P-value
	CS	FSC	SCS 0%	SCS 0.4%	SCS 0.8%		
DMI (kg/d)	7.11 <sup>a</sup>	5.23 <sup>b</sup>	3.87 <sup>b</sup>	4.29 <sup>b</sup>	4.08 <sup>b</sup>	0.26	0.01
Methane emissions							
g/d	204.01	138.27	147.9	141.21	139.57	16.13	0.47
g/kg DMI	23.77	26.73	37.33	30.01	30.23	432.58	0.19
g/kg DNDF	164.37	298.47	201.43	169.17	220.82	14.69	0.05
Methane energy loss							
Gross energy intake (%)	7.08	7.78	10.93	8.79	9.12	0.67	0.22

**Key Words:** corn silage, sugar cane, methane emissions

**T367 Effects of oscillating dietary crude protein on nutrient intake, digestibility, performance, and carcass traits of finishing crossbred bulls in feedlot.** Paloma de Melo Amaral<sup>\*1,3</sup>, Stefanie Alvarenga Santos<sup>2</sup>, Laura Franco Prados<sup>1</sup>, Lays Mariz<sup>1,3</sup>, Lyvian Cardoso Alves<sup>1</sup>, Ana Clara Baiao Menezes<sup>1</sup>, Faider Alberto Castano Villadiego<sup>1</sup>, Flavia Adriane de Sales Silva<sup>1</sup>, Sebastiao Valadares Filho<sup>1</sup>, and Antonio Faciola<sup>3</sup>, <sup>1</sup>Federal University of Vicosa, Vicosa, MG, Brazil, <sup>2</sup>School of Veterinary Medicine and Animal Science of the Federal University of Bahia (UFBA), Salvador, BA, Brazil, <sup>3</sup>University of Nevada, Reno, NV.

Protein is a costly nutrient and excessive dietary N is an important environmental concern. The finishing period may offer the possibility of reducing dietary CP without negatively affecting beef-cattle production. This reduction may be achieved by oscillating dietary CP during the finishing period. Therefore, the goal of this study was to evaluate the effects of fixed or oscillating dietary CP on nutrient intake, digestibility, performance, and carcass traits of crossbred bulls in the finishing period. Twenty-four bulls ( $417 \pm 54$  kg of initial BW) were used in a complete randomized block design in a 2 × 2 factorial arrangement with 6 replications per treatment. The treatments were: Constant 11% CP (11–11), constant 13% CP (13–13), oscillating 11–13% CP (11–13), and oscillating 13–11% CP (13–11). The experiment lasted 72 d and oscillating treatments switched diets at d 37. Animals were housed and fed individually. Data were analyzed using the MIXED procedure in SAS and significance was declared at  $\alpha = 0.05$ . Partial data are presented in Table 1. There were no interactions ( $P > 0.05$ ) between fixed and oscillating CP level. There were no effects ( $P > 0.05$ ) of CP levels on intakes of DM, OM, NFC, and TDN. There were no effects ( $P > 0.05$ ) of CP levels on ADG or in carcass traits. We concluded that there were no benefits of oscillating dietary CP levels for crossbred bulls with ADG of approximately 2 kg/d in feedlots. There were no performance or carcass traits benefits of feeding more than 11% CP in the diets of crossbred bulls in feedlots.



**Table 1 (Abstr. T367).** Effects of constant or oscillating CP levels on intake, performance, and carcass traits

Item	Dietary CP				SEM	P-value		
	11-11%	11-13%	13-11%	13-13%		Pi	Pf	Pi × Pf
Intake, kg/d								
DM	12.1	11.8	10.6	11.3	1.5	0.14	0.80	0.46
OM	11.5	11.2	10.1	10.8	1.4	0.14	0.80	0.46
NFC	6.0	5.9	5.4	5.7	0.8	0.16	0.81	0.46
TDN	8.6	8.3	7.7	8.4	1.0	0.36	0.63	0.52
Performance, kg/d								
ADG	2.1	2.0	1.9	2.0	0.3	0.85	0.89	0.59
Carcass traits <sup>1</sup>								
HCDP, %	58.4	59.0	58.6	59.9	0.02	0.70	0.52	0.30
SFT, mm	2.9	3.1	2.8	3.1	1.12	0.86	0.86	0.66

<sup>1</sup>HCDP = hot carcass dressing percentage, SFT = subcutaneous fat thickness.

**Key Words:** oscillating protein, beef cattle, feedlot

**T368 Identification and removal of outliers in feed databases for beef cattle.** Huyen Tran<sup>\*1</sup>, William Weiss<sup>2</sup>, Galen Erickson<sup>3</sup>, and Phillip S. Miller<sup>3</sup>, <sup>1</sup>National Animal Nutrition Program, University of Kentucky, Lexington, KY, <sup>2</sup>The Ohio State University, Wooster, OH, <sup>3</sup>University of Nebraska, Lincoln, NE.

Accurate feed composition data are critical for diet formulation and determination of nutrient requirements of animals. Large feed databases are available; however, they often contain misidentified feed names and can have biased nutritive values. The first 2 objectives of this project were to identify and characterize outliers in feed databases and to develop feed composition tables for beef cattle. Approximately 1.5 million feed composition records provided by 3 commercial laboratories were sorted, screened, and reclassified. Histograms were used to visualize sample distribution. For most forages, feeds were classified as haylage or hay when DM <70 or ≥70, respectively. Grains were classified as high moisture (DM <80%) and dry grains (DM ≥80%). Any nutrient with a value outside mean ± 3.5 SD was removed (method A). Data were analyzed by laboratory before individual means and variance were weighted for sample size for calculation of the overall mean and SD. The third objective was to compare performance of method A to a combination of univariate and multivariate approaches for identifying outliers. Fifteen feeds were randomly selected representing grains, forages, byproducts, and oilseeds and screened for outliers. Feeds with missing key nutrients were removed. Principal component and clustering analyses of SAS were used in the multivariate approach. Among 1.5 million data classified as 352 feeds, 45.7% of the data seemed to be misidentified, leaving 196 feeds for analysis. Outliers were characterized as inaccurate DM classification, transformation of data, decimal point issues, erroneous data, or terminology inconsistency. Method A removed 1.4% of samples and decreased means by 0.9% and SD by 15.2% for CP. The multivariate analysis removed a larger percentage of samples (33.3%) and decreased means by 1.6% and SD by 38.8% for CP. Clustering analysis defined 8 of 15 feeds with >1 cluster. The multivariate method was powerful in decreasing the SD and clustering feeds. Removing outliers based on 3.5 SD (Method A) was simple to use; but this method was inefficient in clustering feeds classified by economic values or maturity. A National Research Support project supported by USDA-NIFA and the State Agricultural Experiment Stations.

**Key Words:** feed composition, data processing, outlier mining

**T369 Effects of energy and nitrogen supplementation of cheatgrass on ruminal fermentation using a dual-flow continuous culture system.** Lorryny Galoro da Silva<sup>\*1</sup>, Farnaz Malekjahani<sup>1,4</sup>, Pedro Del Bianco Benedetti<sup>1,2</sup>, Eduardo Marostegan de Paula<sup>1</sup>, Teshome Shenkoru<sup>1</sup>, Paloma de Melo Amaral<sup>1,2</sup>, Lays Mariz<sup>1,2</sup>, Hugo Monteiro<sup>1,3</sup>, and Antonio Faciola<sup>1</sup>, <sup>1</sup>University of Nevada, Reno, NV, <sup>2</sup>Federal University of Viçosa, Viçosa, MG, Brazil, <sup>3</sup>Maringa State University, Maringa, PR, Brazil, <sup>4</sup>Ferdowsi University, Mashhad, Iran.

Cheatgrass (CG; *Bromus tectorum*), an annual grass that is one of the main components of sagebrush community in Western US contributes to the fuel-load for wild fires. One fuel-reduction strategy is livestock grazing. The objective of this study was to determine the effects of molasses and urea supplementation on a CG-based diet on ruminal digestibility, rumen microbial fermentation and bacterial N synthesis. Diets were randomly assigned to 8 dual-flow continuous culture fermenters in a 2 × 2 factorial arrangement of treatments (urea and molasses) in a 4 × 4 Latin square design with four 10-d experimental periods consisted of 7 d for diet adaptation and 3 d for sample collection. Fermenters were fed 72 g/d of DM divided in 4 portions of 1 of 4 diets: CG, CG plus urea (CGU), CG plus molasses (CGM), and CG plus urea and molasses (CGUM). Liquid and solid flow rates were adjusted to 10 and 5%/h, respectively. A 500-mL sample was taken on d 8, 9, and 10 and analyzed for rumen traits, nutrient digestibility, and microbial growth. Data were analyzed in SAS. Partial data are presented in the table. The NH<sub>3</sub>-N concentration was higher in the diets containing urea, indicating a higher N availability for microbial growth. Total VFA concentration was not increased by molasses; however, it was lower when urea alone was added. Acetate molar proportion decreased when molasses alone was added. However, propionate molar proportion was increased when molasses was added. Results from this experiment indicate that CG utilization is improved by a combination of N and energy supplementation, which may reduce CG fuel-load in areas where CG is widely spread.

**Table 1 (Abstr. T369).**

Item	Treatment				SEM	P-value
	CG	CGU	CGM	CGUM		
NH <sub>3</sub> -N, mg/dL	3.19 <sup>c</sup>	21.49 <sup>a</sup>	0.82 <sup>c</sup>	13.75 <sup>b</sup>	0.94	<0.01
Total VFA, mmol	60.34 <sup>a</sup>	38.85 <sup>b</sup>	67.05 <sup>a</sup>	68.59 <sup>a</sup>	3.31	<0.01
Acetate, %	72.36 <sup>a</sup>	73.73 <sup>a</sup>	66.16 <sup>b</sup>	65.95 <sup>b</sup>	1.56	<0.01
Propionate, %	19.17 <sup>b</sup>	19.66 <sup>b</sup>	24.40 <sup>a</sup>	25.38 <sup>a</sup>	1.49	<0.01
Butyrate, %	8.12 <sup>a</sup>	6.03 <sup>b</sup>	9.12 <sup>a</sup>	8.10 <sup>a</sup>	0.64	0.02
Isobutyrate, %	0.05 <sup>b</sup>	0.38 <sup>a</sup>	0.06 <sup>b</sup>	0.03 <sup>b</sup>	0.07	<0.01
Valerate, %	0.04	0.02	0.16	0.04	0.05	0.23
Isovalerate, %	0.04 <sup>ab</sup>	0.02 <sup>b</sup>	0.21 <sup>a</sup>	0.04 <sup>b</sup>	0.05	0.07
Acetate:Propionate	3.26 <sup>ab</sup>	3.98 <sup>a</sup>	2.83 <sup>b</sup>	2.66 <sup>b</sup>	0.28	0.02
Total BCVFA, %	0.05	0.14	0.17	0.04	0.04	0.13

**Key Words:** cheatgrass, continuous culture, molasses

**T370 Interactions between physical form of the feed and previous experience on concentrate spillage in Holstein calves.** Maria Devant<sup>\*1</sup>, Alex Bach<sup>2,1</sup>, Josep Ribó<sup>3</sup>, and Anna Solé<sup>1</sup>, <sup>1</sup>IRTA-Ruminant Production, Animal Nutrition, Management, and Welfare Research Group, Caldes Montbui, Spain, <sup>2</sup>ICREA, Barcelona, Spain, <sup>3</sup>Grup Alimentari Guissona, Guissona, Spain.

Twenty-four Holstein bulls (137 ± 2.9 kg of BW and 117 ± 3.02 d old) were housed individually in pens (1.2 m × 1.45 m), and fed concentrate and straw in separate feeders. During the first 2 wk, half of the calves

were fed the same concentrate either in meal (MF) or pellet (PF) form. After these first 2 wk, half of the MF calves continued to be fed MF (MFMF) and half received pellet (MFPF), whereas half of the PF calves were MF (PFMF) and the other half pellet (PFPF) for 3 additional weeks. During the entire 5 wk concentrate and straw intake were recorded daily, attendance (number of visits and duration) at the feeder (concentrate and straw) were recorded through a sensor placed at the access door to the feeder, and concentrate spillage around the feeder was collected weekly. Data were analyzed using a mixed-effects model with repeated measures split in 2 analyses; the first model for the first 2 wk contrasted MF vs PF, and a second model for the last 3 wk analyzed the data as a 2 × 2 factorial design (MFMF, MFPF, PFMF, PFPF). During the first 2 wk of study, apparent mean concentrate ( $4.90 \pm 0.128$  kg/d) and straw ( $0.30 \pm 0.30$  kg/d) intakes were not affected by treatments, however concentrate spillage was doubled ( $P < 0.05$ ) in MF ( $5.9 \pm 0.70\%$ ) than in PF ( $2.8 \pm 0.70\%$ ) calves. Number of daily visits did not differ between treatments ( $14.3$  and  $15.4 \pm 0.48$ , for MF and PF, respectively), but time devoted to each visit tended ( $P = 0.10$ ) to be lesser in PF ( $9.2 \pm 0.83$  min) than in MF ( $11.1 \pm 0.83$  min). In the last 3 wk of study, previous experience did not affect apparent concentrate or straw intake. Previous experience had a positive impact on feed spillage when previous presentation form was PF; thus, concentrate spillage was similar between PFMF ( $2.5 \pm 0.87\%$ ) and PFPF ( $2.6 \pm 0.87\%$ ). In contrast, previous experience did not affect concentrate spillage when calves were initially exposed to MF, and MFMF calves spilled more concentrate ( $6.8 \pm 0.87\%$ ) than MFPF calves ( $2.3 \pm 0.87\%$ ). In conclusion, feeding calves a pellet upon arrival to a grower facility could have long-lasting positive effects due to a reduction on concentrate spillage.

**Key Words:** beef, feed spillage, feed presentation form

**T371 Effect of zinc amino acid complex on growth performance and carcass characteristics of finishing beef steers fed ractopamine hydrochloride.** C. K. Larson and M. E. Branine\*, *Zinpro Corporation, Eden Prairie, MN.*

Ractopamine hydrochloride (RAC) is fed to cattle before slaughter to improve growth performance and carcass lean meat yield. Zinc (Zn) is required for RAC function; however, Zn level and source required to optimize RAC response is unknown. The objective of this research was to evaluate the response of Zn provided as an amino acid complex (Zn-AAC) on growth, feed efficiency, and carcass merit in growing-finishing beef steers. Two well-controlled studies were conducted at commercial feedlot research facilities in TX and OK. At the TX and OK sites, 3,849 (initial BW =  $344 \pm 2.3$  kg) and 2,105 (initial BW =  $311 \pm 3.5$  kg) steers, respectively, were randomized across 8 pens/treatment. Common treatments at each site were: (1) Control (CON) = basal diet with no Zn-AAC or no RAC; (2) RAC = 320 mg RAC·hd<sup>-1</sup>·d<sup>-1</sup> (TX) and 200 mg RAC·hd<sup>-1</sup>·d<sup>-1</sup> (OK); (3) Zn-AAC + RAC = RAC plus 360 mg Zn-AAC·hd<sup>-1</sup>·d<sup>-1</sup>. At both sites, RAC was fed for the final 28-d before slaughter. Basal diets provided steam-flaked corn as the primary grain source. Total dietary Zn concentration in CON diets was 62 and 76 mg Zn·kg<sup>-1</sup>DM for OK and TX, respectively. Individual and combined study analyses were conducted using SAS on growth performance and carcass data. Pen was the experimental unit. Combined study analyses indicated RAC increased carcass-adjusted final BW ( $P \leq 0.02$ ), ADG ( $P \leq 0.01$ , feed efficiency ( $P \leq 0.01$ ), HCW ( $P \leq 0.03$ ) and ribeye area ( $P \leq 0.01$ ) compared with CON. Adding Zn-AAC to RAC produced additional improvements in carcass-adjusted final BW ( $P \leq 0.09$ ); ADG ( $P \leq 0.01$  and HCW ( $P \leq 0.11$ ). Marbling score, back fat thickness and calculated yield grade were not affected by treatment. Incidence and severity of liver abscesses were reduced ( $P \leq 0.02$ ) with Zn-AAC +

RAC compared with CON and RAC. Feeding Zn-AAC to cattle fed RAC produced additional improvements in growth and carcass yield and reduced prevalence of total and severe (A<sup>+</sup>) liver abscesses.

**Key Words:** feedlot, ractopamine, zinc

**T372 Sources of nonfiber carbohydrate in sugarcane silage based diets.** Viviane B. Ferrari\*, Nara R. B. Consolo, Rafael T. Sousa, Frederich D. Rodriguez, and Luis Felipe P. Silva, *University of São Paulo, São Paulo, Brazil.*

The aim of this study was to evaluate sources of nonfiber carbohydrates (NFC) and levels of concentrate, in sugarcane silage based diets, on intake, ADG, final body weight (FBW) and G:F ratio. The trial was repeated in 2 years: 2012 and 2013, to increase the power of the experiment. In each year, 54 Nellore young bulls, with initial body weight of 365 kg, were randomly distributed in 18 pens, with 3 animals per pen. The experimental design was a randomized block design, with 6 replicates, in a 2 × 3 factorial arrangement of treatments. Treatments were 2 levels of concentrate (diets 60% or 80% concentrate on DM basis) and 3 sources of NFC: steam-flaked corn (SFC), pelleted citrus pulp (PCP), or ground corn (GC). Steam-flaked corn and PCP replaced 70% of the ground corn in the diet, and all diets had sugarcane silage as the roughage source. Animals were weighted at the beginning of the experiment and at the end of each period (4 periods of 21 d). Intake was regulated for pen by daily weighting of diet and orts, allowing for 5 to 10% of orts. Samples of feedstuffs and orts were weekly collected for chemical analyses and determination of nutrients intake. There was a NFC × Diet interaction on DMI ( $P = 0.01$ ), as substituting GC for SFC and PCP decreased DMI, but only at the 60% concentrate diet ( $P < 0.01$ ). There was also a NFC × Diet interaction for NDFI ( $P = 0.02$ ). At the 60% concentrate diet, SFC decreased NDFI when compared with GC and PCP ( $P < 0.05$ ). At the 80% concentrate diet, NDFI was higher for PCP than for GC and SFC ( $P < 0.01$ ). Substituting PCP for GC decreased FBW ( $P < 0.01$ ), with no difference between GC and SFC ( $P = 0.26$ ). Similarly, PCP decreased ADG compared with GC ( $1.27$  vs.  $1.40$ ;  $P = 0.04$ ), independently of diet. Increasing the concentrate level in the diet improved G:F ratio ( $0.149$  vs.  $0.137$ ;  $P < 0.01$ ), but there was no effect of NFC sources on G:F ratio ( $P = 0.74$ ), nor there was a NFC × Diet interaction ( $P = 0.21$ ). Pelleted citrus pulp as main carbohydrate source decreased performance of young bulls compared with ground and steam-flaked corn.

**Key Words:** average daily gain, steam-flaking, feed intake

**T373 Effects of starch content on in vitro ruminal fermentation of ground and dry-rolled barley grain.** Uchenna Y. Anele<sup>1</sup>, Basim Refat<sup>1,4</sup>, Mary-Lou Swift<sup>2</sup>, Yanli Zhao<sup>1,3</sup>, Tim McAllister<sup>1</sup>, and Wenzhu Yang\*<sup>1</sup>, <sup>1</sup>Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada, <sup>2</sup>Alberta Agriculture & Rural Development, Lethbridge, AB, Canada, <sup>3</sup>Inner Mongolia Agricultural University, Hohhot, Inner Mongolia, China, <sup>4</sup>Zagazig University, Zagazig, Egypt.

Rapid digestion of barley starch in the rumen is hypothesized that starch content of barley grain can influence both rates of gas production (GP) and dry matter disappearance (DMD). Rumen fermentation of ground and dry-rolled barley grain differing in starch content was evaluated using a batch culture technique. The study was arranged in a 2 starch contents (low vs. high) × 2 processing (ground vs. dry-rolled) factorial design. Barley samples were collected monthly from 10 different feedlots in southern Alberta during one year. Samples were ranked according to



the starch content into low (<60%) and high (>60% of DM). Ten barley samples with 5 low (57.1 ± 1.7%) and 5 high (66.0 ± 0.7% of DM) starch were either ground 2 mm or dry-rolled with processing index (PI) of 75%. Gas production and DMD were estimated at 3, 6, 12 and 24 h of incubation using rumen fluid from 3 fistulated beef heifers fed diet containing 70% barley silage and 30% barley grain (DM basis). Cumulative GP (mL/g DM) was fitted to a model  $GP = B(1 - e^{-c(t-lag)})$ . Starch content × processing interaction was not significant for in vitro GP kinetics. Rate of GP (%/h) was greater ( $P < 0.01$ ) in both high starch (18.3) and ground (20.6) versus, respectively, low starch (16.1) and rolled (13.9) barley samples. Similarly, both high starch (40.0) and ground (44.9) samples had greater ( $P < 0.01$ ) absolute initial GP during the first hour of incubation compared with, respectively, low starch (34.6) and rolled (29.7) barley. Data from DMD at different times of incubation were fitted to a model  $DMD = a + b(1 - e^{-c(t-L)})$ . Starch content × processing interactions were noted for the b fraction ( $P < 0.03$ ) and rate of DMD ( $P < 0.01$ ). Consistently, both high starch and ground barley had greater ( $P < 0.05$ ) a, b and c of DM versus low starch and dry-rolled barley. However, the a, b, and c of starch did not differ between low and high starch barley. Ground barley had greater ( $P < 0.01$ ) c (ground vs. rolled; 8.9 vs 6.1%) compared with rolled barley. The results indicated that starch content of barley had significant effect on in vitro rate of GP and the rate of DMD; processing (ground vs. dry-rolled) increased the extent and rate of DMD and starch.

**Key Words:** barley starch content, in vitro fermentation, grain processing

**T374 Effect of sainfoin hay and pomegranate peel extracts on in vitro fermentation and protein degradation using the Rusitec technique.** Basim Refat<sup>1,2</sup>, Uchenna Y. Anele<sup>1</sup>, Zhixiong He<sup>1,3</sup>, S. M. Bassiony<sup>2</sup>, G. A. Abdel-Rahman<sup>2</sup>, and Wenzhu Yang<sup>1</sup>, <sup>1</sup>*Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada*, <sup>2</sup>*Faculty of Agriculture, University of Zagazig, Zagazig, Egypt*, <sup>3</sup>*Institute of Subtropical Agriculture, The Chinese Academy of Science, Changsha, Hunan, China*.

Pomegranate peel extracts (PPE) have been found to exert beneficial effects on animal health due to their antioxidant, antibacterial and immunological effects. Sainfoin hay that contains moderate to high content of condensed tannins, was reported the reduced rumen proteolysis and decreased urine N excretion in beef cattle. The objective of this study was to determine the effect of sainfoin hay extract (SHE) and PPE supplementation on in vitro rumen fermentation and protein metabolism of high-protein finishing diet using rumen simulation technique (Rusitec). The experiment was a completely randomized design with 3 treatments: Control (10% barley silage, 60% barley grain and 30% wheat distillers grain), and control supplemented with SHE (4.1 g catechin equivalent/kg DM) or with PPE (2.8 g tannic acid equivalents/kg DM). The experiment consisted of 10 d of adaptation and 7 d of data collection. Concentration of volatile fatty acid (VFA) was lower (44.1 or 41.6 vs. 48.2 mM;  $P < 0.02$ ) but molar proportion of acetate was higher (37.2 or 37.4 vs. 34.9%;  $P < 0.01$ ) with SHE or PPE vs. control. Branched-chain VFA decreased ( $P < 0.01$ ) with PPE (0.9%) compared with control. Concentrations (mg/100 mL) of large (10.1) and small peptides (6.1) were not affected but that of NH<sub>3</sub>-N was lower ( $P < 0.01$ ) with PPE (6.3) vs. control (8.1). Digestibility of DM, starch and crude protein decreased ( $P < 0.02$ ) with SHE (58.7, 74.7 and 43.0%, respectively) and PPE (55.5, 68.9 and 43.4%, respectively) supplementation compared with control (63.3, 83.2 and 51.0%, respectively). Bacterial N production (averaged 52 mg/d) and bacterial efficiency (averaged 10.3 g bacterial N/kg digested OM) were not affected by SHE or PPE

supplementation. Overall, there were no differences in VFA concentrations, N fractions and nutrient digestibility between SHE and PPE except for the concentrations of branched-chain VFA and NH<sub>3</sub>-N which were higher ( $P < 0.01$ ) with SHE versus PPE supplementation. These results indicated that supplementation of high-grain diet with SHE or PPE increased rumen by-pass protein; however, suppression of feed fermentation may decrease the feeding value of high-grain diet.

**Key Words:** tannins extracts, fermentation, Rusitec

**T375 Effects of starch content and processing method on in situ rumen digestibility of barley grain in beef heifers.** Yanli Zhao<sup>1,2</sup>, Sumei Yan<sup>2</sup>, Uchenna Y. Anele<sup>1</sup>, Mary-Lou Swift<sup>3</sup>, Tim A. McAllister<sup>1</sup>, and Wenzhu Yang<sup>\*1</sup>, <sup>1</sup>*Lethbridge Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada*, <sup>2</sup>*College of Animal Science, Inner Mongolia Agricultural University, Hohhot, Inner Mongolia, China*, <sup>3</sup>*Alberta Agriculture and Rural Development, Lethbridge, AB, Canada*.

The inherent variability in barley chemical composition leads to differences in animal performance. The objective of this study was to investigate the effects of starch content of barley grain and processing method on in situ rumen digestion of DM and starch. Barley samples (n = 120) were collected monthly from 10 feedlots in Southern Alberta for one year. Samples were ranked according to their starch content into low (<60%) and high (>60% of DM). Ten barley samples with 5 low (57.1 ± 1.7%) and 5 high (66.0 ± 0.7% of DM) starch were either ground 2 mm or dry-rolled with processing index (PI) of 75% (PI = 100 × bulk density processed/bulk density whole). Three beef heifers (650 BW) fitted with rumen cannulas and fed diet consisting of 70% barley silage and 30% barley grain were used for in situ incubation. The study was arranged in a 2 (low and high starch) × 2 (ground and rolled) factorial design. Digestion kinetics of DM after 0, 3, 6, 12, 24, and 48 h of incubation was estimated using the model:  $y = a + b(1 - e^{-ct})$ . Effective rumen digestibility (ED) was estimated using  $ED = a + bc/(c + k)$  with  $k = 6\%/h$ . Particle size distribution of rolled barley differed between low and high starch barley; the particles retained on the 3.35-mm sieve was less (17.8 vs. 25.3%;  $P < 0.01$ ) but the particles on 2.36-mm sieve was greater (40.5 vs. 32.1%;  $P < 0.01$ ) for low vs. high starch barley. Starch content × processing interactions were not noted. Low starch barley had less ( $P < 0.01$ ) a (12.2 vs. 14.8%) and ED of DM (60.4 vs. 64.8%) versus high starch barley. The low starch barley also had less ( $P < 0.01$ ) a (14.2 vs. 23.1%) and ED of starch (68.4 vs. 74.6%) but had greater ( $P < 0.03$ ) b (75.5 vs. 70.5%) compared with high starch barley. As expected, rumen digestion kinetics of DM and starch differed between ground and dry rolled (PI = 75%) samples. Ground samples had greater ( $P < 0.01$ ) a (21.6 vs. 5.4%), c (33.1 vs. 10.1%/h) and ED (71.6 vs. 53.6%) of DM but smaller b (59.8 vs. 77.8%;  $P < 0.01$ ) compared with rolled barley. These results indicated that starch content of barley grain and manipulating processing method could effectively alter rumen digestion of barley grain.

**Key Words:** barley starch content, in situ rumen digestion, beef heifer

**T376 Effect of physical form of concentrate on performance, eating pattern, and behavior in Holstein bulls fed finishing high-concentrate diets.** Marçal Verdú<sup>\*1</sup>, Alex Bach<sup>2,1</sup>, and Maria Devant<sup>1</sup>, <sup>1</sup>*IRTA-Ruminant Production, Animal Nutrition, Management, and Welfare Research Group, Caldes Montbui, Spain*, <sup>2</sup>*ICREA, Barcelona, Spain*.

Pelleting concentrate is one of the predominant grain processing methods in Mediterranean beef feeding systems. A good pellet quality is related to improvements in performance and feed efficiency, but it involves an extra cost at manufacturing. One hundred twelve bulls ( $272 \pm 4.4$  kg of BW and  $216 \pm 1.0$  d of age) were randomly allocated in 6 pens provided with a concentrate single feeder with lateral protections, a straw feeder, and a water bowl. Pens were assigned to 1 of 2 dietary treatments according to the physical form of concentrate: pellet (PF), and crumble (CF) to simulate a worse pellet quality. The experimental design was 3 Latin Squares with periods of 28 d replicated twice. Concentrate intake and eating pattern were recorded daily, and concentrate wastage and animal BW every 14 d. Behavior was registered on d 20 of each period by scan sampling to analyze the general activity and social behavior. Data were analyzed using a mixed-effects model. The PF bulls consumed more concentrate ( $P < 0.01$ ), but had lesser ( $P < 0.01$ ) waste and day-to-day CV of concentrate intake compared with CF ( $7.0$  and  $6.7 \pm 0.08$  kg of DM/d,  $0.06$  and  $0.11 \pm 0.004$  kg of DM/d,  $16.7$  and  $21.3 \pm 0.99\%$ , respectively). However, ADG ( $P = 0.11$ ) and feed efficiency were not affected by physical form. The eating pattern of PF bulls was characterized ( $P < 0.01$ ) by a lesser meal size and meal duration, but a greater meal frequency and eating rate than CF bulls ( $630.9$  and  $668.4 \pm 17.32$  g/meal,  $3.6$  and  $4.2 \pm 0.18$  min/meal,  $11.8$  and  $10.9 \pm 0.32$  meals/d,  $193.0$  and  $174.4 \pm 11.79$  g/min, respectively). Social behavior was not influenced by physical form. In conclusion, the decrease of pellet quality modified eating behavior increasing meal duration and decreasing concentrate intake, may be bulls fed crumbles were sorting avoiding fines. A long-term study is necessary, as it could be hypothesized that the effects of decreased pellet quality on decreased concentrate intake could impair performance.

**Key Words:** bull, eating pattern, physical form of concentrate

### T377 Carcass and sensory traits and free amino acid contents among quality grades in loin and rump of Korean cattle steer.

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This study was performed to compare carcass traits, sensory characteristics, physiochemical composition, and contents of nucleotides, collagen, and free amino acids among quality grades (QG) and to understand the association between QG and above parameters in loin and rump of Korean cattle steer. Loin and rump samples were obtained from 48 Korean cattle steers with each of 4 quality grades (QG 1++, 1+, 1, and 2; average 32 mo of age). Carcass weight and marbling score (MS) were highest in QG 1++, whereas texture score measured by a meat grader was highest in QG 2. A correlation analysis revealed that MS ( $r = 0.98$ ;  $P < 0.01$ ) and fat content ( $r = 0.73$ ;  $P < 0.01$ ) had strong positive correlations with QG and that texture had a strong negative correlation ( $r = -0.78$ ) with QG. Fat content in loin was highest but protein and moisture contents were lowest in QG 1++. Our results confirmed that a major determinant of QG is the MS; thus, intramuscular fat (IMF) content. The CIE L\*, a\*, and b\* values in loin were highest in QG 1++. Numeric values of shear force in loin were lowest in QG 1++, whereas those of tenderness, juiciness, and overall acceptability tended to be highest in QG 1++ without statistical significance. QG was strongly correlated with juiciness ( $r = 0.81$ ;  $P < 0.01$ ) and overall acceptability ( $r = 0.87$ ;  $P < 0.001$ ). All sensory characteristics were higher ( $P < 0.05$ ) in loin than those in rump. Adenosine-5'-monophosphate (AMP) and inosine-5'-monophosphate (IMP) contents in both loin and rump did not differ among QGs. No nucleotide (AMP, IMP, inosine, hypoxanthine) was

correlated with any of the sensory traits. Total, soluble, and insoluble collagen contents in loin were higher in QG 1++ than those in QG 1. All 3 collagens had lower content in loin than that in rump. All 3 collagens were positively correlated with tenderness, juiciness, and overall acceptability. Glutamic acid content did not significantly differ among the 4 QGs in either loin or rump. In conclusion, it is confirmed that QG is associated with sensory traits but nucleotide contents in beef may not be a major factor determining meat palatability in the present study.

**Key Words:** Korean cattle steer, carcass trait, quality grade

**T378 Plasma creatinine concentration of beef heifers fed with different lipid sources and frequency supplementation.** Marcia Cristina A. Santana\*<sup>1</sup>, Ricardo A. Reis<sup>2</sup>, Gabriel M. P. Melo<sup>2</sup>, Viviane C. Modesto<sup>3</sup>, Telma T. Berchielli<sup>2</sup>, Jucilene Cavali<sup>4</sup>, and Juliana F. H. Rodrigues<sup>4</sup>, <sup>1</sup>EMATER, Goiania, Goias, Brazil, <sup>2</sup>Unesp, Jaboticabal, Sao Paulo, Brazil, <sup>3</sup>Unesp, Ilha Solteira, Sao Paulo, Brazil, <sup>4</sup>UNIR, Presidente Médici, Rondônia, Brazil.

This research aims to evaluate urea plasma responses under different lipid sources and supplementation frequencies. The experiment was conducted throughout a 4-mo period during the dry season. The experiment was completely random, using a  $3 \times 2$  factorial arrangement (3 supplements and 2 supplementation frequencies). The supplements were derived from 3 different sources, soybean grains, soybean oil and protected fat (Megalac-E), the 2 supplementation frequencies were (D) daily or 3 d of week (Monday, Wednesday and Friday) called "alternate" (A). In the 4-mo experimental period, August–November, blood samples were taken from the jugular vein 4 h after the morning feeding. In all treatments, no creatinine levels differences were observed during August, October and November ( $P > 0.05$ ). However, on September were observed lower values of creatinine for Megalac-E daily and soybean oil alternately supplied. Therefore, the highest creatinine plasma levels observed for all treatments were on September and the lower showed on November. Overall, these data indicated that the creatinine plasma level can be influenced according to the feeding strategy during the dry season.

**Table 1.** Plasma creatinine concentration of heifers supplemented with different lipid sources at two different frequencies (mg/dL)<sup>1</sup>

	D-SG	A-SG	D-SO	A-SO	D-ML	A-ML
August	1.2 <sup>A,b</sup>	1.2 <sup>A,b</sup>	1.0 <sup>A,b</sup>	1.1 <sup>A,b,c</sup>	1.2 <sup>A,b</sup>	1.3 <sup>A,b</sup>
September	2.8 <sup>A,a</sup>	2.8 <sup>A,a</sup>	2.6 <sup>A,a</sup>	2.2 <sup>B,a</sup>	2.4 <sup>AB,a</sup>	2.6 <sup>A,a</sup>
October	1.1 <sup>A,b</sup>	1.4 <sup>A,b</sup>	1.2 <sup>A,b</sup>	1.4 <sup>A,b</sup>	1.1 <sup>A,b</sup>	1.3 <sup>A,b</sup>
November	0.7 <sup>A,c</sup>	0.8 <sup>A,c</sup>	1.0 <sup>A,b</sup>	0.8 <sup>A,c</sup>	0.8 <sup>A,b</sup>	0.8 <sup>A,b</sup>

a-c,A,B Means with lowercase superscripts in columns and uppercase superscripts in rows differ ( $P < 0.05$ ).

<sup>1</sup>D = daily; A = alternately; SG = soybean; SO = soy oil, and ML = Megalac-E.

**Key Words:** soybean, lipid supplement, dry season

**T379 Efficacy of supplying lasalocid sodium via a self-fed trace mineralized salt block supplement to growing beef calves grazing warm season grass.** Brandon Stewart\*<sup>1</sup>, Paul Beck<sup>1</sup>, John Tucker<sup>2</sup>, Tom Hess<sup>2</sup>, and Don Hubbell<sup>2</sup>, <sup>1</sup>University of Arkansas SWREC, Hope, AR, <sup>2</sup>University of Arkansas LFRS, Batesville, AR.

Two experiments were conducted at the University of Arkansas Southwest Research and Experiment Station (Hope, AR) and Livestock and Forestry Branch Station (Batesville, AR) in northern Arkansas. Growing beef calves ( $n = 96$  steers at the Hope site and 48 steers and 48 heifers at the Batesville site, BW =  $215 \pm 14.5$ ) grazed 0.8 ha warm-season grass

based pastures (n = 24/site, predominantly bermudagrass) during a 56-d summer grazing study to determine the effects of supplementation of growing steers grazing warm-season perennial grass pastures with Lasalocid via self-limited block (Bovatec 2.2 Block, Zoetis Animal Health, Inc.) on growth performance. Pastures were stocked with 4 calves/pasture with 24 total pasture replicates/treatment. Because of drought conditions this study was initiated on June 12 and terminated on August 8 at the Batesville site and was initiated on June 27 and terminated on August 22 at the Hope site. At the Hope site, lack of grazable forage made it necessary to offer grass hay (10% CP and 55% TDN) and soybean hulls at 2 lb/head/d to all pastures for the duration of the study. Beginning and ending weights were collected full on 2 consecutive days, and interim weights were collected full on 28-d intervals. Calves in each pasture were offered free-choice access to either a non-medicated control trace mineralized salt block (Control) or Bovatec 2.2 block (Bovatec). Daily

block intakes at the Hope site averaged  $12 \pm 8.1$  g/calf with an average Bovatec dose of  $59 \pm 39$  mg/head/day. At Batesville, daily intake of control averaged  $28 \pm 12$  g/calf and intake of Bovatec averaged  $20 \pm 5.3$  g/head/day (supplying  $100 \pm 25$  mg Bovatec). There was no treatment  $\times$  site interaction ( $P = 0.44$ ) for performance in this study. At the end of the study there was no difference ( $P \geq 0.16$ ) between Control and Bovatec treatments for BW ( $267$  vs  $269 \pm 3.9$  kg, respectively) or ADG ( $0.75$  vs.  $0.81 \pm 0.0435$  kg/d, respectively). The results of this study indicate that Bovatec offered in a self-fed trace mineralized salt block supplement did not supply a large enough dose of lasalocid to increase growth rate of beef calves grazing warm-season grass pastures.

**Key Words:** growing calves, lasalocid, bermudagrass pasture