

## Ruminant Nutrition: Beef Production II

**399 Precision processing barley grain improves the feeding value of barley grain in beef cattle.** W. Z. Yang<sup>\*1</sup>, M. Oba<sup>2</sup>, and T. A. McAllister<sup>1</sup>, <sup>1</sup>Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada, <sup>2</sup>Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada.

The objectives of this study were to determine the effects of barley grain quality and precision processing (processing based on kernel size and volume weight) on DMI, ruminal pH and fermentation, and apparent total tract digestibility in steers. Eight ruminally cannulated steers were used in a replicated 4 × 4 Latin square design with 21-d periods. The 4 treatments were: 1) light barley (LB); 2) heavy barley (HB), LB and HB processed optimally with processing index ranging 75 to 80%; 3) LB and HB precision processed and mixed in equal proportions (PP); and 4) LB and HB mixed in equal proportions then processed at a single roller setting (industry standard; CON). All diets consisted of 10% barley silage, 67% barley grain, 20% corn DDGS and 3% supplement (DM basis). DMI was greater ( $P < 0.04$ ) for steers fed LB than for HB (13.2 vs. 12.2 kg/d) with greater ( $P < 0.01$ ) NDF intake (4.0 vs. 2.8 kg/d) but less ( $P < 0.01$ ) starch intake (4.7 vs. 5.8 kg/d). Intakes of DM, NDF and starch were greater ( $P < 0.04$ ) for PP (13.0, 3.6 and 5.4 kg/d, respectively) than for CON (12.0, 3.3 and 5.0 kg/d, respectively). There were no differences in mean ruminal pH (5.82 to 5.89) or in the duration of pH < 5.8 (9.9 to 11.5 h) and pH < 5.5 (5.0 to 6.6 h) between LB and HB, or PP and CON. Ruminal NH<sub>3</sub>-N (9.5 to 10.3 mM) and total VFA concentrations (122 to 133 mM), and VFA profile were not affected by treatment. Digestibility of DM was lower ( $P < 0.05$ ) for LB than HB (68 vs. 72%), whereas that of CP, NDF, ADF and starch was not different. Digestibility of DM, CP and ADF was greater ( $P < 0.05$ ) for PP (74, 73 and 48%, respectively) than CON (70, 68 and 39%, respectively). These results suggest greater feed efficiency with HB than with LB due to less DMI and greater digestibility. This work demonstrates that precision processing can be used to improve the utilization of barley grain with variable kernel uniformity by beef cattle.

**Key Words:** feedlot cattle, precision processing, ruminal pH and fermentation

**400 Effect of rumen degradable energy source on performance and forage intake of steers grazing stockpiled crested wheatgrass pasture.** F. Anez<sup>\*1</sup>, J. J. McKinnon<sup>1</sup>, H. A. Lardner<sup>1,2</sup>, G. B. Penner<sup>1</sup>, and P. G. Jefferson<sup>1,2</sup>, <sup>1</sup>University of Saskatchewan, Saskatoon, SK, Canada, <sup>2</sup>Western Beef Development Centre, Humboldt, SK, Canada.

The objective of this experiment was to determine the effects of supplementing blended by-product pellets that differed in starch and degradable fiber content on performance of steers grazing mature crested wheatgrass (CWG). Forty-five yearling crossbreed steers (334 ± 3.5 kg) stratified by BW were randomly assigned to 1 of 9 CWG pastures (5 steers/pasture). Each pasture was randomly assigned (n = 3), in a completely randomized design, to 1 of 3 treatments: no supplement (Control); low-starch high-degradable fiber (LSHDF; 40.3% starch; 29.5% NDF on DM basis) pellet and high-starch low-degradable fiber (HSLDF; 48.6% starch; 22.8% NDF on DM basis) pellet, both fed daily at 0.6% BW. The grazing period lasted 70 d (from late-July to mid-October). Forage utilization and DMI were estimated using the double weigh (before and after grazing) technique. Forage samples were clipped every 2 wk

and analyzed for DM, CP, ADF and NDF. Steers were weighed on 2 consecutive d at the beginning and end, and every 14 d throughout the trial. Ultrasound rib-fat thickness was also measured at the beginning and end of trial. Over the 70-d study, forage CP decreased from 9.9 ± 0.82 to 6.9 ± 0.59% of DM and digestible energy content decreased from 2.6 ± 0.04 to 2.2 ± 0.04 Mcal/kg DM. Treatment did not affect forage utilization ( $P = 0.50$ ; 73.4 ± 3.15%) or DMI ( $P = 0.90$ ; 9.0 ± 1.54 kg/d). Final BW and ADG were not different ( $P > 0.05$ ) between LSHDF (435 ± 6.4 kg and 1.4 ± 0.10 kg/d) and HSLDF (439 ± 10.4 kg and 1.5 ± 0.14 kg/d). However, cattle fed pellets had higher ( $P < 0.05$ ) final BW and ADG than the control cattle (402 ± 5.6 kg and 1.0 ± 0.09 kg/d). No effect of treatment ( $P > 0.05$ ) was noted on rib fat. These results show that beef steers grazing mature CWG were limited in energy intake and that supplementation of metabolizable energy in the form of starch or degradable fiber equally improved performance.

**Key Words:** crested wheatgrass, by-products, grazing steers

**401 Effects of sugarcane fiber digestibility and concentrate level on intake and growth of finishing Nellore bulls.** B. S. Mesquita, D. O. Souza, J. F. Penso, M. H. A. Santana, J. B. S. Ferraz, and L. F. P. Silva, <sup>\*</sup>Universidade de São Paulo, Pirassununga, SP, Brazil.

Sugarcane has low fiber digestibility, one of the main factors limiting beef cattle performance. The objective of this study was to evaluate the effects of sugarcane stalk fiber digestibility and of concentrate level on intake, growth and carcass fat of finishing Nellore bulls. Forty-eight Nellore bulls (319 ± 9.2 kg of BW) were blocked by BW and assigned to 4 treatments in a 2 × 2 factorial arrangement in a randomized complete block design. Treatments were as follows: sugarcane genotype IAC2480 (greater stalk NDF digestibility) as roughage source fed at 20 or 40% of total DM, or sugarcane genotype IAC2094 (lower stalk NDF digestibility), fed at 20 or 40% of total DM intake (n = 4 pens for each of the 4 treatments). Diets were formulated to provide daily gain (ADG) of 1.2 kg/d (40% sugarcane) or 1.4 kg/d (20% sugarcane), and contained freshly cut sugarcane as the sole forage. Sugarcane IAC2480 stalk contained 42% NDF with 15% 30h-NDF digestibility, and sugarcane IAC2094 stalk contained 41.5% NDF with 6.5% 30h-NDF digestibility. Animals were fed ad libitum maintaining a minimum of 10% orts in each pen. Dry matter intake was determined daily, and animals were weighed every 14 d after 16h of fasting. Main effects of sugarcane genotypes (CANE), of level of concentrate (CONC), and their interaction were tested by ANOVA. Feeding sugarcane with higher NDF digestibility increased dry matter intake as a percentage of BW (2.24 vs. 2.12 ± 0.08%,  $P = 0.04$ ) and subcutaneous carcass fat (4.6 vs. 3.1 ± 0.4 mm,  $P < 0.01$ ). There were no significant effects of level of concentrate or of CANE × CONC interaction on these variables. Regarding ADG, there was a CANE × CONC interaction ( $P = 0.03$ ), where sugarcane with higher NDF digestibility increased ADG only when fed at 20% of DM (1.80 vs. 1.52 ± 0.09 kg/d,  $P = 0.005$ ), and not when fed at 40% DM (1.57 vs. 1.59 ± 0.09 kg/d,  $P = 0.87$ ). Feeding finishing bulls a diet containing sugarcane with greater stalk NDF digestibility increased DM intake and subcutaneous fat, regardless of concentrate level. Higher NDF digestibility also increased ADG, but only when fed at 20% of total DM.

**Key Words:** cattle, fiber digestibility, sugarcane

**402 High dietary sulfur decreases apparent absorption of copper and manganese by steers.** D. J. Pogge, M. E. Drewnoski,\* and S. L. Hansen, *Iowa State University*.

The antagonism between S and Cu in ruminants is well established. However, the potential antagonism between high dietary S in concentrate-based diets and the divalent trace minerals Mn and Zn has not been extensively explored. Ruminant metabolism of sulfate can lead to the production of sulfide. Sulfide has the potential to bind divalent minerals and make them less available for absorption. To examine the effect of dietary S on apparent absorption and retention of Cu, Mn, and Zn, 16 steers (8 cannulated; 355 kg; and 8 unmodified; 386 kg) were used in a 2 × 2 factorial design with the 2 factors being modification status and dietary treatment. Dietary treatment consisted of a low sulfate (0.2% S; LS) wheat midd-based pellet or LS plus sodium sulfate added at 2% of DM to achieve a high sulfate (0.7% S; HS) pellet. Steers were blocked to pairs by modification status and BW and pair-fed between treatments. The HS steers were fed 110% of the previous day's intake of pellets and the LS steers were pair-fed 105% of their HS counterpart. All steers were fed chopped brome grass hay at 5% of pellet intake. Steers were adapted to metabolism crates for 4 d, stepped up to a high concentrate diet for 7 d, and after an additional 7 d ad libitum intake period apparent mineral absorption and retention were determined over 5 d in which all urine, feces, and orts were collected. By design, DMI did not differ ( $P = 0.55$ ) between treatments during the collection period (5.8 and 5.6 kg, for LS and HS, respectively). Apparent absorption of Cu was greater ( $P < 0.05$ ) in LS (34.5%) compared with HS (17.9%). Apparent absorption of Mn was also greater ( $P < 0.05$ ) in LS steers (20.4%) vs. HS steers (10.1%); however, apparent absorption of Zn did not differ ( $P = 0.17$ ; 17.3 vs. 12.1% for LS and HS, respectively). These data suggest that high dietary S cannot only negatively affect absorption of Cu but also absorption of Mn, and because both of these minerals are essential to antioxidant enzymes long-term feeding of high S diets may increase the risk of oxidative stress in cattle.

**Key Words:** cattle, copper, manganese

**403 Comparison of receiving strategies on feedlot performance in beef calves at weaning.** K. L. Neuhold\*<sup>1</sup>, J. K. Ahola<sup>1</sup>, C. W. Shonk<sup>1,2</sup>, T. E. Engle<sup>1</sup>, and J. J. Wagner<sup>1,3</sup>, <sup>1</sup>*Colorado State University, Fort Collins*, <sup>2</sup>*Agriculture, Research, Development and Education Center, Wellington, CO*, <sup>3</sup>*Southeast Colorado Research Center, Lamar*.

One hundred twenty-four newly weaned Angus, Hereford, and Angus × Hereford bull and heifer calves (initial BW = 233 ± 14.9 kg) were utilized to evaluate the effects of 2 feedlot receiving management strategies at Colorado State University's Agriculture, Research, Development and Education Center in Wellington, CO on feedlot performance over the first 30 d upon arrival to the feedlot. Cattle were blocked by sex and stratified by weight, breed, and age, and assigned to one of 14 pens (8 - 10 head/pen). Pens were then assigned to one of 2 dietary treatments. Dietary treatments included: 1) dried distiller's grain-based total mixed ration (TMR) initiated upon arrival (DDG), or 2) long-stem grass hay followed by a TMR containing no DDG (HAY). Calves receiving the HAY treatment received only grass hay for the first d after arrival, long stem grass hay and TMR combination the following 2 d, and a grain-based TMR on d 4. Beginning on d 4, calves across all treatments were fed once a d and had access to iso-caloric and iso-nitrogenous diets. Calves were weighed on d 0 and 30, and DMI was determined daily. Initial BW was similar ( $P = 0.99$ ) across treatments; however, d 30 BW was greater ( $P < 0.001$ ) for DDG vs. HAY calves. As a result, ADG was greater ( $P < 0.001$ ) for DDG vs. HAY calves (0.59 vs. 0.41 ± 0.042 kg/d, respectively). Gain-to-feed ratio was greater ( $P < 0.05$ ) for DDG

vs. HAY calves (0.22 vs. 0.17 ± 0.013, respectively), and feed-to-gain ratio tended ( $P = 0.05$ ) to be greater in HAY vs. DDG calves. Daily DMI tended ( $P = 0.06$ ) to be greater in DDG vs. HAY calves (2.70 vs. 2.35 ± 0.256 kg·hd<sup>-1</sup>·d<sup>-1</sup>, respectively). In summary, providing a DDG-based receiving ration to newly weaned calves upon arrival to the feedlot resulted in greater feed intake, gain, and feed efficiency over a 30 d period than traditional long-stemmed grass hay followed by a non-DDG TMR.

**Key Words:** feedlot performance, receiving diet, weaning

**404 Determining the influence of dietary NDF concentration from brome grass hay on performance of steers fed high sulfur diets.** S. J. Morine,\* M. E. Drewnoski, and S. L. Hansen, *Iowa State University, Ames*.

Feedlot cattle are often fed co-products from ethanol production that are rich in protein and energy but high in sulfur (S). Excess sulfate, when fed to ruminants, is reduced to sulfide by ruminal bacteria. Ruminal sulfide can be converted to hydrogen sulfide (H<sub>2</sub>S) in a pH dependent process. Elevated ruminal H<sub>2</sub>S has been correlated to S toxicity. The objective of this study was to determine the effect of feeding 5 dietary concentrations of NDF from chopped brome grass hay (66% NDF) on cattle performance, rumen pH, and H<sub>2</sub>S concentration of steers fed a high S diet. One hundred fifty steers (359 ± 4.9 kg) were fed 1 of 5 diets that included 3.5, 5.7, 7.9, 10.1, or 11.4% added roughage NDF (rNDF) from brome grass hay and contained 0.5% dietary S, from a combination of distillers grains and condensed corn solubles. In all diets hay was added at the expense of corn. Steers were blocked by weight into pens of 5 and then randomly assigned within block to 1 of the 5 treatments (n = 6 pens per treatment). Effective NDF was linearly increased ( $P < 0.01$ ) with increased inclusion of rNDF. The addition of roughage did not appear to negatively affect cattle performance as ADG did not differ ( $P = 0.55$ ) between treatments (2.01 ± 0.05 kg/d). Intake linearly increased ( $P = 0.02$ ) with the increased inclusion of rNDF and gain to feed was linearly decreased ( $P = 0.01$ ) with the increased inclusion of rNDF. At 6 h post-feeding ruminal H<sub>2</sub>S concentrations were linearly decreased ( $P < 0.01$ ; 7365, 6290, 5568, 5148, and 4528 ppm for 3.5, 5.7, 7.9, 10.1, and 11.4% rNDF, respectively) and pH was linearly increased ( $P < 0.01$ ; 5.48, 5.64, 5.75, 5.75 and 5.79 for 3.5, 5.7, 7.9, 10.1, and 11.4% rNDF, respectively) by the increased inclusion of rNDF. Ruminal pH and H<sub>2</sub>S data were negatively correlated ( $R = -0.48$ ;  $P < 0.01$ ). The results of this study suggest that inclusion of hay up to 11.4% rNDF will not decrease cattle gain and will manage the ruminal pH and decrease H<sub>2</sub>S concentrations, thus reducing the risk of S toxicity.

**Key Words:** cattle, roughage, sulfur

**405 Effects of method of forage finishing and cattle breed on growth performance, carcass characteristics, meat quality, and fatty acid composition.** L. Shepherd\*<sup>1</sup>, R. Berthiaume<sup>2</sup>, C. Lafreniere<sup>3</sup>, C. Campbell<sup>1</sup>, L. Pivotto<sup>1</sup>, and I. Mandell<sup>1</sup>, <sup>1</sup>*Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*, <sup>2</sup>*Agriculture & Agri-Food Canada, Sherbrooke, QC, Canada*, <sup>3</sup>*Agriculture & Agri-Food Canada, Kapuskasing, ON, Canada*.

Three methods of forage finishing (pasture, silage, hay) were used to evaluate growth performance, carcass traits, meat quality, and fatty acid composition relative to a grain finished product. 100 Angus (AN) and 100 Hereford (HE) steers were allocated to 2 research stations (each station feeding 50 head from each breed), with one location evaluating alfalfa (Alf) forages while the other station evaluated grass forages.

Regardless of location, growth performance (total gain, average daily gain, feed:gain) and carcass traits (hot carcass weight (HCW), backfat depth) were greater ( $P < 0.03$ ) for cattle fed a high grain (HG) diet vs. forage finishing. Feeding the HG diet decreased ( $P < 0.03$ ) lean yield vs. forage finishing. Within forage treatments, gains were greater ( $P < 0.03$ ) for pasture vs. conserved forages due to poor nutritional quality for the hays at either location. Carcass traits were similar ( $P > 0.40$ ) across method of forage finishing Alf, apart from lower ( $P < 0.09$ ) HCW for conserved forages vs. pasture finishing. Carcass traits were similar ( $P > 0.19$ ) between grass pasture- and grass silage-fed cattle, while no steers fed grass hay were slaughtered due to poor performance. A trained taste panel found HG beef to be more tender ( $P < 0.09$ ) vs. cattle fed Alf and numerically more tender ( $P > 0.12$ ) vs. cattle fed grass forages. Forage finished beef (Alf or grass) had less beef flavor ( $P < 0.02$ ) and increased off flavor ( $P < 0.01$ ) vs. HG beef. Palatability traits were generally similar across method of forage finishing. Omega 3 fatty acids and PUFA were greater ( $P < 0.001$ ) in forage finished vs. HG beef. Linolenic acid content was higher ( $P < 0.013$ ) in grass and Alf finished beef vs. HG beef. Generally, no breed differences existed in palatability traits at either location. Linolenic acid levels were greater ( $P < 0.001$ ) in beef from cattle fed conserved Alf vs. Alf pasture. While palatability traits may be similar regardless of method of forage finishing, differences in fatty acid levels across method of forage finishing may affect nutrient composition claims about grass-fed beef.

**Key Words:** beef cattle, forage finishing, palatability traits

**406 Evaluation of weight gain pattern between 7 and 18 months of age of Hereford heifers and reproductive performance when mated at 18 months of age.** J. B. G. Costa Junior<sup>\*1</sup>, J. O. J. Barcellos<sup>1</sup>, J. C. Whittier<sup>2</sup>, I. D. P. S. Diaz<sup>3</sup>, L. Canellas<sup>1</sup>, V. Peripolli<sup>1</sup>, J. K. Ahola<sup>2</sup>, and R. K. Peel<sup>2</sup>, <sup>1</sup>Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil, <sup>2</sup>Colorado State University, Fort Collins, <sup>3</sup>Universidade Estadual Paulista, Jaboticabal, Sao Paulo, Brazil.

The objective of this study was to evaluate the average ADG, BW, rump fat thickness (RFT) and pregnancy rate in Hereford heifers at 18 mo of age originated from a commercial cattle herd at a facility in state Rio Grande do Sul, Brazil. Three different levels of ADG (high - H, moderate - M and low - L) with 3 different combinations (LHM; HLL; MMH) were considered. These ADG levels were applied between 7 to 12 mo (P12); 12 to 15 mo (P15) and 15 to 18 mo of age (P18). The heifers were mated by natural service without synchronization of estrus for 60 d. Used to the LHM, MMH, and HLL treatments 65, 58, and 60 heifers respectively. The overall pattern of gain during the study period was different for each treatment. The animals had the same initial (171 kg) and final (312 kg) BW. The heifers submitted to the HLL treatment presented higher gains than the rest ( $P = 0.09$ ). These animals probably presented compensatory growth. The heifers in MMH treatment, which had the highest BW at 12 mo of age, also had higher pregnancy rate than the heifers in LHM treatment. At the beginning of mating BW was similar between both MMH and LHM treatments. The combination of the BW gain in the winter (19.5 kg during 148 d or ADG of 0.131 kg/d) allowed compensatory gain in the spring and high BW gain before mating which were the factors that determined the highest pregnancy rate (94.8%) in heifers of the MMH treatment. The MMH treatment also had the highest BW (315 kg) at the end of post-weaning period. At the beginning of the mating, the RFT was different among the treatments. The pregnancy percentage was higher for heifers of the MMH treatment, which had higher RFT associated with the intermediary BW gain at the beginning of the experimental period P12. The RFT at

the beginning of the mating did not differ among heifers in the MMH and LHM treatments (2.19 and 1.96mm, respectively) and heifers in the HLL treatment (1.53mm) it was low, ( $P < 0.05$ ) indicating that the backfat thickness at the mating was accumulated lately during the rearing and the fat precociously deposited during P12 could be mobilized. Considering the observed results, the MMH sequence of body weight gain between the 7 and 18 mo of age increased the pregnancy rate and the RTF of heifers mated at the age of 18 mo.

**Key Words:** body weight, pregnancy rate, rump fat thickness

**407 Evaluation of feed efficiency and feeding behavior traits in performance tested bulls.** J. G. Moreno<sup>\*1</sup>, G. E. Carstens<sup>1</sup>, D. Crews Jr.<sup>2</sup>, L. O. Tedeschi<sup>1</sup>, L. R. McDonald<sup>3</sup>, and S. Williams<sup>3</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Colorado State University, Fort Collins, <sup>3</sup>Midland Bull Test, Columbus, MT.

Objectives of this study were to characterize feed efficiency traits and examine phenotypic relationships with feeding behavior traits in bulls. Performance, feed intake and feeding behavior traits were measured in bulls ( $n = 5,073$ ) representing 11 breeds (3,335 Angus). Intake and feeding behavior traits were measured for 70 d using a GrowSafe system while fed a corn silage based diet (ME = 2.42 Mcal/kg DM). BW was measured at 14-d intervals. Residual feed intake (RFI) was calculated as the difference between actual DMI and that expected from regression of DMI on mid-test BW<sup>0.75</sup> (MBW) and ADG, and residual gain (RG) as the difference between actual ADG and that expected from regression of ADG on MBW and DMI. Both models included fixed effects of trial ( $n = 12$ ) and breed. A 2-population distribution model was fit to log<sub>10</sub>-transformed interval lengths between bunk visit events to estimate meal criterion, and compute meal traits. As expected, RFI was correlated with DMI ( $r = 0.52$ ,  $P < 0.0001$ ) but not MBW or ADG, whereas, RG was correlated with ADG ( $r = 0.72$ ,  $P < 0.0001$ ) but not MBW or DMI. RFI was positively correlated with F:G ( $r = 0.35$ ,  $P < 0.0001$ ) and negatively correlated with RG ( $r = -0.44$ ,  $P < 0.0001$ ). Initial BW was weakly correlated with F:G ( $r = 0.15$ ,  $P < 0.0001$ ) and RG ( $r = -0.11$ ,  $P < 0.0001$ ) but not RFI, indicating that lighter bulls were more efficient based on F:G and RG. Feeding bout (FB) frequency and duration were correlated with RFI ( $r = 0.30$ ,  $0.26$ ;  $P < 0.001$ ), but were not significant or weakly correlated ( $r < 0.10$ ) with RG and F:G. Meal criterion and duration were both correlated ( $r = -0.07$ ,  $0.18$ ;  $P < 0.0001$ ) with RFI, but not with RG or F:G. Bulls with low RFI spent less time at the feed bunk (118 vs 133 ± 0.80 min/d) and had fewer FB events (75 vs 89 ± 0.6 events/d) than high-RFI bulls. Low-RFI bulls had longer ( $P < 0.001$ ) meal criterion (11.3 vs 10.6 ± 0.2 min) indicating they took longer to initiate new meals, and had longer meal durations (216 vs 233 ± 1 min/d) than high-RFI bulls. Bulls have distinctive feeding behavior patterns that contribute to between-animal variation in RFI. However, feeding behavior traits were not associated with between-animal variance in F:G or RG.

**Key Words:** feeding behavior, residual feed intake, residual gain

**408 Ergot alkaloids decrease rumen epithelial blood flow.** A. P. Foote<sup>\*1</sup>, N. B. Kristensen<sup>2</sup>, J. L. Klotz<sup>3</sup>, D. H. Kim<sup>1</sup>, A. F. Koontz<sup>1</sup>, K. R. McLeod<sup>1</sup>, L. P. Bush<sup>1</sup>, and D. L. Harmon<sup>1</sup>, <sup>1</sup>University of Kentucky, Lexington, <sup>2</sup>Syddansk Kvæg, Vojens, Denmark, <sup>3</sup>USDA-ARS, FAPRU, Lexington, KY.

Ergot alkaloids induce vasoconstriction of peripheral and core body vasculature resulting in altered blood flow. An experiment was conducted to determine if ergot alkaloids affect blood flow to the absorptive surface

of the rumen. Steers ( $n = 8$ ) were pair-fed alfalfa cubes at  $1.5 \times \text{NE}_m$  and received ground endophyte-infected tall fescue seed (E+;  $0.015 \text{ mg ergovaline} \cdot \text{kg BW}^{-1} \cdot \text{d}^{-1}$ ) or endophyte-free tall fescue seed (E-) via rumen cannula  $2 \times$  daily for 7 d at thermoneutral (TN;  $21^\circ\text{C}$ ) and heat stress (HS;  $32^\circ\text{C}$ ) conditions. On d 8 the rumen was emptied and rinsed with tap water and saline. Buffer containing VFA was incubated in the following sequence: control (CON),  $0.015 \text{ mg ergovaline/kg BW}$  ( $1 \times \text{EXT}$ ), and  $0.045 \text{ mg ergovaline/kg BW}$  ( $3 \times \text{EXT}$ ). Ergovaline in the buffer was supplied as a seed extract solubilized in methanol. For each buffer treatment there were 2 30-min incubations; a 30 min incubation of a treatment buffer with no sampling followed by removal of the buffer and incubation of an identical sampling buffer with the addition of Cr-EDTA and  $\text{D}_2\text{O}$ . Epithelial blood flow was estimated as ruminal clearance of  $\text{D}_2\text{O}$  corrected for influx of physiological water and liquid outflow. Feed intake data was analyzed as a CRD. Blood flow data was analyzed as a split plot with a whole plot factorial of seed and temperature and buffer treatment was the subplot factor using a mixed model. Feed intake decreased with dosing E+ at HS but not at TN ( $P = 0.016$ ). Seed treatment did not affect rumen epithelial blood flow ( $P = 0.73$ ). Inclusion of the seed extract in the buffer caused a 50% reduction in epithelial blood flow ( $P < 0.0001$ ) but there was no difference between  $1 \times \text{EXT}$  and  $3 \times \text{EXT}$  ( $P = 0.53$ ). The  $3 \times \text{EXT}$  tended to reduce blood flow more at TN than HS ( $P = 0.11$ ). Chronic exposure to ergot alkaloids through dosing steers with E+ seed did not alter rumen epithelial blood flow. However acute exposure through inclusion of ergot alkaloids in the washed rumen buffer did decrease rumen epithelial blood flow indicating that gut vasculature responds to acute alkaloid exposure and nutrient absorption could be decreased.

**Key Words:** blood flow, washed reticulorumen

**409 Feeding distillers grains as an energy source to gestating and lactating beef heifers: Effect on feedlot performance, carcass characteristics, and glucose tolerance of steer progeny.** P. J. Gunn<sup>\*1</sup>, G. A. Bridges<sup>2</sup>, R. P. Lemenager<sup>1</sup>, and J. P. Schoonmaker<sup>1</sup>, <sup>1</sup>Department of Animal Sciences, Purdue University, West Lafayette, IN, <sup>2</sup>North Central Research and Outreach Center, University of Minnesota, Grand Rapids.

Angus-cross beef heifers pregnant to a single sire ( $n = 80$ ) were used to assess the effects of feeding dried distiller's grains with solubles (DDGS) as an energy source during late gestation and early lactation on feedlot performance, carcass characteristics, and glucose tolerance of male progeny. From 192 d of gestation through  $118 \pm 0.2$  d of lactation, dams were fed either a control diet of corn silage and haylage (CON; 10% CP prepartum; 11.8% CP postpartum) or corn stover and DDGS (DG; DDGS at 1.2% BW per d; 15.7% CP) diet. Male progeny ( $n = 36$ ) were weaned, commingled, and started on a step-up diet at  $186 \pm 0.2$  d of age. At  $210 \pm 0.2$  d of age, steers were placed in individual pens and fed a diet devoid of DDGS (12.7% CP, 1.36 kcal/kg NEg on DM basis) once daily for ad libitum consumption. Steer weights and back fat measurements via ultrasound were recorded on 21-d intervals. At  $520 \pm 38$  kg, a subsample of 20 steers was selected for intravenous glucose tolerance testing (IVGTT). Steers were harvested at a common 12th rib fat depth of  $1.41 \pm 0.22$  cm. Carcass characteristics were determined following

a 72-h chill. Categorical and continuous data were analyzed with the GLIMMIX and MIXED procedures of SAS, respectively. Weaning wt, feedlot entry wt, slaughter wt, slaughter frame score, days on feed, and feedlot performance parameters including ADG, DMI, and G:F did not differ due to maternal diet ( $P \geq 0.11$ ). Steer IVGTT parameters including fasted, average, and peak glucose and insulin concentrations, and area under the curve did not differ ( $P \geq 0.24$ ) between treatments. Furthermore, HCW, back fat, LM area, KPH, yield grade, marbling score, quality grade, and proportion of Certified Angus Beef carcasses did not differ ( $P \geq 0.18$ ) between treatments. Dressing percent, however, tended to be greater ( $P = 0.08$ ) in DG (59.2%) than CON (58.5%) progeny. In summary, feeding DG at 1.2% of BW per d to first-parity heifers did not affect post-weaning performance, carcass characteristics or glucose tolerance of steer progeny.

**Key Words:** DDGS, developmental programming, steer

**410 Effects of roughage concentration in dry-rolled corn-based diets containing wet distillers grains with solubles on performance and carcass characteristics of finishing beef steers.** K. E. Hales\* and H. C. Freetly, USDA, ARS, US Meat Animal Research Center, Clay Center, NE.

Distillers grains and distillers solubles are by-products of grain fermentation used to produce ethanol and contain relatively high concentrations of NDF and ADF compared with other grains and concentrates it replaces in feedlot diets. Typical finishing diets in the US contain 8.3 and 9.0% roughage in the summer and winter months, respectively. Therefore, it is plausible that the dietary concentration of roughage can be altered when distillers grains are included in feedlot diets. The effects of roughage concentration in dry-rolled corn-based diets containing wet distillers grains with solubles (WDGS) were evaluated in MARC II steers ( $n = 128$ , initial BW =  $339 \pm 6.51$  kg) using Calan gates. Diets consisted of 25% WDGS and the balance being dry-rolled corn and coarsely ground alfalfa hay (AH) replacing corn at 2 (AH-2), 6 (AH-6), 10 (AH-10), and 14% (AH-14) of dietary dry matter. Daily feed offered was recorded, feed refusals were measured weekly, and BW was measured on d 0, 1, 35, 70, 105, 140, 174, and 175. At harvest, camera data were collected. The data were analyzed using the Mixed procedure of SAS. The fixed effect of treatment was included in the model. Decreasing concentrations of AH in the finishing diet resulted in no differences in final BW ( $P = 0.18$ ), but a tendency for ADG ( $P = 0.06$ ) to be greater when steers were fed intermediate concentrations of AH (6 and 10%) than AH-2 and AH-14. Steers consuming AH-2 had a lower DMI ( $P = 0.04$ ) than steers consuming AH-6, AH-10, or AH-14; whereas, G:F was greater for steers consuming AH-2, AH-6, and AH-10 than AH-14 ( $P < 0.01$ ). Concentration of AH in the finishing diet did not affect HCW, LM area, marbling score, or the proportion of cattle grading USDA choice ( $P \geq 0.32$ ); however, dressing percent was greater for steers fed AH-2 and AH-14 than AH-6 and AH-10 ( $P = 0.04$ ). Results indicate that decreasing AH to 2% in a finishing diet based on dry-rolled corn with WDGS may not affect ADG, but does decrease DMI which results in an increased G:F. USDA is an equal opportunity provider and employer.

**Key Words:** cattle, distillers grains, roughage