

## Ruminant Nutrition: Beef Co-Products

**786 Performance by feedlot cattle fed varying proportions and amounts of lime treated crop residues and distillers grains as substitutes for corn grain.** A. L. Shreck\*<sup>1</sup>, C. J. Schneider<sup>1</sup>, B. L. Nuttelman<sup>1</sup>, D. B. Burken<sup>1</sup>, G. E. Erickson<sup>1</sup>, T. J. Klopfenstein<sup>1</sup>, and M. J. Cecava<sup>2</sup>, <sup>1</sup>University of Nebraska-Lincoln, Lincoln, <sup>2</sup>Archer Daniels Midland, Decatur, IL.

The objective of this experiment was to displace graded amounts of dry-rolled corn (DRC) with varying ratios of distillers grains and lime-treated crop residues (DGCR). Linear and quadratic effects of DRC displacement within ratio of DGCR were tested. Sixty individually fed steers (Initial BW: 402 ± 31.3 kg) were assigned randomly to 10 treatments (6 steers/ treatment) and blocked (20 steers/block) based on initial BW. Treatments were 2 ratios of DGCR, 2 types of treated crop residue, and 3 DRC concentrations in the diet (10%, 25%, 40%; DM basis). The DGCR replaced corn and consisted of 2:1 or 3:1 ratios of modified distillers grains plus solubles (MDGS) and treated corn stover or a 3:1 ratio of MDGS and treated wheat straw. The control diet contained 35% MDGS, 5% untreated corn stover, and 56% DRC. All diets contained 4% supplement. Corn stover and wheat straw were ground (76 mm screen) and treated with 5% CaO (DM basis) at 50% DM and stored anaerobically. Increasing DRC quadratically increased ( $P = 0.06$ ) DMI within the 3:1 straw diets. When comparing 3:1 treated stover and straw, DMI tended ( $P = 0.10$ ) to interact across corn amount with DMI decreasing for treated stover and increasing for treated straw with increasing corn level. Carcass adjusted final BW tended ( $P = 0.10$ ) to quadratically increase and G:F ( $P = 0.06$ ) quadratically increased as corn amount increased in 3:1 stover diets. Increasing corn amount increased ( $P = 0.07$ ) G:F in treated stover diets, regardless of ratio. Increasing corn level tended to increase ( $P = 0.10$ ) ADG and increased ( $P = 0.01$ ) 12th rib fat for 3:1 ratios. Cattle fed diets containing at least 25% corn and 3:1 ratios of distillers grains and lime-treated crop residues can achieve similar efficiency and carcass merit compared with cattle fed diets containing 5% roughage and 56% corn.

**Key Words:** alkaline treatment, corn, grain replacement

**787 Comparing wet and dry distillers grains plus solubles for yearling finishing cattle.** B. L. Nuttelman,\* D. B. Burken, C. J. Schneider, G. E. Erickson, and T. J. Klopfenstein, *University of Nebraska-Lincoln, Lincoln.*

A finishing trial was conducted to compare the effects of drying distillers grains plus solubles (DGS) produced from the dry milling process. Yearling, crossbred steers ( $n = 171$ ; 362 ± 30 kg) were utilized in a randomized complete block design, stratified within block, and then randomly assigned to one of 21 pens (8 or 9 steers/pen). Pens were assigned randomly to one of 3 treatments (7 replications/treatment) that consisted of: 1) corn-based control (CON); 2) wet distillers grains plus solubles (WDGS, 34.6% DM); and dried distillers grains plus solubles (DDGS, 88.2% DM). Distillers grains plus solubles were included at 35% of the diet DM and replaced a 1:1 blend (DM basis) of high-moisture and dry-rolled corn which was the same blend in CON. Grass hay and dry supplement were included at 7.5% and 5.0% of diet (DM), respectively in all diets. Additional fat was not added to CON, and therefore diets including DGS contained more fat than CON. All diets were formulated to contain a minimum of 13% CP. Steers were fed for 148 d. Final BW for WDGS and DDGS (679 and 675 kg, respectively) was greater than

CON (646 kg;  $P < 0.01$ ). Daily gain increased 0.23 and 0.20 kg/d for WDGS and DDGS, respectively when compared with CON (2.11, 2.08, and 1.88 kg, respectively;  $P < 0.01$ ). Dry matter intake was not different ( $P = 0.33$ ) between CON, WDGS, and DDGS (12.9, 13.1, and 13.3 kg/d, respectively). Cattle fed WDGS had greater G:F than DDGS and CON steers (0.162, 0.157, and 0.146, respectively;  $P < 0.01$ ), and DDGS steers were more efficient than CON ( $i > P < 0.01$ ). Cattle fed either distillers grains gained more, and thus had heavier HCW ( $P < 0.01$ ). There were no differences for 12th rib fat, marbling score, or LM area ( $P > 0.09$ ). Using G:F values, a 31.3 and 21.5% improvement above CON was calculated for WDGS and DDGS at 35% inclusion, respectively. Using the same calculations, WDGS was determined to have a 9.1% greater feeding value than DDGS. Similar to previous work, feeding DGS improves gain and efficiency compared with corn based diets, and WDGS has greater energy than DDGS.

**Key Words:** distillers grains, energy value, finishing cattle

**788 Performance of cattle fed diets based on blended by-product pellets varying in rumen available energy and protein content.** M. G. Zenobi\*<sup>1</sup>, P. Yu<sup>1</sup>, D. A. Christensen<sup>1</sup>, P. G. Jefferson<sup>1,2</sup>, H. A. Lardner<sup>1,2</sup>, and J. J. McKinnon<sup>1</sup>, <sup>1</sup>University of Saskatchewan, Saskatoon, SK, Canada, <sup>2</sup>Western Beef Development Centre, Humboldt, SK, Canada.

Two trials were conducted to evaluate the performance of growing cattle fed blended by-product pellets. Pellets were based on by-products from the oilseed and grain sectors and were formulated to be isonitrogenous (17.0% CP) and isocaloric (1.92 and 1.28 Mcal/kg NE<sub>m</sub> and NE<sub>g</sub>, respectively). In trial 1, 4 pellets were evaluated. The pellets were formulated to be either high starch (HS 45% DM basis) or high fat (HF 8.8% DM basis) and either low or high in soluble protein (LSP 27% of CP; HSP 37% of CP DM basis). In trial 2, only the 2 HF pellets were evaluated. In trial 1, 300 cross-bred steers (320 ± 19.6 kg, mean ± SD) were randomly assigned to one of 25 pens and fed one of 5 diets in a completely randomized block design. The control diet consisted of 46.9% forage and 53.1% barley-based concentrate. The 4 treatment diets consisted of 48.4% forage and 51.6% blended pellets (DM basis). All diets were formulated to 1.63 and 1.02 Mcal/kg NE<sub>m</sub> and NE<sub>g</sub>, respectively (DM basis). In trial 2, 180 cross-bred steers (326 ± 0.2 kg) were randomly assigned to one of 15 pens with each pen randomly assigned to one of 3 treatments in a completely randomized design. Treatments included a barley-based control and the 2 HF pellets from trial 1. In trial 1, no ( $P = 0.36$ ) effect of treatment was observed on ADG, however, DMI was reduced ( $P \leq 0.01$ ) with the HS LSP treatment and was highest ( $P \leq 0.01$ ) for the HF HSP treatment. Gain:feed (G:F) was poorest ( $P \leq 0.01$ ) for the HF HSP diet. In Trial 2, no effect of treatment was observed on ADG ( $P = 0.80$ ) or DMI ( $P = 0.06$ ), however cattle fed the barley-based control diet had the highest ( $P \leq 0.01$ ) G:F ratio. Relative to the control diet, the calculated NE<sub>g</sub> content (Mcal/kg DM) was 8.7% lower ( $P \leq 0.01$ ) for the HF HSP treatment in trial 1 and 6.7% lower ( $P \leq 0.01$ ) for both HF treatments in trial 2. The results indicate that blended by-product pellets can be a viable alternative for supplementing energy and protein in backgrounding diets. Caution needs to be exercised when feeding HF pellets due to poorer G:F ratios and potential negative impacts on cost of gain.

**Key Words:** blended by-product pellets, fat, growing cattle

**789 Replacement of grazed forage and animal performance with distillers grains supplementation in a forage system.** K. L. Gillespie,\* T. J. Klopfenstein, B. L. Nuttelman, C. J. Schneider, J. D. Volesky, and G. E. Erickson, *University of Nebraska, Lincoln*.

A beef systems study was conducted to determine optimal time within a forage system to supplement distillers grains, and feedlot performance relationship to supplementation. A completely randomized design with a  $2 \times 2$  factorial arrangement was used. Spayed heifer calves ( $n = 203$ ,  $BW = 205 \pm 23$  kg) grazed corn residue 138 d and brome grass 29 d (WTR), native Sandhills range 128 d (SMR), and were finished on a common diet. Factorial treatments were 0.91-kg DM wet distillers grains with solubles (WDGS) (LO) or 2.3-kg DM WDGS (HI) supplement on corn residue, and modified distillers grains with solubles (MDGS) fed at 0.6% BW daily (SUP) or no MDGS (NO) during SMR. Available SMR grazing acres for SUP were 17% less than NO based on past research. Winter ADG was greater for HI cattle at 0.62 kg than LO at 0.31 kg ( $P < 0.01$ ). Summer SUP ADG at 0.82 kg was greater than NO at 0.58 kg ( $P < 0.01$ ). System gains included total WTR and SMR gains and were greatest among treatments for HI, SUP at 0.66 kg ( $P < 0.01$ ). HI, NO and LO, SUP had a greater system ADG than LO, NO ( $P < 0.01$ ). There were no differences in system ADG of HI, NO at 0.59 kg and LO, SUP at 0.57 kg ( $P = 0.09$ ). Of all treatments, LO, NO had the lowest system gain at 0.47 kg ( $P < 0.01$ ). There was no system gain interaction between WTR and SMR treatments ( $P = 0.14$ ). Factorial treatments were maintained through finishing with 2 replications per treatment. Cattle were serially slaughtered and performance data adjusted to 1.32 cm BF. With SMR supplementation, feedlot ADG decreased ( $P = 0.02$ ). Feedlot ADG for HI, NO and LO, NO were 1.8 kg and 1.7 kg, respectively, and for HI, SUP and LO, SUP were 1.6 kg and 1.5 kg, respectively. There were no significant DMI treatment differences. Summer SUP decreased G:F ( $P = 0.005$ ) with HI, NO and LO, NO at 0.144 and 0.140, respectively, and HI, SUP and LO, SUP at 0.132 and 0.128, respectively. Higher WTR supplementation positively affected HCW ( $P = 0.004$ ) with HI, NO and HI, SUP at 382.3 kg and 369.0 kg, respectively, and LO, SUP and LO, NO at 355.3 kg and 350.8 kg, respectively. Gains increased with higher WTR WDGS level and SMR MDGS supplementation, due to additional energy or undegradable intake protein supplied. System gains were highest for HI, SUP, intermediate for HI, NO and LO, SUP, and lowest for LO, NO. Winter supplementation increased HCW, and SMR supplementation decreased feedlot ADG and G:F, and no winter by summer treatment interactions were observed.

**Key Words:** beef cattle, distillers, supplement

**790 Flint corn grain processing and increasing levels of citrus pulp in finishing diets for Nellore bulls.** V. N. Gouvea<sup>1</sup>, L. J. Chagas<sup>1</sup>, J. Souza<sup>1</sup>, F. Batistel<sup>1</sup>, C. Sitta<sup>1</sup>, P. R. B. Campanili<sup>1</sup>, D. B. Galvani<sup>2</sup>, and F. A. P. Santos\*<sup>1</sup>, <sup>1</sup>University of São Paulo, Piracicaba, SP, Brazil, <sup>2</sup>EMBRAPA Goats and Sheep, Sobral, CE, Brazil.

The effects of flint corn processing (steam flaking, 310g/l vs. grinding, 1.3 mm GMD) and the partial replacement of corn with citrus pulp (0, 25, 50 or 75%) in feedlot diets were evaluated. A total of 216 Nellore bulls (IBW 350 kg) were allotted to 40 pens and used in a randomized complete block design with a  $2 \times 4$  factorial arrangement of treatments (SF100:CIT0; SF75:CIT25; SF50:CIT50; SF25:CIT75; GC100:CIT0; GC75:CIT25; GC50:CIT50; GC25:CIT75) for 103 d. The diets contained (% DM) 12% sugar cane bagasse and 88% concentrate. Data were analyzed using mixed procedure of SAS with pens as experimental units. For DMI, ADG, G/F and observed  $NE_g$  the effects of grain processing, the effects of citrus pulp inclusion in the diets and interactions

were significant ( $P < 0.01$ ). All the diets containing SFC presented less DMI than the GC75:CIT25 and the GC50:CIT50 diets. Citrus pulp had no effect on DMI of the SFC diets, however it increased DMI when it replaced up to 50% of the GC ( $P < 0.01$ ). Inclusion of CIT decreased ADG in the SFC diets (1.80; 1.52; 1.70; 1.58 kg/head) and it increased ADG in the GC diets (1.60; 1.74; 1.85; 1.70 kg/head). The greatest G/F was observed for Nellore cattle fed the SF100:CIT0 diet followed by the SF50:CIT50 diet. Inclusion of citrus pulp decreased G/F of cattle fed SFC (0.222; 0.190; 0.200; 0.184) and had no effect for cattle fed GC diets (0.180; 0.176; 0.180; 0.186). Diet  $NE_g$  was greater for SFC diets (1.73; 1.51; 1.56; 1.45 Mcal/kg DM) than for GC diets (1.42; 1.37; 1.39; 1.44 Mcal/kg DM), with a negative effect of CIT in the SFC diets. Fat thickness was greater for GC than for SFC diets (4.4 mm vs. 5.0 mm). When CIT replaced up to 50% of corn in the diets fecal starch was less for SFC diets than for GC diets (2.0% vs. 9.3%). In conclusion, SFC increases diet  $NE_g$  for Nellore cattle fed high concentrate diets compared with ground corn. Citrus pulp decreases  $NE_g$  in SFC diets and has no negative effects on ground corn diets  $NE_g$  for Nellore cattle.

**Key Words:** citrus pulp, feedlot, grain processing

**791 Evaluation of rumen metabolism and digestibility when treated crop residues are fed in cattle finishing diets.** A. L. Shreck\*<sup>1</sup>, J. L. Harding<sup>1</sup>, G. E. Erickson<sup>1</sup>, T. J. Klopfenstein<sup>1</sup>, and M. J. Cecava<sup>2</sup>, <sup>1</sup>University of Nebraska-Lincoln, Lincoln, <sup>2</sup>Archer Daniels Midland, Decatur, IL.

Five rumen fistulated steers were used in an incomplete  $5 \times 7$  Latin square design. A  $2 \times 3 + 1$  factorial arrangement of treatments was used. One factor was crop residue type (corn cobs, wheat straw, corn stover) and the other factor was degree of processing. For processing, residues were ground but not treated or ground and treated with 5% CaO (lime) at 50% moisture and stored anaerobically. All diets contained 40% wet distillers grains plus solubles and 4% supplement (DM basis). Residues replaced DRC at 25% of the diet (DM basis). The control diet contained 10% roughage (equal cobs, straw, and stover) and 46% DRC. An interaction ( $P = 0.06$ ) was observed for acetate:propionate (C2:C3) ratio. Treatment of cobs (3.1 vs 2.6) and corn stover (2.9 vs 2.6) increased C2:C3 but treatment of wheat straw increased propionate which decreased C2:C3 (2.4 vs 2.6). No difference ( $P > 0.10$ ) was observed for treated straw or stover compared with control (2.6) for C2:C3. An interaction was noted for average ruminal pH because compared with untreated forms, treated cobs (6.52 vs 6.38) and stover (6.23 vs 5.95) had greater pH but treated straw (5.81) had lower ( $P = 0.08$ ) pH compared with untreated (6.05). Greater DM (73.7 vs 66.1%;  $P = 0.001$ ), OM (77.0 vs 68.5%;  $P = 0.001$ ), lipid (89.2 vs 85.2;  $P = 0.02$ ) and NDF (66.8 vs 51.5%;  $P < 0.001$ ) digestibility were noted when diets contained treated compared with untreated residues. However, no difference ( $P > 0.10$ ) was observed between control and treated diets for DM (70.7 vs 73.7%) or OM (72.1 vs 76.9%) digestibility. Similar DMI was noted for treated and untreated ( $P = 0.38$ ) diets but lower ( $P = 0.001$ ) NDF intake was observed for treated diets (3.1 vs 3.5 kg/d), suggesting that CaO treatment partially solubilized NDF thereby decreasing measurable NDF intake. Results suggest that treated crop residues can substitute a portion of grain in feedlot diets and result in similar nutrient supply to the animal. The improvements in digestibility when treated residues are fed compared with untreated residues are related to fiber solubilization and improved fiber digestibility.

**Key Words:** alkaline treatment, crop residues, grain replacement

**792 Effects of alternate feeding of dried distillers grains plus solubles on performance and body composition in gestating forage-fed beef cows.** S. I. Klein,\* P. L. Steichen, A. Islas, R. S. Goulart, T. C. Gilbery, and C. R. Dahlen, *Department of Animal Sciences, North Dakota State University, Fargo.*

Forty-six nonlactating, gestating beef cows were used to examine effects of feeding either dried distiller's grains plus solubles (DG) or grass hay on alternate days during mid-late gestation on intake, BW, ADG, G:F, and ultrasound carcass characteristics. Cows were arranged in a completely randomized design and dietary treatments included: 1) ad libitum hay daily (CON; n = 12); 2) hay and 0.4% BW DG daily (DG7; n = 12); 3) hay daily and 0.93% BW DG on Monday, Wednesday, and Friday (DG3; n = 11); and 4) hay only on Tuesday, Thursday, Saturday, and Sunday and 0.93% BW DG only on Monday, Wednesday, and Friday (DGA; n = 11). Cows were fed diets for 84 d with BW and carcass ultrasound data collected every 28 d. Feed intake was continuously monitored and intake data collected daily using the Insentec B. V. roughage intake control feeding system. Hay intake was greatest ( $P < 0.01$ ) in CON ( $15.5 \pm 1.0$  kg/d) and least ( $P < 0.01$ ) in DGA ( $10.6 \pm 1.0$  kg/d) with DG7 ( $13.6 \pm 1.0$  kg/d) and DG3 ( $12.7 \pm 1.0$  kg/d) being intermediate. By design DG intake was similar for DG7 ( $3.4 \pm 0.1$  kg/d), DG3 ( $3.3 \pm 0.1$  kg/d), and DGA ( $3.2 \pm 0.1$  kg/d). Total DMI was less ( $P < 0.01$ ) for DGA compared with all other treatments. Body weight was similar ( $P > 0.10$ ) among treatments at each weigh date, however a decrease ( $P < 0.01$ ) in ADG was observed for CON ( $0.34 \pm 0.06$  kg/d) compared with all other treatments (0.73, 0.75, and  $0.60 \pm 0.06$  kg/d for DG7, DG3, and DGA, respectively). Likewise, the G:F ratio was least ( $P < 0.01$ ) for CON compared with all other treatments ( $0.02 \pm 0.003$ ,  $0.04 \pm 0.003$ ,  $0.05 \pm 0.003$ , and  $0.04 \pm 0.003$  kg of gain/kg of feed for CON, DG7, DG3, and DGA, respectively). Change in REA from d 1 to d 84 was greater ( $P < 0.05$ ) in DG7 compared with all other treatments however there were no differences among treatments for intramuscular fat, rib fat, and rump fat throughout the trial. The feeding strategy DGA altered hay intake, total DMI, and REA, but did not alter other performance and carcass characteristics compared with other supplementation methods.

**Key Words:** beef cows, distillers grains, supplementation frequency

**793 Dry-rolled or whole shell corn with or without wet corn gluten feed in receiving diets.** A. V. Siverson\*<sup>1</sup>, S. P. Montgomery<sup>2,1</sup>, B. E. Oleen<sup>1</sup>, and D. A. Blasi<sup>1</sup>, <sup>1</sup>*Kansas State University, Manhattan*, <sup>2</sup>*Corn Belt Livestock Services, Cedar Rapids, IA.*

With historically high grain and cattle prices, reducing ration costs while maintaining health and performance is important for attaining profitability. Previous research indicates the use of whole shell corn in receiving diets allows for cheaper processing costs and has the added benefit of slowing starch fermentation enough to limit incidence of grain-induced acidosis. Wet corn gluten feed (WCGF) is a byproduct that can aid in controlling bloat by providing energy in the form of fermentable fiber and protein. Our objective was to determine whether corn processing with or without WCGF had any effect on growth and performance. Two hundred 79 crossbred calves (230 kg) were randomly assigned to 24 pens. Pens were randomly allocated to treatment sequence in a  $2 \times 2$  factorial completely randomized design. Treatments were a diet including 47% whole shelled corn (WSC), a diet including 29% whole shelled corn with 30% WCGF (BP WSC), a diet including 47% dry rolled corn (DRC), and a diet with 29% dry rolled corn with 30% WCGF (BP DRC). Diet percentages were recorded on a dry matter basis (DM). Data were analyzed using mixed models including the fixed effects of treatment and lot number while the random effects were lot  $\times$  treatment,

period, pen, and period  $\times$  pen interaction. The addition of WCGF had a positive effect on ending weight; they were significantly higher than the WSC or DRC diets alone ( $P = 0.03$ ). Daily gains for diets with WCGF were also higher ( $P = 0.04$ ), thus making overall weight gain on the BP WSC and BP DRC significantly better ( $P = 0.02$ ). There were no corn processing effects (all  $P \geq 0.34$ ). There was an apparent interaction between digestive upsets that required treatment and the DRC diet ( $P = 0.006$ ). However, this may be misleading due to the fact only 4 animals were treated for illness over the course of the study. Only one animal was treated for a digestive problem. There was no benefit seen to processing corn, but including WCGF at 30% (DM) increased gains and overall performance.

**Key Words:** receiving, whole shell corn, wet corn gluten

**794 Effect of dried distillers grains with solubles on enteric methane emissions and nitrogen excretion from finishing beef cattle.** M. Hünnerberg\*<sup>1,2</sup>, T. A. McAllister<sup>2</sup>, K. A. Beauchemin<sup>2</sup>, S. M. McGinn<sup>2</sup>, O. M. Harstad<sup>3</sup>, and E. K. Okine<sup>1</sup>, <sup>1</sup>*University of Alberta, Edmonton, AB, Canada*, <sup>2</sup>*Agriculture and Agri-Food Canada, Lethbridge, AB, Canada*, <sup>3</sup>*Norwegian University of Life Sciences, Norway.*

The objectives of this study were to examine the effect of corn- or wheat-based dried distillers grains with solubles (WDDGS, CDDGS) on enteric CH<sub>4</sub> emissions from finishing beef cattle, and to determine if any observed reductions were a result of the fat content of CDDGS. Another objective of this study was to compare the effect of CDDGS or WDDGS on N excretion. The experiment was designed as a replicated  $4 \times 4$  Latin square with 28-d periods using 16 ruminally fistulated cross-breed heifers ( $529.1$  kg  $\pm$  41.1). The control diet contained 87% barley grain, 8% barley silage and 5% supplement (DM basis). Treatment diets were formulated by replacing 40% of barley grain DM with CDDGS, WDDGS, or WDDGS+oil. Corn oil was added to WDDGS (3.4% fat DM) to achieve the same level of fat as CDDGS (9.7% DM). All diets were fed as total mixed rations once daily ad libitum. Total collection of urine and feces was conducted between d 18 and 21. Enteric CH<sub>4</sub> was measured between d 25 and 28 using 4 environmental chambers. Feeding WDDGS increased ( $P < 0.05$ ) CH<sub>4</sub> emissions as a percentage of gross energy intake (GEI) from 4.9 to 5.6% compared with the control. Heifers offered CDDGS (3.9% of GEI) or WDDGS+oil (4.2% of GEI) produced less ( $P < 0.05$ ) CH<sub>4</sub> than heifers fed the control diet. Emissions between CDDGS and WDDGS+oil did not differ ( $P > 0.15$ ). Excretion of N (as % of daily N intake) was greater ( $P < 0.05$ ) for CDDGS, WDDGS and WDDGS+oil (82.5, 82.6 and 83.0%) compared with the control diet (73.8%). Results suggest that feeding CDDGS or WDDGS+oil can mitigate enteric CH<sub>4</sub> emissions in finishing beef cattle. However, the potential contribution of increased N excretion to heightened nitrous oxide emissions would have to be considered in a life cycle analysis of greenhouse gases arising from the feedlot.

**Key Words:** methane, beef cattle, dried distillers grains with solubles

**795 Comparing the digestibility of wet and dry distillers grains plus solubles in cattle finishing diets.** B. L. Nuttelman,\* A. L. Shreck, J. L. Harding, G. E. Erickson, and T. J. Klopfenstein, *University of Nebraska-Lincoln, Lincoln.*

Twelve crossbred steers ( $525 \pm 34$  kg) were utilized in a 3-period crossover design to compare the digestion characteristics of wet and dry distillers grains plus solubles (DG) in finishing diets. Diets consisted of 40% of wet distillers grains plus solubles (WDGS, 34.1% DM) or dried distillers grains plus solubles (DDGS, 93.1% DM), or a corn control

(CON) containing no DG. Basal ingredients were dry-rolled corn, 7.5% alfalfa hay, and 5% dry supplement (DM basis) with DG replacing DRC. Molasses was included at 5% in the CON and DDGS diets to prevent sorting. Steers were adapted to diets for 14 d before the 5 d total fecal collection period. During the collection period, steers were individually tethered in stalls lined with rubber mats. Feces were collected and weighed daily at 0800 h and a composite was made by steer within collection period and analyzed to determine total tract nutrient digestibility. A duplicate sample was taken by day and dried for 48 h in a 60°C forced air oven to determine fecal DM output. There were no differences observed for DM or OM intake ( $P > 0.15$ ). The CON and WDGS treatments had greater ( $P < 0.03$ ) OM digestibility than DDGS diets (76.2, 73.0, and 67.3%, respectively), but were similar between CON and WDGS ( $P = 0.22$ ). Diets containing DG had greater NDF intake compared with CON ( $P < 0.01$ ). However, there were no differences for NDF digestibility between CON, WDGS, and DDGS (64.3, 62.0, and 58.4%, respectively;  $P = 0.28$ ). Fat intake was greater for DG diets ( $P < 0.01$ ), but fat digestibility was not different ( $P = 0.46$ ) between treatments. Previous literature suggests animal performance will be improved when WDGS is included up to 40% compared with corn-based diets, and that drying DG negatively affects the feed efficiency relative to WDGS. Results from this study suggest OM digestibility is negatively affected when DG is dried to produce DDGS. However, OM digestibility for WDGS and corn-based diets are similar in this study and do not explain the improved performance in finishing diets containing WDGS.

**Key Words:** digestibility, dried distillers grains plus solubles, wet distillers grains plus solubles

**796 The effects of titrating corn-based dried distillers grains plus solubles with sorghum-based wet distillers grains plus solubles on yearling heifers feedlot performance and carcass characteristics.** B. T. Johnson,\* C. L. Maxwell, B. K. Wilson, J. J. Wagner, C. J. Richards, and C. R. Krehbiel, *Oklahoma State University Department of Animal Science, Stillwater.*

This study compared performance and carcass effects of altering corn dried distillers grains plus solubles (DDGS) to sorghum-based wet distillers grains plus solubles (WDGS) ratios in a dry-rolled corn feedlot ration with 30% distillers grains plus solubles (DM basis). Yearling cross-bred heifers ( $n = 150$ ; initial BW  $383 \pm 28$  kg) were blocked by BW, implanted with Revalor H, stratified by hide color and randomized to treatment, and fed for 125 d. On d 98,  $330 \text{ mg} \cdot \text{hd}^{-1} \cdot \text{d}^{-1}$  of ractopamine hydrochloride (Optaflexx) was included into each treatment ration and fed the final 27 d of the finishing period. Combinations of distillers grains evaluated were: 30% DDGS (TRT1); 22.5% DDGS: 7.5% WDGS (TRT2); 15% DDGS:15%WDGS (TRT3); 7.5%DDGS:22.5%WDGS (TRT4); and 30% WDGS (TRT5). There were no differences ( $P > 0.54$ )

among treatments in overall ADG, G:F, and DMI. Between Treatments 1 and 5, DMI increased 3.3% ( $P = 0.05$ ) and G:F decreased 14.6% ( $P = 0.03$ ) from 57 to 84 d. No other differences were detected in HCW, dressing percentage, marbling score, KPH or USDA Yield grade. Data suggest that when fed at 30% of the finishing diet DM, corn DDGS and sorghum WDGS can be blended or exchanged with no effect on finishing performance or carcass characteristics. These data would serve as a useful tool when formulating least cost dry-rolled corn based rations.

**Key Words:** beef heifers, carcass characteristics, distillers grains

**797 Effects of increasing levels of distillers dried grains on intake and digestibility of moderate quality fescue hay.** W. W. Miller,\* J. D. Kohler, and M. D. Hudson, *Missouri State University, Springfield.*

Ethanol production in the United States has increased more than 7-fold in the past decade, displacing nearly one-third of corn once used for livestock feed. Producers must find alternative feed sources, such as distillers dried grains plus solubles (DDGS). Including DDGS in dairy and finishing diets has been widely studied, but less information is available regarding the use of DDGS as a supplement for cattle consuming a forage-based diet. The purpose of this study was to determine the differences in voluntary intake and digestibility of moderate quality, long-stem fescue hay (9.5% CP, 72.3% NDF; DM-basis) by steers consuming increasing levels of DDGS (27.7% CP, 35.7% NDF; DM-basis). Four Hereford steers ( $384 \pm 42.8$  kg) were housed in individual pens ( $4 \times 4$  m) and randomly assigned to treatment blocks in a completely randomized, replicated  $4 \times 4$  Latin square design. Steers were fed daily one of 4 levels of DDGS (0, 0.2, 0.4, or 0.8% of BW; DM-basis), denoted as control (CON), low (LOW), moderate (MOD) and high (HI). Steers were fed DDGS at 0800 and ad-libitum hay was offered at 0830. Steers had access to fresh water and salt at all times. Each pd consisted of a 10-d adaptation and a 7-d collection, during which hay intake, orts, and total fecal output were measured daily, followed by a 10-d washout. Data were analyzed using PROC Mixed, where the model included the fixed effects of treatment and pd and steer was included as a random variable. Period was the repeated measure and included steer nested within pd. Hay intake (kg DM or % of BW) did not differ ( $P > 0.47$ ) between treatments. Total tract DM digestibility did not differ between CON and LOW steers but tended ( $P = 0.09$ ) to be greater for MOD compared with LOW (56.48 vs. 51.11%, respectively). Digestibility did not differ between HI and MOD, but HI steers had greater ( $P < 0.05$ ) DM digestibility (60.54%) compared with LOW and CON steers (51.11 and 51.98%, respectively). Digestibility of NDF did not differ between treatments. Increased DDGS did not affect hay intake; however, total tract digestibility of diet DM was improved as DDGS supplementation increased.

**Key Words:** DDGS, fescue hay, intake and digestibility