

Ruminant Nutrition: Beef: By-Product Feeds

198 Use of dried distillers grains throughout a beef production system: I. Stocker phase. E. K. Buttrey*^{1,2}, F. T. McCollum III¹, J. C. MacDonald^{2,3}, and K. H. Jenkins³, ¹Texas AgriLife Extension Service, Amarillo, ²West Texas A&M University, Canyon, ³Texas AgriLife Research, Amarillo.

During the winters of 2008 and 2009, a study was conducted at the Texas AgriLife Research facilities in Bushland, Texas, to evaluate dried distillers grains as a supplement to wheat pasture. Each yr, 60 preconditioned Hereford steers (initial BW = 198 kg ± 3) were revaccinated against viral and Clostridial pathogens and implanted with 36 mg of zeranol. Steers were stratified by BW and randomly assigned to one of 15 2.2-ha wheat pastures (4 steers/pasture). Treatments were assigned within 5 blocks of 3 pastures. Treatments were: 1) Control (CON)- no supplement, 2) dry rolled corn (DRC), and 3) dried distillers grains (DDG). DRC and DDG were fed at 0.5% BW (DM) daily, pro-rated and delivered 6 d/wk. Full BW was measured and supplement amounts were adjusted every 28d. All steers had ad libitum access to water and a monensin-containing mineral supplement throughout grazing. Forage mass was measured by clipping at initiation and termination of grazing. Across yr, steers grazed an average of 128 d. Initial forage mass was not different among treatments ($P = 0.49$; Table 1). However, treatment affected final forage mass. At the end of grazing, DRC pastures had more ($P = 0.02$) residual forage mass than CON and DDG was intermediate. Gain was greater for DDG steers than CON and DRC ($P < 0.01$). Final forage mass suggests DRC depressed forage intake, while DDG had less influence on intake while increasing weight gain.

Table 1. Effect of stocker treatment on forage mass and steer performance

Item	CON	DRC	DDG	SE
Initial forage, kg DM/ha	2515	2750	2696	202
Final forage, kg DM/ha ^{a,1}	640	969	848	134
Gain, kg/d ^b	1.29	1.31	1.40	0.03
Adjusted gain, kg/d ^{b,2}	1.30	1.29	1.40	0.03

^aTreatment effect, $P = 0.07$; pairwise CON < DRC, $P = 0.03$.

^bTreatment effect, $P = 0.003$; pairwise DDG > CON, DDG > DRC, $P < 0.01$.

¹Initial forage mass used as covariate.

²Final forage mass used as covariate.

Key Words: dried distillers grains, supplement, wheat pasture

197 Use of dried distillers grains throughout a beef production system: II. Finishing phase. E. K. Buttrey*^{1,2}, F. T. McCollum III¹, J. C. MacDonald^{2,3}, and K. H. Jenkins³, ¹Texas AgriLife Extension Service, Amarillo, ²West Texas A&M University, Canyon, ³Texas AgriLife Research, Amarillo.

To evaluate the effects of feeding dried distillers grains throughout a beef production system, a 2-yr study was conducted using a 3 × 2 factorial arrangement of treatments. Factors were wheat pasture supplement (no supplement, dry-rolled corn, and dried distillers grains; CON, DRC, and DDG, respectively) and finishing diet (steam-flaked corn based diet containing 0 or 35% DDG, SFC and 35DDG, respectively). Each yr, 60 preconditioned Hereford steers (initial BW = 198 kg ± 3) were stratified by BW and randomly assigned to one of 15 2.2-ha wheat pastures (4 steers/pasture). Supplements were assigned within 5 blocks of 3 pastures. Supplements were fed at 0.5% BW daily, pro-rated and delivered 6 d/

wk. Following the grazing period, pastures within supplement treatment were randomly assigned to SFC or 35DDG. Steers were fed once daily ad libitum and pens of steers were harvested when estimated fat thickness reached 1.27 cm. A 3-way interaction between supplement, finishing diet, and yr was detected for HCW ($P = 0.08$) and carcass-adjusted total system weight gain ($P = 0.04$). Wheat pasture ADG was greater for DDG steers compared with CON and DRC steers ($P < 0.01$; 1.40, 1.30, and 1.29 kg/d for DDG, CON and DRC, respectively). With the exception of carcass-adjusted G:F for which DRC was greater than CON and DDG was intermediate ($P = 0.03$; 0.161 vs. 0.150, DRC and CON, respectively, 0.154 DDG), finishing performance and carcass traits were not affected by wheat pasture supplement ($P \geq 0.12$). Initial and final BW, DMI, and ADG were similar for SFC and 35DDG steers ($P \geq 0.20$). Steers receiving SFC had greater carcass-adjusted G:F ($P < 0.01$, 0.160 vs. 0.149), dressing percent ($P = 0.01$, 63.6 vs. 62.8), and twelfth rib fat thickness ($P < 0.01$, 1.27 vs. 1.12 cm) than 35DDG steers. The use of dried distillers grains as a supplement to wheat pasture results in greater ADG on wheat. However dried distillers grains included in steam-flaked corn based finishing diets appears to reduce G:F and dressing percent.

Key Words: dried distillers grains, stocker, finishing

199 Comparison of wheat or corn dried distillers grains with solubles on rumen fermentation and nutrient digestibility in feedlot heifers. L. J. Walter*¹, T. A. McAllister², W. Yang², K. Beauchemin², and J. J. McKinnon¹, ¹University of Saskatchewan, Saskatoon, SK, Canada, ²Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB, Canada.

A 5 × 5 Latin square design trial was conducted to evaluate rumen fermentation and apparent nutrient digestibility in 5 rumen cannulated heifers (420 ± 6 kg) fed diets supplemented with wheat (WDDGS) or corn (CDDGS) dried distillers grains with solubles. The composition of the control diet was 88.7% rolled barley grain, 5.5% supplement and 5.8% barley silage (DM basis). Treatments included replacement of barley grain at 20 or 40% of the diet DM with WDDGS or CDDGS. Contrasts included CDDGS vs. WDDGS; Control vs. CDDGS or WDDGS; 40% WDDGS vs. 40% CDDGS. Rumen pH, duration and area under pH curve thresholds of 5.8, 5.5 and 5.2 were not affected ($P > 0.05$) by treatment. WDDGS increased ($P \leq 0.05$) rumen NH₃-N levels relative to the control and CDDGS treatments, but decreased ($P = 0.04$) propionate relative to the control. Both DDGS sources increased ($P \leq 0.03$) rumen butyrate concentration and the digestibility ($P \leq 0.04$) of NDF, ADF and ADIN. WDDGS decreased ($P \leq 0.02$) DM and GE digestibility while CDDGS increased ($P \leq 0.001$) CP digestibility. With the exception of ADF ($P = 0.78$), feeding 40% WDDGS reduced ($P \leq 0.02$) nutrient digestibility relative to 40% CDDGS. Inclusion of WDDGS and CDDGS increased ($P < 0.001$) N and P intakes as well as excretion, with WDDGS having the greatest ($P < 0.001$) effect. Fecal N and P excretion was increased ($P < 0.001$) for WDDGS, but not for CDDGS ($P = 0.56$ and 0.27). Both DDGS sources resulted in higher ($P < 0.001$) urinary N and P output. Replacement of barley grain with up to 40% WDDGS or CDDGS did not mitigate rumen fermentation conditions associated with acidosis. CDDGS had the largest beneficial influence on apparent nutrient digestibility, while both DDGS sources altered the amount and route of N and P excretion.

Key Words: corn DDGS, wheat DDGS, nutrient digestibility heifers

200 Effects of wet distillers grains plus solubles concentration in steam-flaked corn-based finishing diets on nutrient digestibility. M. K. Luebbe^{*1}, K. H. Jenkins¹, J. Patterson¹, E. K. Buttrey², and J. C. MacDonald^{1,3}, ¹Texas AgriLife Research, Amarillo, ²Texas AgriLife Extension, Amarillo, ³West Texas A&M University, Canyon.

Six ruminally and duodenally cannulated crossbred steers (BW = 481 ± 18 kg) were used to determine effects of corn and sorghum based (<15% sorghum) wet distillers grains plus solubles (WDG) on nutrient digestibility. Seven periods consisted of 17 d of adaptation and 4 d collection of feces, duodenal and ruminal samples. Steers were fed twice daily in equal proportions. Fecal and duodenal samples were collected 3 times daily with sampling time advancing 1 h to represent every hour between feeding. Ruminal fluid samples were collected in the same manner with the addition of samples collected before feeding and 8 h post-feeding each d during the 4 d collection period. Wet distillers grains (0, 15, 30, 45, and 60% dietary inclusion; 0WDG, 15WDG, 30WDG, 45WDG, and 60WDG, respectively) replaced cottonseed meal, supplemental fat (yellow grease), urea, and steam-flaked corn (SFC). Additionally, a dry-rolled corn control diet (DRC) was included. Dietary fat was set at a minimum of 6.5% and alfalfa hay was included at 10% of diet DM. Contrasts included DRC vs. SFC, and linear and quadratic effects of WDG level. Average ruminal pH was not different ($P = 0.99$). Change in ruminal pH was lowest ($P < 0.01$) for the DRC treatment. Dry matter and OM intake were not different ($P > 0.15$) among WDG level. Intake of NDF linearly increased ($P < 0.01$) with WDG level. Starch intake responded quadratically ($P = 0.06$) with WDG level. Total tract DM, OM, and NDF digestibility decreased linearly ($P < 0.01$) with WDG level. Total tract starch digestibility responded quadratically ($P < 0.01$) with WDG level (98.1, 99.0, 98.6, 98.2, and 97.4%; 0WDG, 15WDG, 30WDG, 45WDG, 60WDG, respectively). Dry-matter, OM, and starch intake was not different ($P > 0.80$) for DRC and SFC whereas intake of NDF was greater ($P = 0.04$) for DRC compared with SFC. Total tract DM and OM digestibility was not different ($P > 0.45$) for DRC and SFC. Total tract starch and NDF digestibility were greater ($P < 0.01$) for SFC compared with DRC. Level of WDG concentration and corn processing method impacts nutrient intake and digestibility.

Key Words: wet distillers grains, digestibility, corn processing

201 Effects of wet distillers grains plus solubles concentration in steam-flaked corn-based finishing diets on performance and carcass characteristics of beef steers. M. K. Luebbe^{*1}, T. C. Davis¹, K. H. Jenkins¹, F. T. McCollum III², N. A. Cole³, and J. C. MacDonald^{1,4}, ¹Texas AgriLife Research, Amarillo, ²Texas AgriLife Extension, Amarillo, ³USDA-ARS, Bushland, TX, ⁴West Texas A&M University, Canyon.

Six hundred crossbred steers (365 ± 35 kg) were used in a randomized complete block design to determine effects of a corn and sorghum based (<15% sorghum) wet distillers grains plus solubles (WDG) on animal performance and carcass characteristics in steam-flaked corn (SFC) diets. Forty-eight pens were utilized resulting in 8 replications per treatment. Wet distiller's grains (0, 15, 30, 45, and 60% dietary inclusion; 0WDG, 15WDG, 30WDG, 45WDG, and 60WDG, respectively) replaced cottonseed meal, supplemental fat (yellow grease), urea, and SFC. Additionally, a dry-rolled corn control diet (DRC) was included. Dietary fat was set at a minimum of 6.5% with supplemental fat from yellow grease. Alfalfa hay was included at 10% of diet DM. Contrasts included DRC vs. SFC, and linear and quadratic effects of WDG concentration. Final BW, ADG, G:F, HCW, and fat depth were greater ($P \leq 0.05$) for SFC than DRC. Dry-matter intake tended ($P = 0.06$) to be greater for DRC than SFC. Marbling score, dressing percent, and LM area were not different ($P > 0.40$) for DRC and SFC. Final BW, ADG, HCW, fat depth,

and marbling score decreased linearly ($P < 0.01$) with WGDS inclusion level. Gain efficiency and DMI responded quadratically ($P < 0.01$) across WDG inclusion levels. Dressing percent tended to decrease linearly ($P = 0.07$) with WDG level and LM area was not different ($P = 0.31$) across WDG inclusion levels. Feeding SFC improved animal performance and carcass characteristics compared with DRC. The relative energy content of WDG in SFC-based diets appears to dilute the energy density of the diets and negatively impacts animal performance.

Table 1. Distillers grains and animal performance

Item	0WDG	15WDG	30WDG	45WDG	60WDG	DRC	SEM
Final BW, kg ^a	616	614	600	597	581	601	7
DMI, kg	11.3	11.5	11.5	11.4	10.5	11.7	0.2
ADG, kg ^a	2.05	2.02	1.91	1.89	1.75	1.92	0.05
G:F, g/kg ^a	182	176	166	166	167	163	3

^aCalculated from HCW divided by a common dressing percentage of 63%.

Key Words: wet distillers grains, corn processing, finishing diets

202 Supplementing modified wet distillers grains with solubles to long yearling steers grazing native range. K. M. Rolfe^{*}, W. A. Griffin, T. J. Klopfenstein, and G. E. Erickson, *University of Nebraska, Lincoln.*

A 2-yr study was designed to evaluate the effects of supplementing modified wet distillers grains with solubles (MDGS) to long yearling steers while grazing native range (warm season grass). Steers (n = 240; BW = 229 ± 16 kg) were backgrounded on cornstalk residue from late fall to mid-spring (144 d). While grazing cornstalks calves were supplemented 2.27 kg/steer daily of Sweet Bran. Following backgrounding steers were allowed to graze smooth bromegrass pastures for 21 d. After grazing smooth brome calves were weighed, stratified by BW, assigned randomly to summer grazing treatments, and relocated to graze Sandhills range. Summer grazing treatments included: grazing native range with no supplementation (CON); and grazing native range with MDGS supplementation at a level of 0.6% BW (SUPP). Modified wet distillers grains with solubles was fed daily on the ground. Steers were allowed to graze Sandhills range for the remainder of the summer grazing period (137 d) before entering the feedlot in early fall. Upon time of harvest cattle were serially slaughtered in 2 groups within each summer grazing treatment. At the time of summer treatment assignment, BW was not different between SUPP and CON steers ($P = 0.36$). However at feedlot entry, SUPP steers were 47 kg heavier ($P < 0.01$) than CON steers. Therefore, SUPP steers had 0.31 kg greater ($P < 0.01$) ADG than CON steers. Because SUPP steers were heavier than CON steers at feedlot entry, 24 fewer days on feed in the feedlot ($P < 0.01$) were required to achieve the same final BW ($P = 0.85$). Feedlot ADG and DMI were not different between SUPP and CON steers ($P > 0.47$). Similarly, HCW, LM area, and BF did not differ between the 2 summer grazing treatments ($P > 0.19$). These data show that MDGS can be fed on the ground, increase gains during summer grazing, and decrease days on feed in the feedlot.

Key Words: modified wet distiller grains, supplementation, yearling steer

203 Influence of feeding dried distillers grains plus solubles in potato byproduct-based finishing diets. J. I. Szasz^{*1,4}, D. S. Secrist², K. K. Karges³, C. W. Hunt¹, K. A. Johnson⁴, and T. N. Bodine⁵, ¹Univer-

city of Idaho, Moscow, ²Agri Beef Co., Moses Lake, WA, ³Poet Nutrition, Sioux Falls, SD, ⁴Washington State University, Pullman, ⁵Performix Nutrition Systems, Nampa, ID.

One hundred 44 crossbred yearling beef steers (mean BW = 372 kg) were used in a randomized complete block study to evaluate the influence of dried distillers grain plus solubles (DDGS; 10, 20, 30, or 40%, DM basis) fed in place of dry-rolled corn in finishing diets containing wet potato byproduct. Pen served as the experimental unit. Steers were fed twice daily in equal proportions using a bunk management approach that minimized accumulation of refused diet. Final BW ($P = 0.05$), DMI ($P = 0.05$), ADG ($P = 0.07$), and HCW ($P = 0.02$) increased quadratically with DDGS level, reaching maximum (636, 11.7, 2.17, and 405 kg, for final BW, DMI, ADG, and HCW, respectively) at the 20% DDGS level. Dry feed conversion (DMI/ADG) increased ($P = 0.04$) linearly from 5.31 to 5.53 for 10 and 40% DDGS, respectively, and performance-based diet NE_g tended ($P = 0.11$) to decrease linearly from 1.444 to 1.382 Mcal/kg for 10 and 40% DDGS, respectively. Similar responses were noted for carcass-adjusted performance, with the exception that dry feed conversion was not different between dietary treatments. Dressing percentage and percentage of cattle grading USDA Choice or Prime were similar between dietary treatments; although, marbling score increased ($P = 0.07$) quadratically with DDGS, reaching maximum (508) at the 20% DDGS level. Liver abscess incidence and other measures of performance were similar across dietary treatments. DDGS fed in place of dry-rolled corn improved ADG when fed up to 20% of the diet DM, yet negative effects on feed conversion were realized with increasing DDGS level. These results parallel findings from published trials where ADG was improved between 20 and 30% DDGS, but are in conflict with research demonstrating optimized feed conversion near 20% DDGS in the finishing diet. Future research should identify possibilities for this discrepancy as well as evaluate graded levels of DDGS in potato byproduct-based finishing diets containing more aggressively processed grain (e.g., high-moisture, steam-flaked).

Key Words: feedlot, distillers grains, finishing cattle

204 Effect of feeding modified distillers grains and wet corn gluten feed compared to forage on ruminal pH, intake and digestibility when adapting cattle to finishing diets. M. G. Dib*¹, G. E. Erickson¹, T. J. Klopfenstein¹, J. O. Sarturi¹, R. Lindquist², K. M. Rolfe¹, C. D. Buckner¹, and V. R. Bremer¹, ¹University of Nebraska, Lincoln, ²Archer Daniels Midland, Columbus, NE.

A 39-d grain adaptation metabolism study was conducted comparing a combination of modified distillers grains plus solubles and wet corn gluten feed (BYP) fed at decreasing levels (87.5% to 35%) to a traditional grain adaptation (CON) with decreasing forage (45% to 7.5%). In both adaptation schemes, dry-rolled corn increased (up to 57.5%). Measurements included DMI, ruminal pH, ruminal H₂S, and DM digestibility (DMD) for the first adaptation diet and the finishing diet. Six yearling steers (BW = 405 ± 20 kg) were assigned randomly to 1 of 2 treatments in a CRD with 3 steers per treatment (BYP and CON). Cattle were fed ad libitum once daily. Five adaptation diets were used to increase corn with diets fed 9, 7, 7, 7, and 9 d, respectively. The last 9-d period consisted of a common finishing diet containing the combination of gluten feed and distillers grains (30% of diet DM). Intake and pH (wireless pH probes) measurements were collected every minute during the entire study. Ruminal gas samples were collected 8 h post feeding on the last 2 d of each period, and H₂S concentrations were analyzed. Data were analyzed using the GLIMMIX procedure of SAS. During adaptation, DMI expressed as % of BW tended ($P = 0.09$) to be greater for steers fed CON compared with BYP during the

first period, but was not different in subsequent adaptation diets ($P > 0.20$). Average pH was lower ($P < 0.01$) for BYP on adaptation 1 and 2 compared with CON (5.76 vs. 6.18; 5.75 vs. 6.07, respectively). No difference ($P > 0.44$) was observed between treatments in ruminal pH for adaptation 3 and 4. Average pH was lower ($P < 0.01$) for CON on the last period when both treatments were being fed the same diet (5.61 vs. 5.80). Both adaptation methods resulted in safe ruminal pH (>5.6) and H₂S concentrations (<36 μmol/L gas). No difference ($P > 0.15$) was observed for DMD between treatments. Results suggest that decreasing inclusion of a combination of distillers grains and gluten feed was as effective as the traditional method using forage for adapting feedlot cattle to high-concentrate diets.

Key Words: byproducts, grain adaptation, metabolism

205 Effects of wet distillers grain and a direct-fed microbial on finishing performance and carcass characteristics of beef steers fed a sorghum-based finishing diet. J. R. Jaeger*¹, J. W. Waggoner¹, K. C. Olson², J. W. Bolte¹, and S. R. Goodall³, ¹Western Kansas Agricultural Research Centers, Kansas State University, Hays, ²Kansas State University, Manhattan, ³Nova Microbial Technologies, Omaha, NE.

Angus x calves (n = 406; initial BW = 441 ± 31 kg) were stratified by BW and ultrasonically measured longissimus muscle characteristics and assigned randomly to 1 of 4 ration treatments (4 pen replicates per treatment). Ration treatments were: 1) soybean meal protein supplement (CON); 2) control plus direct-fed microbial (CON+DFM); 3) wet distiller's grain plus solubles (WDGS; 15% of diet DM); and 4) WDGS plus direct-fed microbial (WDGS+DFM). Steers were fed for 106 d before harvest. Longissimus muscle characteristics were measured ultrasonically on d 0 and 70 of the feeding period. Increase in backfat thickness was greater ($P < 0.01$) for steers receiving WDGS compared those receiving the control diet during the first 70 d on feed. In addition, increase in longissimus muscle depth was greater ($P < 0.01$) for cattle receiving DFM compared those receiving no microbial treatment. Change in marbling score was similar ($P = 0.44$) among treatments. Steer ADG during the entire feeding period was greater ($P < 0.01$) for WDGS than for CON (1.66 and 1.43 ± 0.02 kg/d, respectively). Likewise, harvest BW was greater ($P < 0.01$) for steers receiving WDGS compared with steers receiving the control diet. Carcass weight was greater in steers fed WDGS+DFM compared with WDGS, but was lower in steers fed CON+DFM compared with CON (WDGS × DFM; $P = 0.01$). Dressing percent and LM area were similar ($P > 0.30$) between treatments. USDA yield grade ($P = 0.41$) and quality grade ($P = 0.45$) were also similar among treatments with 69.0% of steers grading choice or better. Under the conditions of our study, these data were interpreted to suggest that sorghum-based feeding diets containing WDGS and a direct-fed microbial may improve finishing performance and carcass merit compared with diets containing no distiller's grains. Further research is needed to elucidate optimal use conditions of direct-fed microbials in sorghum-based finishing diets.

Key Words: beef cattle, distillers grains, direct-fed microbial

206 Feeding *Lactobacillus acidophilus* combined with *Propionibacterium freudenreichii* to determine performance and carcass characteristics in feedlot heifers fed with or without wet distillers grains plus solubles. B. K. Wilson*¹, B. P. Holland¹, T. G. Nagaraja², and C. R. Krehbiel¹, ¹Oklahoma State University, Stillwater, ²Kansas State University, Manhattan.

Increasing corn prices related to increased ethanol production have had a significant impact on the cost of gain for cattle producers who rely on

corn-based diets, and the inclusion of wet distiller's grains plus solubles (WDGS) in feedlot diets has become a common practice in many regions of the US. In addition, direct-fed microbials (DFM) have been shown to improve ADG and feed efficiency, alter ruminal fermentation, and decrease fecal shedding of harmful pathogens in feedlot cattle. The objective of this experiment was to evaluate the effects of *Lactobacillus acidophilus* (LA) combined with *Propionibacterium freudenreichii* (PF) on performance and carcass characteristics in feedlot heifers fed with or without WDGS. Crossbred heifers ($n = 288$; initial BW = 295 ± 28 kg) were assigned to 1 of 4 treatments in a randomized complete block design with a 2×2 factorial arrangement of treatments. Across the feeding period, heifers fed 30% WDGS tended ($P = 0.09$) to have greater ADG and had greater carcass-adjusted ADG ($P = 0.05$) compared with heifers fed dry-rolled corn. Dry matter intake was not affected ($P = 0.65$) by diet, although carcass adjusted F:G tended ($P = 0.08$) to be improved for heifers fed WDGS. Heifers fed 30% WDGS tended ($P \leq 0.10$) to have greater fat thickness at the 12th rib, lower marbling scores, and higher yield grades. The inclusion of LA combined with PF in the diet had no effect ($P > 0.10$) on performance or carcass merit in the present experiment. Feeding 30% WDGS to feedlot heifers improved animal performance. Similar results can be anticipated when a DFM is included in the diet.

Key Words: beef cattle, direct-fed microbials, wet distillers grains plus solubles

207 Growth performance of finishing steers fed dry or wet distillers grains plus solubles differing in sulfur content. J. O. Sarturi*, G. E. Erickson, T. J. Klopfenstein, J. T. Vasconcelos, W. A. Griffin, and J. R. Benton, *University of Nebraska, Lincoln*.

A finishing study was conducted to determine the effect of dietary sulfur on beef cattle finishing diets formulated with wet or dry distillers grains with soluble (DGS). Sulfur concentration in DGS was either 0.82 or 1.16% and similar between wet or dry DGS. Steers ($n = 120$, BW = 345 ± 34 kg) were assigned to 1 of 13 treatments in a RCBD (9 steers/diet, except 12 steers for control) and fed for 151 d. Cattle were fed ad libitum once daily using Calan individual bunks. Treatments were designed with 3 DGS inclusion (20, 30, and 40%), fed either wet or dry that consisted of low or high sulfur concentration in DGS as a $3 \times 2 \times 2$ factorial. A corn control diet was included resulting in a $3 \times 2 \times 2 + 1$ treatment design. All diets contained 15% corn silage, 5% supplement and a blend (60:40) of high-moisture and dry-rolled corn. Initial BW was based on weighing 3 d following a limit-feeding period of 5 d at 2% of BW. Final BW, ADG, and G:F were based on HCW using a 62% dressing percentage. Data were analyzed using the GLIMMIX procedures of SAS as a $3 \times 2 \times 2$ factorial. Orthogonal contrasts were used for comparing DGS to the control diet. Intake linearly increased ($P = 0.02$) when dry 0.82% S DGS was included in the diet, but DMI was not affected when wet 0.82% S DGS was fed. When wet and dry 1.16% S DGS was added, DMI decreased linearly ($P < 0.01$) and qua-

dratically ($P < 0.01$), respectively. Gain decreased linearly ($P = 0.02$) as wet DGS that was 1.16% S increased in the diet. Other diets did not result in a similar pattern. Steers fed wet DGS had improved G:F with similar ADG. A quadratic response ($P < 0.05$) was observed for G:F when wet DGS increased in the diet, with the greatest values at 20 and 30%, regardless of sulfur content. A linear ($P < 0.05$) decrease was observed for HCW and fat thickness as wet and dry 1.16% S DGS increased in the diet, while no changes were observed for wet and dry 0.82% S DGS diets. High sulfur DGS reduces DMI, ADG, and G:F when fed at high levels in beef cattle finishing diets, but depends on whether fed wet or dry.

Key Words: distillers grains plus solubles, feedlot cattle, sulfur

208 Comparing dry, wet, or modified distillers grains plus solubles on feedlot cattle performance. B. L. Nuttelman*, W. A. Griffin, J. R. Benton, G. E. Erickson, and T. J. Klopfenstein, *University of Nebraska, Lincoln*.

A finishing experiment was conducted to compare dry, wet, and modified (partially dried) distillers grains plus solubles. Crossbred, yearling steers ($n = 440$; initial BW = 353 ± 20 kg) were utilized in a RCBD with steers stratified within block, and assigned randomly to one of 55 pens (8 steers/pen). Pens were assigned randomly to one of 10 treatments as a $3 \times 3 + 1$ factorial. Diets contained 3 inclusions (20, 30, or 40%) of 3 different types: wet distillers grains plus soluble (WDGS, 34.8% DM), modified distillers grains plus soluble (MDGS, 50.6% DM), or dried distillers grains plus soluble (DDGS, 91.4% DM). The 0% inclusion, corn control was repeated within replication (10 replications) whereas all other treatments had 5 replications. Basal ingredients consisted of high-moisture and dry-rolled corn fed at a 60:40 ratio (DM basis), 15% corn silage, and 5% dry supplement (DM basis). No interactions between type and inclusion were observed ($P > 0.16$) for any variables. No difference was observed in ADG ($P = 0.30$) between WDGS, MDGS, or DDGS. Steers fed WDGS had 0.73 and 1.04 kg/d less ($P < 0.01$) DMI than MDGS and DDGS, respectively. Steers fed WDGS (0.165) had greater G:F ($P < 0.01$) compared with steers fed MDGS or DDGS (0.158 or 0.150, respectively). Cattle fed MDGS tended ($P = 0.06$) to have greater G:F than steers consuming DDGS. Type had no impact ($P > 0.15$) on carcass traits. A linear increase ($P = 0.01$) in DMI, quadratic response ($P = 0.04$) in ADG, and a linear increase ($P < 0.01$) in G:F were observed as distillers grains increased from 0 to 40%. Generally, ADG and G:F increased from 0 to 20% inclusion and little change from 20 to 40% inclusion. Increased levels of distillers grains increased HCW quadratically ($P = 0.05$) and increased fat depth ($P < 0.01$). Based on G:F, the feeding value of WDGS was 35.4 and 17.8% greater than DDGS and MDGS, respectively. Feeding value of WDGS, MDGS, and DDGS were 45.7, 26.5, and 9.3% greater than corn-based diets when included at 20, 30, or 40% of the diet DM, respectively.

Key Words: dried distillers grains plus solubles, finishing cattle, wet distillers grains plus solubles