

## Ruminant Nutrition: Protein and Amino Acids - Beef

**724 Heat production and efficiency of energy utilization in finishing steers fed diets containing wet distillers grains with solubles (WDGS).** M. J. Spieth\*, C. L. Ferrell, J. A. Nienaber, T. M. Brown-Brandl, and S. D. Shackelford, *ARS-USDA, US Meat Animal Research Center, Clay Center, NE.*

This study was conducted to evaluate heat production (HP) and efficiency of energy utilization in feedlot cattle fed diets containing WDGS. Steers ( $n=24$ ,  $BW = 452.5 \pm 36.8$  kg) were assigned in a randomized complete block design to diets containing 0, 20, 40, or 60% WDGS on a DM basis providing calculated ME concentrations of 3.11, 3.06, 3.05, and 3.02 Mcal ME per kg and 0.70, 5.89, 7.63, and 9.36% fat, respectively. The trial consisted of three 96 h periods of total urine and feces collection followed by 6 h of indirect calorimetry with 8 steers per period (2/trt). Data were analyzed as a randomized complete block design. Regression analysis was conducted to determine linear and quadratic effects. There was a linear decrease in DMI ( $P < 0.01$ ;  $R^2 = 0.29$ ) with increasing level of WDGS in the diet. As a result, ME intake decreased as levels of WDGS increased in the diet. Heat production was similar for cattle fed all four diets but retained energy (RE) decreased linearly ( $P < 0.01$ ,  $R^2 = 0.40$ ) with increasing inclusion of WDGS in the diet. Due to the high fat content in WDGS, RQ decreased as WDGS increased in the diet. Based on this data, HP for cattle fed diets containing WDGS can be estimated using the following equation:  $HP = 174.9 + 16.4 \cdot DMI + 11.5 \cdot \text{proportion of WDGS in diet}$ . This study indicates that finishing cattle fed increasing levels of WDGS in the diet have decreased efficiency of energy utilization which could lead to decreased performance in the feedlot, primarily due to lower DMI.

**Table 1.**

Item	0% WDGS	20% WDGS	40% WDGS	60% WDGS	SEM	<i>P</i> Value
DMI, g/ ( $BW^{0.75,d}$ )	84.3 <sup>a</sup>	71.7 <sup>a,b</sup>	68.3 <sup>a,b</sup>	64.0 <sup>b</sup>	2.04	0.013
ME intake, kcal/ ( $BW^{0.75,d}$ )	262.2 <sup>a</sup>	219.3 <sup>a,b</sup>	208.2 <sup>b</sup>	193.3 <sup>b</sup>	6.27	0.001
HP, kcal/ ( $BW^{0.75,d}$ )	178.4	171.0	177.4	168.6	2.74	0.526
RE, kcal/ ( $BW^{0.75,d}$ )	83.8 <sup>a</sup>	48.3 <sup>a,b</sup>	30.8 <sup>b</sup>	24.7 <sup>b</sup>	5.31	0.004
CH <sub>4</sub> , L/ ( $BW^{0.75,d}$ )	1.20 <sup>a</sup>	1.08 <sup>a,b</sup>	0.85 <sup>a,b</sup>	0.95 <sup>b</sup>	0.04	0.096
RQ	1.00 <sup>a</sup>	0.99 <sup>a,b</sup>	0.95 <sup>b,c</sup>	0.93 <sup>c</sup>	0.01	0.001

Within a row means without a common superscript letter differ ( $P < 0.05$ ).

**Key Words:** Distillers Grains, Energy, Finishing Cattle

**725 Effects of distillers grains on feedlot performance of crossbred steers.** C. Ferrell\*, S. Shackelford, and V. Varel, *USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

Objectives were to determine effects of wet distillers grains with solubles (WDGS) on growth rate, feed intake and feed efficiency of finishing steers when fed at 0, 20, 40, or 60% of diet DM. Crossbred, fall-born steers (304) were weaned, moved to the feedlot, and fed a corn silage

based diet. Steers were implanted with Synovex-S (April) and with Revalor-S at study initiation (July). Steers were moved to individual feeding facilities, and trained over 4 wk to headgates (Calan-Broadbent®) in pens of 4 or 10 steers. Steers were blocked by sire breed, dam breed, and pretrial BW and assigned to diets. Alfalfa was included in all diets at 10.6% of DM. Control diet contained 82.7% rolled corn, 5.7% soybean meal, and 1.1% supplement. The 20, 40, and 60 WDGS diets contained 68.2, 48.2, and 28.2% corn and 20, 40, and 60% WDGS on DM basis. The WDGS diets contained 1.2% of a second supplement. Monensin (480 mg•hd•d) and thiamin (200 mg•hd•d) were fed in all diets. The CP, P, S, and fat % increased with increased WDGS inclusion in diets. Initial BW (IBW; 402 kg), 28 d, 56 d, 84 d, and final BW (FBW) were recorded. Feed was recorded daily, and orts weekly. Linear and quadratic effects of proportion WDGS were evaluated. The IBW was included as a covariate. Means were compared by *t* test if  $P \leq 0.05$  for *F* test. Linear and quadratic effects of diet influenced ( $P < 0.001$ ) DMI, ADG, and FBW, and linear ( $P < 0.001$ ) effects influenced gain/dmi (G/F). Steer performance traits were improved or unaffected by inclusion of WDGS at 20 or 40% of diet DM. WDGS at 60% decreased DMI, ADG, and FBW, but did not depress G/F. Although inclusion of 60% WDGS significantly decreased ADG, feeding levels of WDGS as high as 60% may be the most profitable choice, depending on the relative costs of feed ingredients and yardage costs.

**Table 1.**

WDGS	CP, %	P, %	S, %	DMI, kg/d	ADG, kg/d	FBW, kg	G/F
0%	13.44	0.35	0.16	9.48 <sup>b</sup>	1.73 <sup>b</sup>	584 <sup>b</sup>	0.184 <sup>b</sup>
20%	15.50	0.45	0.28	9.84 <sup>a</sup>	1.82 <sup>a</sup>	594 <sup>a</sup>	0.187 <sup>b</sup>
40%	21.06	0.57	0.42	9.16 <sup>c</sup>	1.82 <sup>a</sup>	594 <sup>a</sup>	0.200 <sup>a</sup>
60%	25.63	0.66	0.54	7.39 <sup>d</sup>	1.43 <sup>c</sup>	552 <sup>c</sup>	0.195 <sup>a</sup>
SEM				0.09	0.03	3	0.003

**Key Words:** Efficiency, Environment, WDGS

**726 Effects of increasing level of corn dried distiller's grains with solubles on intake, digestion, and ruminal fermentation in steers fed backgrounding diets.** J. L. Leupp\*, G. P. Lardy, and J. S. Caton, *North Dakota State University, Fargo.*

Five ruminally and duodenally cannulated steers ( $500 \pm 5$  kg of initial BW) were used in a  $5 \times 5$  Latin square to evaluate effects of increasing level of corn dried distiller's grains with solubles (DDGS) in backgrounding diets (60% concentrate) on OM intake, site of digestion, ruminal fermentation, and microbial efficiency. Diets consisted of 30% grass hay, 6% concentrated separator byproduct, 4% supplement, and 60% dry-rolled corn, sunflower meal, and/or DDGS (DM basis). Treatments consisted of increasing DDGS at 0, 15, 30, 45, or 60% of diet DM replacing a combination of dry-rolled corn and sunflower meal. Diets were balanced for growing steers gaining 1.22 kg/d and included 0.25% (DM basis) chromic oxide as a digesta flow marker. Steers were offered diets ad libitum (10% above previous day's intake) and adapted to diets for 14 d followed by a 7-d collection period. Intake of OM responded quadratically ( $P = 0.004$ ) with greatest intakes at 15% DDGS and lowest at 60% DDGS. No differences ( $P > 0.13$ ) were observed in CP intake or duodenal flow of OM, CP, and NDF. Apparent and true ruminal OM

digestibilities decreased (linear;  $P \leq 0.009$ ) with increasing DDGS inclusion. Total tract CP digestibility increased (linear;  $P < 0.001$ ) with increasing DDGS, however, total tract OM digestibility was not different ( $P = 0.74$ ). Microbial efficiency, expressed as g of microbial N/kg of OM truly fermented, was not affected ( $P = 0.22$ ) by treatment. As dietary DDGS increased, ruminal pH increased (linearly;  $P = 0.004$ ) while ammonia concentration remained unchanged ( $P = 0.42$ ). Acetate proportions decreased ( $P < 0.001$ ) with increasing DDGS while propionate and butyrate were similar ( $P \geq 0.19$ ). A cubic ( $P = 0.02$ ) effect was observed for total ruminal fill (as is basis) with the greatest fill at 30% DDGS and the least fill at 45% inclusion. Replacing dry-rolled corn with moderate to high levels of DDGS in backgrounding diets resulted in no adverse effects on digestion or ruminal fermentation although OM intake was reduced at 60% DDGS inclusion.

**Key Words:** Backgrounding Diets, Corn Dried Distiller's Grains with Solubles, Steers

**727 Effect of feeding distillers grains on performance and marbling deposition in steers fed high-concentrate or high-forage diets.** J. P. Schoonmaker\*, A. H. Trenkle, and D. C. Beitz, *Iowa State University, Ames.*

One hundred thirty-seven Angus cross yearling steers (init. BW  $390 \pm 0.5$  kg), were allotted by BW to a  $3 \times 2$  factorial arrangement of 6 treatments (4 pens per treatment) to determine the effect of wet distillers grains concentration (0, 20, 40 % diet DM) in high concentrate (12 % hay) and high forage (50 % hay) diets on growth performance and marbling content. Steers were implanted on d 0 with Component TE-S® and were slaughtered in 3 groups when final BW was estimated to be 579 kg. Final BW was similar among treatments and averaged 578 kg. Concentrate-fed steers gained faster ( $P < 0.01$ ) than did forage-fed steers; amount of distillers grain fed did not affect ( $P > 0.25$ ) daily gain. Hot carcass weight and dressing percentage was greater ( $P < 0.01$ ) for concentrate-fed than for forage-fed steers. Dressing percentage tended ( $P < 0.08$ ) to increase as distillers grain concentration increased. Longissimus dorsi area tended to be greater ( $P < 0.08$ ) and yield grade was greater ( $P < 0.01$ ) for concentrate compared with forage-fed cattle. Longissimus dorsi area and yield grade increased ( $P < 0.03$ ) as distillers grain concentration increased. In concentrate-fed steers, marbling score decreased as distillers grain concentration increased (325, 306, 265), but, in forage-fed steers, marbling score increased from the 0 to 20% inclusion rate, and then decreased from the 20 to 40% inclusion rate (249, 282, 262; diet x distillers grain interaction;  $P < 0.01$ ). Similarly, in concentrate-fed steers, fat thickness tended to decrease as distillers grain concentration increased, but, in forage-fed steers, fat thickness tended to increase from the 0 to 20% inclusion rate, and then tended to decrease from the 20 to 40% inclusion rate (diet x distillers grain interaction;  $P < 0.08$ ). In conclusion, when fed to a common live-weight end-point, starch concentration of distillers grain diets alters lean and adipose tissue deposition. (Supported in part by the Iowa Beef Industry Council and the Iowa Beef Center).

**Key Words:** Beef, Marbling, Distillers Grains

**728 Effect of wheat-, corn-, and triticale-based distillers grains with solubles on performance and carcass characteristics of growing lambs.** L. E. McKeown\*<sup>1,2</sup>, A. V. Chaves<sup>2</sup>, M. Oba<sup>1</sup>, E. Okine<sup>1</sup>,

T. A. McAllister<sup>2</sup>, and D. Gibb<sup>2</sup>, <sup>1</sup>*University of Alberta, Edmonton, AB, Canada*, <sup>2</sup>*Agriculture and Agri-Food Canada, Lethbridge, AB, Canada.*

The objective of this study was to determine the effect of wheat-, corn- and triticale-based dry distillers grains with solubles (DDGS) on dry matter intake, average daily gain, feed efficiency (FE; g gain / g DM ingested) and carcass traits in lambs. Sixty ram lambs were blocked by live weight (LW;  $22.6 \pm 3.0$  kg) and randomly assigned to one of four experimental diets. Either wheat-, corn- or triticale-based DDGS was included at 20% of dietary DM, replacing 10% canola meal and 10% barley grain in the control diet. The control diet contained 54% barley grain, 16% sunflower hulls, 11.5% beet pulp, 10% canola meal and an 8.5% mixture of oil, molasses, vitamins and minerals. All experimental diets were formulated to contain approximately 17% CP and 23% NDF. The lambs were individually housed, weighed weekly, and slaughtered between 45-50 Kg LW. Saleable meat yield (SMY) was determined from proximal cuts such as short cut leg, sirloin, chine off rack, loin short cut, square shoulder and front shank. Data were analyzed using the MIXED procedure of SAS. Dry matter intake was similar among treatments ( $1.40 \pm 0.05$  kg/d;  $p = 0.32$ ). Average daily gain was 15% higher ( $p = 0.05$ ) for lambs fed the corn-based DDGS ( $377 \pm 14.0$  g/d) than for lambs fed the wheat- or triticale-based DDGS ( $329$  and  $328 \pm 14.0$  g/d respectively) although no treatment differed from the control ( $338 \pm 14.0$  g/d). There was a treatment by week interaction for FE ( $p = 0.03$ ). In week 1, FE was higher ( $p < 0.05$ ) for lambs fed corn-based DDGS ( $0.49 \pm 0.03$ ) compared to lambs fed control, triticale- or wheat-based DDGS (0.35, 0.31 and  $0.33 \pm 0.03$  respectively). Overall, final LW ( $48.2 \pm 1.1$  kg), cold carcass weight ( $21.9 \pm 0.07$  kg), and SMY ( $14.5 \pm 0.4$  kg) were not affected by dietary treatment ( $p > 0.05$ ). This study indicates that the sources of DDGS tested can replace a mixture of barley grain and canola meal at 20% of the dietary DM without adverse effects on intake, growth performance or carcass traits of lambs.

**Key Words:** Dried Distillers Grains with Solubles, Feed Efficiency, Growing Lamb

**729 Feeding dry-rolled or steam-flaked corn with increasing levels of wet distillers grains to finishing steers.** C. M. Godsey\*, M. K. Luebbe, G. E. Erickson, and T. J. Klopfenstein, *University of Nebraska, Lincoln.*

The objective of this study was to determine the effect of corn processing method, either dry-rolled (DRC) or steam-flaked (SFC) corn, on cattle performance and carcass characteristics in diets containing 0, 20, or 40% wet distillers grains (WDG). The WDG used in this trial did not contain solubles and was 33.6% CP and 10% fat. One hundred twenty individually fed steers (BW =  $355 \pm 55$  kg) were weighed on three consecutive d and assigned randomly to 1 of 8 treatments (15 head/treatment). Diets contained 0, 20 or 40% WDG and 82.5, 67.5 or 47.5% corn respectively, as either DRC or SFC. Two additional diets containing 40% WDG and 11.25 or 15.0% alfalfa were fed with SFC to determine if added roughage improves performance in diets containing WDG and SFC. No significant interaction between corn processing method (DRC or SFC) and WDG (0, 20, or 40) level was observed for DMI ( $P = 0.27$ ) or G:F ( $P = 0.17$ ). However, a significant interaction was observed for ADG ( $P = 0.09$ ), therefore only the simple effects of processing method and WDG level are reported. A quadratic response was observed for ADG in DRC-based diets ( $P = 0.02$ ), with 1.38, 1.67, 1.58 kg/d for 0, 20, and 40, respectively. No response was observed for ADG in diets containing

SFC ( $P=0.20$ ). Quadratic G:F responses in DRC-based diets ( $P=0.03$ ) were observed, however no response was observed in SFC-based diets. Feed efficiency was 0.140, 0.164, 0.163 for 0, 20, 40 DRC-based diets and 0.158, 0.169, and 0.165 for 0, 20, 40 SFC-based diets, respectively. For steers fed SFC, increasing roughage level tended to increase DMI ( $P=0.07$ ) and decrease G:F linearly (0.165, 0.153, 0.155 for 7.5, 11.25, and 15.0% roughage;  $P=0.09$ ). In this study, G:F was similar as WDG inclusion increased from 20 to 40% in the diet. However, in corn control diets (0% WDG), steers fed SFC had 12.9% greater G:F than steers fed DRC. Additionally, increasing roughage levels in SFC-based diets containing WDG did not improve feed efficiency.

**Key Words:** Corn Processing, Feedlot, Wet Distillers Grains

**730 Effects of distiller's grain and probiotic on growth and carcass characteristics of finishing beef steers.** F. F. Korthaus<sup>\*1</sup>, E. S Vanzant<sup>1</sup>, G. Rentfrow<sup>1</sup>, K. K. Kreikemeier<sup>1,2</sup>, D. L. Harmon<sup>1</sup>, and K. R. McLeod<sup>1</sup>, <sup>1</sup>University of Kentucky, Lexington, <sup>2</sup>Vit-E-Men, NE.

To evaluate the effects of modified corn distiller's grain (MDG) and a direct fed microbial (DFM; Vit-E-Men probiotic 10G), 192 crossbred steers (initial BW  $394 \pm 1.2$  kg) were used in a 112 day finishing study. Steers were assigned, within weight blocks, to 6 treatments in a 3x2 factorial arrangement and fed in pens of 4 (8 pens/treatment). Treatments included 0, 20 or 40% (DM basis) of MDG with or without DFM provided at  $10 \text{ g} \cdot \text{hd}^{-1} \cdot \text{d}^{-1}$ . The diet DM was comprised of 5% corn silage, 5% alfalfa haylage, 10% supplement and 80% concentrate, comprised of varying quantities of MDG, cracked corn, and high moisture corn. The 0 and 20% MDG diets contained 14.2% CP and the 40% MDG diet, 18.6% CP. Body weight measurements were taken on d 0, 1, 28, 56, 84, 111 and 112. Steers were harvested on d 113 and carcass data was collected. There were no interactions between the level of MDG and DFM ( $P > .14$ ). Across the entire feeding period, steers fed 20% MDG consumed more DM (quadratic,  $P = .01$ ; 11.1 kg) and gained more (quadratic,  $P = .09$ ; 2.03 kg/d) compared with the 0% (10.59 kg and 1.91 kg/d) and 40% (10.76 kg and 1.96 kg/d) treatments, such that gain:feed was unaffected ( $P \geq .63$ ) by MDG. Steers fed DFM had greater ADG ( $P = .04$ ; 1.91 vs 2.02 kg/d), HCW ( $P = .02$ ; 369 vs 378 kg), ribeye area ( $P = .08$ ; 83.7 vs 85.6cm) and were more efficient ( $P = .07$ ; gain:feed .186 vs .179). Including MDG at 20% of a finishing diet increased DMI and ADG by 4% and 6%, whereas at 40% MDG, these responses diminished to control levels. Administration of DFM resulted in a 4% increase in growth efficiency concomitant with a 6% increase in ADG which were both consistent across levels of MDG. These data demonstrate the efficacy of DFM and suggest that steer growth can be compromised by MDG inclusion above 20%.

**Key Words:** Distiller's Grain, Direct Fed Microbial, Carcass Traits

**731 Effect of varying ruminally degradable to undergradable protein ratio on feed intake, nutrient digestion and N balance of buffalo calves.** J. I. Sultan<sup>\*1</sup>, A. Javed<sup>1</sup>, M. Yaqoob<sup>2</sup>, and P. Akhtar<sup>2</sup>, <sup>1</sup>Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan, Faisalabad, Punjab, Pakistan, <sup>2</sup>University of Agriculture, Faisalabad, Pakistan.

A 4 X 4 Latin Square design buffalo calves metabolism trial was conducted with buffalo calves to explore the effects of varying ruminally degradable protein (RDP) to ruminally undegradable protein (RUP) ratio on dry matter intake (DMI), nutrient digestion and N balance. Four Nili Ravi buffalo calves (avg wt, 100kg) were fed diets viz A, B, C and d, having RDP to RUP ratio of 70:30, 65:35, 60:40 and 55:45, respectively. All experimental diets were isonitrogenous (CP 16%) and isocaloric (ME, 2.74 Mcal/kg). Dry matter intake in calves fed diet C was higher ( $P<0.05$ ) than those fed diet D and lower ( $P<0.05$ ) than calves fed diet A, however, it was similar to those fed diet B. Total tract dry matter digestibility (DMD) was higher ( $P<0.01$ ) in calves fed diet A and B than those fed diet C and D. There was a linear decrease in DMI and DMD with decreasing the RDP and RUP ratio. The N retention (g/d) was similar among the calves fed diet B, C and D; however, it was higher ( $P<0.05$ ) than those fed diet A. Decreasing the RDP to RUP ratio resulted in linear increase ( $P<0.01$ ) in N retention. N retention, as percent of N intake was significantly ( $P<0.05$ ) different across all treatments. Decreasing RDP to RUP ratio resulted in linear increase ( $P<0.01$ ) in N retention, as percent of N digestion. Decreasing dietary RDP to RUP ratio resulted in a linear decrease ( $P<0.05$ ) in blood urea nitrogen concentration. A linear increase in weight gain was observed with decreasing RDP to RUP ratio. The diet containing RDP to RUP ratio 55:45 resulted in more weight gain compared to other diets.

**Key Words:** RDP, Digestibility, RUP

**732 Effects of 20% corn wet distillers grain's plus solubles in steam-flaked and dry-rolled corn-based finishing diets.** J. C. MacDonald<sup>1,2</sup>, K. H. Jenkins<sup>\*1</sup>, F. T. McCollum III<sup>3</sup>, and N. A. Cole<sup>4</sup>, <sup>1</sup>Texas AgriLife Research, Amarillo, TX, <sup>2</sup>West Texas A&M University, Canyon, <sup>3</sup>Texas AgriLife Extension, Amarillo, TX, <sup>4</sup>USDA- Agricultural Research Service, Bushland, TX.

Two hundred sixty four crossbred yearling heifers ( $354 \pm 1$  kg) were blocked by weight and used in a 2X2 factorial arrangement of treatments to determine effects of wet distiller's grains plus solubles (WDGS) derived from corn on animal performance, carcass characteristics, and the amount of manure harvested in steam-flaked corn (SFC) and dry-rolled corn (DRC) based finishing diets. Heifers were fed DRC or SFC based finishing diets with or without 20% WDGS (DM basis). Control diets with no WDGS were formulated to contain 13.5% CP. The WDGS replaced 15.2 percentage units of corn and 4.8 percentage units of cottonseed meal. All diets contained 10% alfalfa hay, 2% supplemental yellow grease, 4% glycerin, 1.2% urea, and 0.70% Ca. There were 24 pens ( $n=6$  per treatment) that housed 8, 10, or 18 heifers with pen size serving as a blocking factor. Heifers were implanted once with Revalor-H<sup>®</sup> approximately 120 days before slaughter and were on feed for an average of 154 d. No corn processing method by WDGS inclusion interactions were found for any response variable ( $P > 0.39$ ). Heifers consuming SFC-based diets had lower DMI ( $P < 0.01$ ), similar ADG ( $P = 0.71$ ), and greater feed efficiency ( $P < 0.05$ ) than heifers consuming DRC-based diets. Corn processing method had no effect on any carcass characteristic ( $P > 0.58$ ). There was a slight tendency for heifers consuming WDGS to have greater final BW ( $P = 0.15$ ), ADG ( $P = 0.18$ ), and hot carcass weight ( $P = 0.16$ ). Inclusion of WDGS did not impact any other animal performance or carcass characteristic ( $P > 0.22$ ). Feeding DRC resulted in increased manure OM harvested •heifer<sup>1</sup>•d<sup>-1</sup> ( $P < 0.01$ ) compared to SFC and feeding WDGS resulted in a slight tendency

to increase manure OM harvested•heifer<sup>1</sup>•d<sup>-1</sup> ( $P = 0.16$ ). These data indicate that corn processing method has a greater impact on animal performance and amount of manure harvested than does the inclusion of WDGS when WDGS is included at 20% of diet DM.

**Key Words:** Corn Processing, Wet Distiller's Grains, Feedlot

**733 Effect of supplementation frequency of soyhulls and corn gluten feed based mix on digestion and nitrogen balance of beef steers.** M. E. Drewnoski\* and M. H. Poore, *North Carolina State University, Raleigh.*

For small producers the labor cost of feeding is often very high. Feeding a supplement less frequently would reduce labor and could therefore have the potential to increase profit. Six ruminally cannulated beef steers were used in a replicated 3 × 3 Latin square design to determine the effect of supplement frequency (daily or alternate days) on digestion and ruminal parameters when feeding hay and supplementing with a mixture of soyhulls and corn gluten feed. Dietary treatments consisted of ad-libitum fescue hay (8.8% CP and 35.8 % ADF) that was supplemented at 1% BW daily (SD), supplemented 2% BW on alternate days (SA) or

not supplemented (H). The supplement contained 47% soyhull pellets, 47% corn gluten feed pellets, 2 % feed grade limestone and 4% liquid yeast and was 14.6 % CP and 29.8 % ADF. Each period consisted of a 14 d adaptation phase followed by 6 days of total fecal, urine and ort collection. All supplement offered was consumed within 2 h. Ruminal fluid was collected every 4 h over two days; therefore samples were taken on a day that both SD and SA were supplemented and on a day when only SD was supplemented. Hay intake was reduced by daily supplementation and further reduced ( $P < 0.01$ ) by less frequent supplementation. Hay intake was 1.54, 1.19 and 1.02 % BW (SE ± 0.036) for H, DS and SA, respectively. There was a significant ( $P < 0.01$ ) a trt by day interaction for mean ruminal pH. Ruminal pH for SA (6.13), on the day of supplementation was lower ( $P < 0.01$ ) than both SD (6.29) and H (6.52). However, on the day SA did not receive supplement ruminal pH of SA (6.53) did not differ ( $P = 0.87$ ) from H and was higher ( $P < 0.01$ ) than SD. Ruminal pH was lower ( $P < 0.01$ ) for SD than for H on both days. Diet DM digestibility was increased ( $P < 0.01$ ) by supplementation but did not differ ( $P = 0.94$ ) due to frequency. DM digestibility was 57.93, 64.37, 64.42 % (SE ± 0.71) for H, SD and SA, respectively. The amount of N retained was higher ( $P < 0.01$ ; SE ± 4.81) for both supplemented trt (23.7 and 19.8 g for SD and SA, respectively) than H (4.22 g) but did not differ ( $P = 0.35$ ) due to frequency.

**Key Words:** Supplementation Frequency, Cattle, Digestibility