

RUMINANT NUTRITION X

0701 Evaluation of 2013 survey of beef producers in Nebraska. M. Jones*, *University of Nebraska–Lincoln, Lincoln.*

Methane is a type of greenhouse gas (GHG) that can capture heat in the atmosphere 21 times more efficiently than carbon dioxide, illustrating its potency as a GHG. Enteric fermentation by ruminants is a known contributor to methane production. A survey was sent to 3391 Nebraska cattle producers with a 19% response rate. The objective of the survey was to evaluate producer opinions regarding beef cattle, climate, and their interaction to direct extension education at reducing GHG emissions in intensive and extensive beef systems. Data were analyzed using the chi-squared method in SPSS. Before accounting for size and type of operation, overall findings were not significant even though numerical differences were evident for many questions. When asked whether they agree or disagree with the statement “methane production impacts cattle performance,” 48.1% of all respondents neither agreed nor disagreed. Almost half (45.6%) disagreed with the statement “cattle diet influences methane production.” The majority of respondents believed cattle had a positive impact on the environment and reported their confidence in methane production as “not very confident” or “somewhat confident” (34.9 and 45.1%, respectively). After accounting for size and type of operation, significant variables were found using a 99% confidence interval. Feedlots of all sizes tended to agree they were likely to adopt practices that would improve animal performance ($\chi^2 = 45.8$). Veterinarians tended to neither agree nor disagree with methane production being a concern to the environment ($\chi^2 = 22.0$). Producers who obtain livestock production information from the government and other sources tended to agree that cattle diet influences methane production ($\chi^2 = 29.0$). An open-ended question was included in the survey, and responses contained themes on how methane production by cattle was a minor issue, cattle impact on

the environment outweighs any negative effects by methane production, and an acknowledgement of a lack of knowledge on the subject. While survey analysis has shown differences among groups for many of the questions, there does not appear to be one specific target group in need of outreach activities. Therefore, extension outreach efforts should focus on current management practices that improve profitability of the operation while also including information about how to reduce methane production in intensive and extensive systems.

Key Words: greenhouse gases, methane, beef cattle, education

0702 Meta-analysis of concentrate supplement effects on voluntary intake in high and low quality pastures. J. R. R. Dórea and F. A. P. Santos*, *University of Sao Paulo, Piracicaba, Brazil.*

The objective was to evaluate the effects of level of supplementation and forage quality on forage and total dry matter intake (DMI). Individually intakes from 1153 beef animals reported in 45 articles published from 1974 to 2011 were compiled. Forage was classified as high quality (more than 9% of CP) and low (less than 9% of CP). A meta-analysis approach was used according to St. Pierre (2001). For high quality pastures forage DMI decreased linearly as the supplementation level increased (-0.651% BW for energy 1% BW supplementation level) ($P < 0.05$). However, total DMI increased linearly ($P < 0.05$) as supplementation level increased (0.348% BW for energy 1% BW supplementation). On the other hand, for low quality pastures forage DMI was increased up to 0.25% BW supplementation level and it was decreased ($P < 0.05$) with high levels of supplementation. Total DMI was increased linearly ($P < 0.05$). The positive effect of supplementation fed up to 0.25% BW on low quality forage intake is due to the high CP content of these supplements supplying RDP to microbes. The negative effect of supplementation on forage DMI occurs when doses are greater than 0.25% BW, and energy is included in the supplement.

Key Words: pasture, protein, supplementation

Table 0702. Best-fit equations for simple regression of response to concentrate supplementation on voluntary intake in different pastures quality

Pasture quality	Variable	Intercept	SE	Slope						r ²	RMSE
				β1	SE	β2	SE	β3	SE		
High	TI	2.35	0.15	0.348	0.242	–	–	–	–	0.66	0.462
	FI	2.35	0.15	-0.651	0.242	–	–	–	–	0.35	0.465
Low	TI	1.70	0.13	0.900	0.122	–	–	–	–	0.65	0.338
	FI	1.63	0.14	1.732	0.789	-5.281	2.670	3.384	2.126	0.30	0.372

FI = forage intake, TI = total intake, SE = standard error, RMSE = root means square error.

0703 Determining the preference and in situ digestibility of a microalgae co-product for beef cattle. M. L. Van Emon*, S. L. Hansen, and D. D. Loy, *Iowa State University, Ames.*

Two experiments were conducted to determine preference (Exp. 1) and in situ digestibility (Exp. 2) of dried, mechanically de-oiled, milled microalgae co-product (ALG) in beef steers. In both experiments, three ruminally cannulated steers (998 ± 103 kg BW) and four treatments were utilized: 1) dry rolled corn-based diet (CON), 2) 15% ALG as a DM replacement of corn (ALG15), 3) 30% ALG (ALG30), and 4) 45% ALG (ALG45). Exp. 1 was performed in a 3×6 Latin square design with six 5-d periods and six paired diet combinations. Steers were fed the CON diet for 3 d. On d 4, each steer was offered two diets, placed in either side of a bunk divider in-tubs. Steer diet preference was determined based on DM disappearance for the 4-h immediately post-feeding. On d 5, paired diets were again offered to each steer, on the opposite side of the divider. Exp. 2 was conducted in a 3×4 unbalanced Latin square design with three diets fed each period and four 14-d periods. Steers were limit-fed at 2% of BW and adapted to diets for 12 d. On d 13, Dacron bags containing samples of dried and ground corn, soyhulls, or ALG were incubated in the rumen for 6, 12, 24, or 36 h to determine DM disappearance. Data were analyzed using Glimmix and PROC MIXED of SAS for Exp. 1 and 2, respectively. In Exp. 1, the proportion of total DM consumed by steers during the 4-h period was affected ($P = 0.01$) by the paired diet combination. Intake of ALG45 was lesser ($P \leq 0.008$) when offered in combination with the ALG15 or ALG30 diets, but not when offered with CON ($P = 0.76$). No other paired diet combinations altered ($P \geq 0.23$) DMI. In Exp. 2, inclusion of ALG in the diet did not affect ($P \geq 0.12$) rate of, or overall digestibility of, corn, soyhulls, or ALG ($71.5 \pm 0.83\%$ DM disappearance for ALG at 24 h). Additionally, DMI was linearly decreased ($P = 0.05$) as ALG increased in the diet due to lesser intake ($P = 0.05$) by ALG45 compared with CON, while ALG15 and ALG30 did not differ from CON ($P \geq 0.19$). In summary, steers readily consumed the microalgae co-product but preferred concentrations of less than 45% of diet DM under the conditions of these experiments.

Key Words: beef, digestibility, microalgae

0704 Digestibility of traditional and adding cellulosic ethanol wet distillers grains in finishing lambs. E. L. Lundy*, M. L. Van Emon, D. D. Loy, and S. L. Hansen, *Iowa State University, Ames.*

The feeding value of further processed distillers grains is unclear. A new, secondary fermentation process for converting corn kernel fiber into cellulosic ethanol, including a pretreatment with cellulosic enzymes, yeast, and heat, results in a novel wet distillers grain (WDG) called Adding Cellulosic Ethanol WDG (A-WDG). The study objective was to evaluate

the impact of increasing inclusion of WDG from traditional WDG (T-WDG) or A-WDG on nutrient digestibility in lambs. Ten wethers (34.1 ± 0.74 kg) were used in a replicated 5×5 Latin square with 15-d periods, including 10-d of diet adaptation and 5-d of fecal and urine collection. Lambs received one of five diets per period: a corn-based control containing 7.5% each of T-WDG and A-WDG (CON), and 30% and 45% inclusion of T-WDG (30T-WDG or 45T-WDG) or A-WDG (30A-WDG or 45A-WDG) on a DM basis. Data were analyzed using PROC MIXED. Dry matter intake (DMI) was not affected ($P \geq 0.25$) by concentration of T-WDG. However, DMI was quadratically affected ($P = 0.02$) by increased concentration of A-WDG, due to lesser DMI by lambs fed 30A-WDG. Digestibility of DM tended to decrease quadratically ($P = 0.09$) in lambs fed T-WDG diets (80.6, 80.0, and 77.4%, SEM 0.57 for CON, 30 and 45T-WDG, respectively). Digestibility of DM linearly decreased ($P < 0.01$) as A-WDG inclusion in the diet increased (78.3 and 75.3%, for 30 and 45A-WDG, respectively). Diet NDF concentration linearly increased ($P < 0.01$) with increasing inclusions of A-WDG (24.6, 31.0, and 33.6%, SEM 0.83 for CON, 30A-WDG, and 45A-WDG, respectively). Diet NDF concentration quadratically increased ($P = 0.03$) with increasing inclusions of T-WDG (26.9 and 32.2%, for 30T-WDG, 45T-WDG, respectively). Digestibility of NDF and ADF did not differ ($P \geq 0.25$) with increased inclusion of A-WDG in the diet. A linear increase in NDF and ADF digestibility was observed with increased inclusion of T-WDG ($P < 0.05$; 50.8, 51.8, and 55.1%, SEM 1.04 for NDF digestibility, and 50.2, 51.8, and 57.2%, SEM 1.74 for ADF digestibility of CON, 30T-WDG, and 45T-WDG, respectively). In this study, WDG from a novel, secondary fermentation process appeared to be an effective substitute for corn in finishing diets, with similar fiber digestibility and a slight decrease in DM digestibility as inclusions increased. With traditional WDG, fiber digestion was linearly improved with increasing inclusions and DM digestibility was decreased only at the highest inclusion.

Key Words: cellulosic ethanol, digestibility, wet distillers grains

0705 Effect of sugarcane fiber digestibility and mode of conservation on intake and ruminal short chain fatty acids of growing steers. D. Sousa*¹, B. Mesquita¹, J. Diniz-Magalhes¹, F. Rodriguez², I. Bueno¹, and L. F. P. Silva², ¹*University of São Paulo, Pirassununga, Brazil*, ²*University of Sao Paulo, Pirassununga, Brazil.*

Effect of sugarcane stalk fiber digestibility (NDFD) and method of conservation on intake and ruminal short chain fatty acids (SCFA) was evaluated. Eight ruminally cannulated steers (275 ± 20 kg BW) were used in a duplicated 4×4 Latin square design with a 2×2 factorial arrangement of treatments. Two sugarcane genotypes with differing stalk

NDFD were used: IAC86–2480 with higher NDFD (33.7% 30h-NDF digestibility), and SP91–1049 with lower NDFD (29.6% 30h-NDF digestibility). Treatment diets contained 40% sugarcane (DM basis) as sole roughage source given as freshly-chopped or as silage. All diets were formulated with 14.8 CP to provide daily gain of 1.2 kg/d. Animals were housed individually in tie-stalls with free access to water, and fed ad libitum allowing 10% orts. Periods lasted for 14 d, with 10 d for adaptation and 4 d for sample collection. Dry matter intake was determined on d 10, 11, and 12, and rumen fluid samples were collected at six times: 0, 1, 3, 6, 9, and 12 h after feeding on d 14. Samples were taken from three areas of the rumen, filtered through a 1-mm nylon mesh, and centrifuged at 6500×g for 15 min. A 2-mL subsample of the supernatant was taken, mixed with 0.4 mL of formic acid for SCFA determination by gas chromatography. Main effects of sugarcane genotype (GEN), method of conservation (CONS), and their interaction were tested by PROC MIXED. Feeding sugarcane with higher NDFD increased DM intake (5.6 vs. 4.5 ± 0.5 kg/d, $P = 0.01$), however the interaction GEN × CONS was significant ($P = 0.01$). The effect of greater NDFD on DMI was only significant when feeding sugarcane as silage ($P < 0.01$), having no effect on DMI when sugarcane was fresh ($P = 0.53$). Total concentration of SCFA was higher for fresh sugarcane compared with silage (114 vs. 99 ± 12 mM, $P = 0.05$). Conserving sugarcane as silage resulted in greater acetate proportion in the rumen, when compared with fresh sugarcane (58.7 vs. 55.8 ± 1.6% of total SCFA, $P = 0.01$). Proportion of propionate was also affected by conservation method, with greater proportion for diets with fresh sugarcane than sugarcane silage (24.2 vs. 20.6 ± 1.6% of total SCFA, $P = 0.01$). There was no effect of GEN of SCFA in the rumen. Increased in vitro NDFD improved intake, but only when given as silage. Feeding sugarcane ensiled decreased total SCFA and propionate proportion and increased acetate proportion.

Key Words: sugarcane silage, cattle, NDF digestibility, short chain fatty acids.

0706 Evaluation of a mixture of crude glycerol and molasses as an energy supplement for beef cattle consuming bermudagrass hay.

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The objective of this study was to evaluate the effects of a crude glycerol:molasses supplement on forage digestibility and cattle performance. Twenty-four Angus crossbred heifers (380 ± 31 kg) were used in the study. On d 0, heifers were weighed after 16-h feed withdrawal, stratified, blocked by initial BW (2 blocks: lightest and heaviest), and randomly assigned to one of four treatments: 0.00, 0.45, 1.36, and 2.27 kg/d of a 50:50 liquid mixture of crude glycerol:molasses. Heifers were housed in individual pens for 28 d and had ad

libitum access to ground Tifton 85 bermudagrass hay (13.0% CP, 56% TDN, DM basis). Individual intake of hay was monitored using a GrowSafe feed intake monitoring system. The liquid supplement was weighed and offered daily to each individual animal. Any unconsumed amount of supplement was weighed and recorded. Feed (hay and liquid) and fecal samples were collected starting on d 22 and d 23, respectively, for four consecutive days to determine apparent total tract digestibility of DM, OM, CP, NDF, and ADF. Fecal samples were collected twice daily at 0800 h and 1600 h from the ground, inside the pen, immediately after the animal defecated. Feed and fecal samples were pooled within heifer and indigestible NDF (iNDF) was used as an internal indigestible marker. Concentrations of iNDF in feed and feces were determined by in vitro incubations conducted for 288 h. Data were analyzed as a generalized randomized block design using heifer as the experimental unit and the model included the fixed effects of treatment, and the random effect of block. Orthogonal polynomial contrasts were conducted to determine the effects of supplementation level on animal performance or nutrient digestibility. There was a linear effect ($P \leq 0.05$) of liquid feed supplementation level on ADG, total DMI, and G:F measured using hay DMI only. No effect on G:F ($P = 0.70$) was observed using total DMI (hay plus supplement). The ADG was 1.31, 1.37, 1.39, and 1.56 kg for 0, 0.45, 1.36, and 2.27 kg/d, respectively. Apparent total tract digestibility of DM, OM, NDF, and ADF increased linearly ($P \leq 0.05$), while that of CP decreased linearly ($P = 0.01$) as the level of supplementation increased. The inclusion of up to 2.27 kg/d of a mixture of crude glycerol:molasses supplement may favor forage fiber digestion, improving performance of beef cattle.

Key Words: crude glycerol, molasses, forage digestibility

0707 The effects of dietary energy density and intake restriction on apparent maintenance energy requirements of beef cows. L. A. Trubenbach*, T. A. Wickersham, and J. E. Sawyer, *Texas A&M University, College Station.*

Intensification of cow calf systems may offer a mechanism to increase land use efficiency of beef production. To determine effects of dietary energy density and intake restriction on energy requirements of beef cows, 32 crossbred cows were individually fed using Calan gates. Cows were fed either a high energy density (H; 1.54 Mcal NEm/kg) or low energy density (L; 1.08 Mcal NEm/kg) diet at each of two levels of intake to achieve 80 or 120% of maintenance energy requirements as predicted by the NRC model. Cows were blocked by BW and treatments were applied in a 2 × 2 factorial to yield four treatment combinations (H80, H120, L80 and L120). After initial treatment application (d -7), cows were weighed daily for 7 d to detect measurable fill change. To accommodate initial fill differences, BW gain was measured from d

–4 to d 42. On days –7 and 42, 12th rib fat thickness was measured via ultrasound. Equations from the NRC model were utilized to calculate heat energy (HE) for individuals. All responses were analyzed as a randomized block design with a factorial treatment arrangement. No energy density by intake level interactions were observed for any response ($P > 0.14$). While there was a difference ($P < 0.01$) in initial body weight between energy density groups due to differential fill loss before d –4, neither diet energy density ($P = 0.09$) nor intake restriction ($P = 0.13$) affected change in BW over the 46-d observation period. Similarly, change in rib fat was not affected by diet energy density ($P = 0.48$) or intake restriction ($P = 0.24$). Cows fed H had 11.6% lower ($P < 0.01$) HEd^{-1} and 9.9% lower maintenance requirements (daily $\text{HE/kg BW}^{0.75}$; $P < 0.01$) than cows consuming L. Cows fed 80 had 28.7% lower ($P < 0.01$) HEd^{-1} and 29.1% lower maintenance requirements ($P < 0.01$) compared to cows fed 120. When predicted NEm requirements were based on the equation: $0.077\text{Mcal NEm per BW}^{0.75}$, apparent maintenance requirement deviations were greater (more negative) in both H ($P < 0.01$) and 80 ($P < 0.01$). These results suggest that the additive effects of increasing diet energy density and restricting intake reduce apparent maintenance requirements of beef cows. Substantial gains in efficiency of maintaining beef cows in intensive systems can be achieved by limit feeding an energy dense ration.

Key Words: cow energy requirements

0708 Comparison of the effects of pectin and starch on the rumen fermentation, growth performance, and microbial populations in sheep. J. Liu¹, M. Liu¹, and J. X. Liu², ¹*Institute of Dairy Science, Zhejiang University, Hangzhou, China*, ²*Zhejiang University, Hangzhou, China*.

Supply of available energy is important for microbial synthesis in the rumen. Pectin and starch are two primary sources of soluble carbohydrates, but remarkably different in digestion and fermentation characteristics. This study was conducted to compare the effects of pectin and starch on rumen metabolism, growth performance, and microbial populations in sheep. Forty-five male sheep (40.2 ± 3.16 kg) were divided into five groups of nine animals each according to body weight, with three pens of three sheep in each group, and then assigned to five dietary treatments with supplementation of 0, 2.5, and 5% pectin or corn starch, respectively, to a basal diet consisted of corn stover and concentrate mixture (50:50, DM basis). The trial lasted 5 wk, and feeds offered and refused were recorded for two consecutive days every week. Body weights were measured at the beginning and end of the feeding trial for two consecutive days. At the end of the trial, two-thirds of experimental sheep were slaughtered before morning feeding to collect samples of rumen contents. Dry matter intake was increased quadratically or decreased linearly with the increasing level of pectin or starch, respectively. Increasing level of

pectin led to a linear increase ($P < 0.01$) in microbial protein synthesis and daily weight gain, with highest values at 5% pectin among all treatments ($P < 0.01$). Total volatile fatty acids concentration in the rumen was linearly increased ($P < 0.01$) by inclusion of either pectin or starch, but the ratio of acetate to propionate was not affected. Abundances of *Treponema* genus and *Treponema saccharophilum* quantified by real-time PCR were positively stimulated ($P < 0.01$) only by pectin, suggesting their specific role on pectin digestion. On the contrary, abundances of typical rumen amyolytic bacteria such as *Succinivibrio dextrinosolvens*, *Ruminobacter amylophilus*, *Succinimonas amyolytica* were higher ($P < 0.05$) when starch was supplemented. Both pectin and starch increased ($P < 0.01$) the population of *Treponema bryantii*. Increasing the level of pectin led to a linear decrease ($P < 0.01$) of the rumen lipolytic bacterium *Anaerovi briolipolytica*, whereas starch stimulated the growth of the species. Because *A. lipolytica* cannot utilize starch but lactate as substrate, the growth of *A. lipolytica* in starch treatments may be attributed to the lactate accumulation. A better understanding of microbial populations that accompany dietary differences will expand our knowledge of ecological importance of bacteria in the rumen and may further lead to beneficial strategies to improve ruminant production performance.

Key Words: soluble carbohydrate, microbial protein synthesis, bacterial populations

0709 Effect of dietary starch at similar energy intake during backgrounding on subsequent finishing performance and carcass characteristics in beef cattle: a meta-analysis. P. A. Lancaster*, C. R. Krehbiel, and G. W. Horn, *Oklahoma State University, Stillwater*.

Intramuscular fat is reported to utilize glucose for fatty acid synthesis rather than acetate, but inconsistent results have been reported on the effect of dietary starch on marbling in beef cattle. The objective of this study was to use meta-analysis methods to determine the effect of dietary starch during backgrounding on subsequent finishing performance and carcass characteristics in beef cattle. Following a literature search, 14 studies were identified where diets differing in grain inclusion level were fed to normal-weaned steers such that energy intake was controlled for similar ADG. All treatments within a study were fed the same finishing diet. Treatments within study were classified as low, medium, or high starch based on grain inclusion level of the diet. This resulted in subdividing the dataset to analyze comparisons of high (HI1) vs. medium (MED) starch (9 studies) and high (HI2) vs. low (LOW) starch (seven studies); not enough studies had a medium vs. low starch comparison. Data were analyzed using a linear mixed model (PROC MIXED of SAS) that included diet as a fixed effect and intercept as a random effect with the unstructured option and study as the subject. Least square means

were computed using the inverse of the squared standard error for the dependent variable as a weighting factor. The mean grain inclusion level, calculated NEg concentration, and growing phase ADG were 79.4 and 45.2% of DM, 1.42 and 1.02 Mcal/kg DM, and 1.07 and 1.12 kg/d for HI1 and MED, respectively, and were 72.8 and 16.4% of DM, 1.42 and 1.03 Mcal/kg DM, and 1.30 and 1.26 kg/d for HI2 and LOW, respectively. Growth rate, DMI, and G:F were similar ($P > 0.05$) between HI1 and MED and HI2 and LOW. Likewise, HCW, LM area, and 12th-rib fat thickness were similar ($P > 0.05$) between HI1 and MED and HI2 and LOW. Marbling score was similar ($P > 0.05$) between HI1 and MED (427 and 436 \pm 17; 400 = Small¹⁰⁰) and HI2 and LOW (443 and 434 \pm 19). These data indicate that dietary starch inclusion level at similar energy intake during the growing phase does not impact subsequent finishing performance or carcass characteristics.

Key Words: backgrounding, dietary starch, marbling

0710 Evaluation of MegaFerm Fiber to enhance ruminal fermentation and nutrient digestibility of a total mixed ration using an in vitro gas production measurement system. D. Casper^{*1}, I. P. Acharya¹, and D. Miller², ¹South Dakota State University, Brookings, ²Miller-Casper Life Sciences, Brookings, SD.

The addition of specific feed additives to a total mixed ration (TMR) has the potential to enhance the rate and/or extent of ruminal fermentation and nutrient digestibility. MegaFerm Fiber (MFF) is a unique blend of nutritional technologies that enhances the ruminal fermentation and nutrient digestion of a TMR fed to lactating dairy cows. A standard TMR consisting of alfalfa haylage, corn silage, and a grain mix was dried at 55°C and ground through an ultracentrifuge mill having a 1.0-mm screen. One g of ground TMR was placed in a 50 μ m dacron bag, heat sealed, and then placed in a 500 mL Ankom Gas Fermentation Bottle (GFB) to measure rate of gas production and digestion. Treatments were: Control (C) and MFF fed at 3 rates to equate to a feeding rate of 5, 10, and 15 g/cow/d. Each treatment was replicated six times as individual GFB. Rumen fluid was collected from a ruminally cannulated lactating dairy cows fed the same TMR. The rumen fluid was strained through four layers of cheesecloth and 20 mL were added with 200 mL of buffer to each GFB. Bottles were incubated in a circulating water bath at 39°C and gas measurements were collected every 5 min for 30 h. At the completion of 30 h fermentations, Dacron bags were removed and dried to calculate dry matter disappearance and then analyzed for NDF concentrations to calculate NDF digestibility. The rate of gas production was linearly improved ($P < 0.07$) with the addition of MFF to the C TMR (8.0, 8.2, 9.0, and 8.6%/h for C, and MFF at 5, 10, and 15 g/cow/d, respectively). The extent of digested dry matter (76.8, 76.7, 75.8, and 75.2%) was similar ($P > 0.09$) for all treatments. The pH at 30 h was similar for all treatments (6.45,

6.45, 6.46, and 6.49). The pH decline from 0 to 30 h was similar for all treatments (-0.069, -0.073, -0.097, and -0.089 pH units). This study demonstrated that MFF can enhance the rate of digestion by increasing the rate of gas production, but the extent of nutrient digestibility was not affected. The enhanced rate of nutrient digestibility could possibly enhance the milk production of lactating dairy cows

Key Words: gas production, nutrient digestibility, MegaFerm Fiber

0711 Application of fecal NIRS profiling to predict diet characteristics and voluntary intake in beef cattle. J. R. Johnson^{*1}, G. E. Carstens¹, S. D. Prince², K. H. Ominski³, K. M. Wittenberg³, M. Undi³, J. A. Basarab⁴, T. D. Forbes⁵, A. N. Hafila⁶, and D. R. Tolleson⁷, ¹Texas A&M University, College Station, ²Texas A&M AgriLife Research, Temple, ³University of Manitoba, Winnipeg, Canada, ⁴Alberta Agriculture and Rural Development, Lacombe, Canada, ⁵Texas A&M Agrilife Research, Uvalde, ⁶USDA-Agricultural Research Service, University Park, PA, ⁷University of Arizona, Camp Verde.

Objectives of this study were to evaluate the use of fecal near-infrared reflectance spectroscopy (fecal NIRS) to predict dietary characteristics and voluntary DMI in beef cattle. Fecal samples and phenotype data were collected from 11 growing cattle trials for which intake was measured individually (Calan-gate or GrowSafe systems), and residual feed intake (RFI) calculated. For each trial, animals were fed diets containing at least 70% roughages (1.9 to 2.7 Mcal ME/kg DM), and composite fecal samples were analyzed using a Foss NIRS 6500 monochromator. Modified partial least squares approach was used to develop calibration equations to predict CP, NDF, and DMI using fecal NIRS spectra as independent variables, and CP, NDF, or DMI as dependent variables. Calibration accuracies (SE calibration; SEC and R^2 of calibration; R^2) were 0.61 and 0.90 for prediction of CP, 2.35 and 0.85 for NDF, and 11.3 and 0.76 for DMI. Validation of equations was accomplished by cross-validation and evaluated using SE cross-validation (SECV) and R^2 of cross-validation (R^2_{cv}). Validation accuracies (SECV and R^2_{cv}) for prediction of CP and NDF were acceptable and in agreement with previous studies, further indicating that fecal NIRS is a capable tool for predicting dietary CP and NDF. Validation accuracy for prediction of DMI was less accurate than for prediction of dietary CP and NDF. However, the results were comparable to those reported for the prediction of individual-animal intake by fecal NIRS and n-alkane methods in previous studies. Additionally, the fecal NIRS prediction equation for DMI in this study was able to predict individual-animal DMI for the evaluation of divergent RFI groups. Across studies, low RFI animals consumed 12% less ($P < 0.01$) than high RFI animals based on observed intakes (107.8 vs. 122.4 \pm 2.2 g/BW^{0.75}), and 10% less ($P <$

0.01) based on fecal NIRS predicted intakes (108.9 vs. 120.9 \pm 2.13 g/BW^{0.75}). Results from this study indicate that fecal NIRS profiling may be useful in predicting animal variance in diet characteristics and DMI.

Key Words: beef cattle, fecal NIRS, feed intake

Table 0711. Statistical performances of fecal NIRS calibrations

Item	N	Outliers ¹	Mean	SEL ²	Calibration		Validation	
					SEC	R ² _c	SECV	R ² _{cv}
CP, % DM	408	22	13.14	0.10	0.61	0.90	0.67	0.88
NDF, % DM	408	15	55.21	0.31	2.35	0.85	2.46	0.82
DMI, g/BW ^{0.75}	408	20	109.1	1.18	11.3	0.76	11.8	0.73

¹ Identified by “GH” statistic \geq 8.0 or “T” statistic \geq 2.5.

² SEL: SE laboratory.