

Ruminant Nutrition: General Topics

244 Effect of rice bran and legume inclusion in a straw diet on intake, digestibility, nitrogen retention, digesta kinetics and methane production of beef cattle. M. Pen*, D. B. Savage, J. V. Nolan, and R. S. Hegarty, *School of Environmental and Rural Science, University of New England, Armidale, NSW, Australia.*

The effect on production of supplementing a straw diet with legume forage or rice bran was evaluated in beef steers. Twelve Brangus-cross, rumen-fistulated steers (671 ± 40 kg) were allocated randomly to 3 treatments ($n = 4$): straw only (S), 75% straw + 25% alfalfa (SA), 82% straw + 18% rice bran (SRB) on DM basis and were adapted to diets for 17 d, followed by 18 d of experimentation. Wheaten straw (DM 88.9%, CP 6%, crude fat < 1%), alfalfa (DM 86.2%, CP 15.8%, crude fat 1.3%) and rice bran pellet (DM 91%, CP 15.3%, crude fat 17.2%) were offered ad libitum each day at 10:00H and 17:00H. Fecal DM excretion and kinetics of particulate and liquid phases of digesta were determined from fecal marker patterns after dosing with Cr-mordanted-NDF and Co-EDTA. The purine derivatives:creatinine in 'spot' urine samples enabled prediction of daily microbial crude protein production (MCP). The data were analyzed by the General Linear Model procedure using SPSS 17.0. Inclusion of alfalfa or rice bran with straw increased DM intake by 19% and 15% ($P < 0.01$) and N intake by 83% and 67% ($P < 0.001$). DM digestibility did not differ between treatments (53.5%). The effective rumen degradation rate of straw in situ (rumen dilution rate 0.02/h) was lowest ($P < 0.001$) in SRB; i.e., 21.6%, cf. 32% (SA) and 29% (S). Rumen ammonia-N concentrations (mg/L) were 55 (SA), 36 (SRB) and 19 (S) ($P < 0.05$). MCP (g/d) for SA (184) was higher ($P < 0.05$) than for SRB (90) and S (97). N retention for S (20 g/d) was increased ($P < 0.01$) by SA (122g) and SRB (149g). Methane yield (L/kg DMI) in respiration chambers, estimated over two 24-h periods, differed between treatments ($P < 0.05$), i.e., 23.1 (SA), 15.6 (SRB), 27.7 (S). The lowest yield (SRB-fed cattle) was associated with the highest crude fat intake ($P < 0.001$) and these cattle had the lowest total VFA concentration ($P < 0.01$), acetate:propionate ($P < 0.01$) and protozoa numbers ($P < 0.001$) in rumen fluid. The study indicates that inclusion of rice bran or alfalfa can markedly improve production in beef cattle given low-digestibility straw diets.

Key Words: rice bran, alfalfa, enteric methane emission

245 In vitro gas production and DM digestibility of two malt barley varieties sown with different seeding and N fertilization rates in seven sites across Canada. S. Ding*^{1,2}, M. Oba², M. L. Swift³, W. Z. Yang¹, and T. A. McAllister¹, ¹Lethbridge Research Centre, Lethbridge, AB, Canada, ²Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada, ³Alberta Agriculture and Rural Development, Lacombe, AB, Canada.

Chemical composition of malt barley grain varies with seeding rate (SR), N fertilizer application rate (NR) and growing environment. However, few studies have documented the effects of these agronomic factors on the fermentability in the rumen. An in vitro study was conducted to examine the effects of SR and NR on gas production (GP) and DM disappearance (DMD) of malt barley grain using batch culture. Two malt barley varieties, Copeland (CL) and Metcalfe (MC), seeded at rates of 200 or 400 plants/m² with NR of 0, 30, 60, 90 and 120 kg/ha, respectively, were harvested and collected in 2007 from 7 sites across Canada. Total 560 samples (i.e., 7 sites \times 2 varieties \times 2 SR \times 5 NR \times 4

samples) were ground through a 6-mm screen and fermentability was assessed by measuring in vitro GP and DMD after 24 h of incubation. Across the 7 sites, the CP content (% DM) of malt barley linearly ($P < 0.01$) increased from 8.7 to 15%, whereas the starch content (% DM) linearly ($P < 0.01$) reduced from 66 to 57% with increasing NR. However, there were only 4 sites in which the effects of SR on the contents of CP and starch were significant ($P < 0.01$). Increasing NR linearly ($P < 0.01$) reduced DMD of CL from 2 sites and reduced DMD of MC from one site with no effects for other sites. There was only one site where SR decreased ($P < 0.01$) DMD of CL by 11%, but increased ($P < 0.01$) DMD of MC by 17%. At SR of 400, high NR (120 kg/ha) decreased ($P < 0.03$) GP of CL from 2 sites by 12–17% compared with control, whilst reduced ($P < 0.01$) GP of MC from one site by 38%. The results indicated that NR effectively changed CP, starch content of malt barley and ruminal degradation. Further, the differences in GP and DMD were site-dependent, suggesting a potential effect of growing environment on the nutritive value of malt barley.

Key Words: DM digestion, gas production, malt barley

246 Biomass yield and nutritive value assessment of *Chloris gayana* grown in a tropical region. S. Uwituze*¹, O. Twajamaho¹, G. Uwimana², and M. Mutimura², ¹National University of Rwanda, Butare, Rwanda, ²Rwanda Agriculture Board, Kigali, Rwanda.

The present study evaluated suitability of *Chloris gayana* (CG; also known as Rhodes grass) for pasture production in terms of biomass yield and nutritive value. The experiment was a complete randomized design with 3 treatments and 3 replicates. Treatments consisted of 3 cutting stages: at 80 d after planting (First cut), at 70 d after the first cut (Second cut), and at 150 d after planting (Late cut). There were 3 plots per treatment. The herbage was cut manually with a sickle to 5 cm above ground when CG achieved 50% flowering. Subsamples were used for proximate analysis. In vitro fermentation medium consisted of 1:2 ruminal fluid: McDougall's buffer and each sample (0.2 g, DM basis) was put in a gas syringe. There were 3 replicates per treatment. Syringes containing samples with 30 mL of fermentation medium and 2 blanks were incubated in a water bath at 39°C for 72 h. Readings of gas volumes were recorded every 2 h. Gas accumulated within 24 h of incubation was used to compute kinetic coefficients of fermentation using PROC Nonlinear Model of SAS. Biomass yield for the late cut (1.88 ton DM/ha) was greater ($P < 0.01$) than that obtained during the first (0.79 ton DM/ha) or second (0.71 ton DM/ha) cuts. The first cut of CG yielded biomass similar ($P = 0.68$) to that obtained during the second cut. Concentrations (DM basis) of ash (10.1%), CP (8.7%), P (0.4%), N (1.4%) decreased as CG matured from 80 d to 150 d (9.0, 6.9, 0.3, 1.1) % for ash, CP, P and N, respectively. There was an interaction between incubation time and cutting stage ($P < 0.01$). The first cut of CG yielded more gas throughout the 72-h incubation period than the second and late cuts, but the second and late cuts produced similar gas over time ($P > 0.05$). First cut had the greatest ($P < 0.05$) degradation rate but the shortest ($P < 0.05$) in vitro retention time compared with the second and late cuts, respectively. The current study recommends CG for farmers of tropical region due to its good biomass yield and nutritional quality. It is also recommended to harvest CG for the first time at 80 d after planting to benefit from its best nutritive value.

Key Words: biomass yield, *Chloris gayana*

247 Dietary exposure to ergot alkaloids decreases contractility of bovine mesenteric vasculature. A. M. Egert^{*1}, D. H. Kim¹, D. L. Harmon¹, and J. L. Klotz², ¹University of Kentucky, Lexington, ²USDA-ARS, FAPRU, Lexington, KY.

Ergot alkaloids are hypothesized to cause vasoconstriction in the midgut, and prior exposure may affect vasoactivity of these compounds. Objectives were to profile vasoactivity of ergot alkaloids in mesenteric artery and vein and determine if previous exposure to endophyte-infected tall fescue affected vasoactivity of ergonovine (ERN), ergocryptine (ERP), ergotamine (ERT), ergocristine (ERS), ergocornine (ERO), ergovaline (EXT), lysergic acid (LSA), and 5-hydroxytryptamine (5HT). Ruminally cannulated Angus steers (n = 12; BW = 547 ± 31 kg) were paired by weight and randomly assigned to 6 blocks. Steers were ruminally dosed daily with 1 kg of either endophyte-infected (E+; 4.45 ppm ergovaline) or endophyte-free (E-) tall fescue seed for 21 d before slaughter. Branches of mesenteric artery (MA) and vein (MV) supporting the distal jejunum were collected after slaughter, placed in a modified Krebs-Henseleit buffer on ice, cleaned of fat and connective tissue, and sectioned into 2-mm segments. Vessels were equilibrated to 1.0 g tension for 90 min in a multi-myograph chamber with 5 mL of Krebs-Henseleit buffer and constant oxygenation (95% O₂/5% CO₂; pH = 7.4; 37°C). Final working concentrations of alkaloids ranged from 5 × 10⁻¹⁰ to 1 × 10⁻⁶ M for EXT and 5 × 10⁻⁹ to 1 × 10⁻⁴ M for all other agonists. Contractile response was normalized to a maximum KCl response. Data were analyzed using PROC MIXED of SAS for effects of seed treatment, agonist concentration, and the interaction. There were seed × concentration interactions (P < 0.01) for ERP, ERT, ERS, ERO, EXT, ERN, and 5HT in MA indicating that E- steers had a greater contractile response than E+ steers. Steers receiving E- had a greater MV contractile response to ERP, ERN, and 5HT (P < 0.01) and tended to for EXT (P = 0.09). No response was evident for ERN, ERP, ERS, LSA, and 5HT in MA and ERN, LSA, and 5HT in MV of E+ steers. These data show that steers exposed to E+ had diminished contractility in small intestinal vasculature and suggests initial exposure to ergot alkaloids has potential to alter nutrient absorption from the midgut, but the response may be transient.

Key Words: ergot alkaloid, mesenteric artery and vein, tall fescue

248 Steam-explored rice straw produced in an industrial-scale reactor as a feed ingredient for lactating dairy cow. Y. J. Su¹, G. L. Liu^{*1,2}, X. K. Zhang¹, C. G. Zhang¹, and G. Yang¹, ¹State Key Laboratory of Dairy Biotechnology, Shanghai Bright Holstein Co. Ltd., Shanghai, China, ²Shanghai Dairy Breeding Center Co. Ltd., Shanghai, China.

Rice straw is an important roughage resource for ruminants in many rice-producing countries. In this study, Steam-explored rice straw (SERS) was produced by the proprietary process in an industrial-scale reactor. To evaluate the value of SERS as a feed ingredient for lactating dairy cow, production parameters and milk composition were determined in a feeding trial with 50 Chinese Holstein cows (DIM = 82 ± 10.0 d; BW = 538 ± 54.9 kg) in a completely randomized design involving 2 diets and 60-d periods. One diet was a conventional dairy ration that contained corn silage, alfalfa hay, Chinese leymus and commercial concentrate. The other diet contained these same feed ingredients and added SERS at 2% of ration dry matter. These 2 diets were formula to be similar net energy of lactation (1.7 Mcal/kg), neutral detergent fiber (32.4%) and crude protein (17.2%) levels. There were no difference in average DMI (23.5 versus 23.6 kg/d, P = 0.832) and milk yield (38.6 versus 38.8 kg/d, P = 0.899) for cows fed the 2 diets. Compared with the conventional ration, the diet that contained SERS did not affect (P

> 0.05) the percentage of milk protein, fat and lactose. These results indicated that SERS produced in an industrial-scale reactor may be useful as a feed ingredient for lactating dairy cows in China.

Key Words: dairy cow, rice straw, steam

249 Volatile fatty acids accumulated in rumen contributed to the low dietary physically effective NDF induced subacute ruminal acidosis. F. Li, J. Yao^{*}, Z. Li, S. Li, and K. Liu, College of Animal Science and Technology, Northwest A&F University, Yangling, Shaanxi, China.

The objective of this experiment was to characterize the relationship among rumen fermentation variables, microorganisms and dietary peNDF content that eliminating the confounding effects of dissimilar DMI. Ten multiparous Xinong Sannen dairy goats with 4 fitted with ruminal cannula were divided into 2 groups. Goats in each group were assigned into 1 of the 2 dietary treatments (Long alfalfa, LA or Short alfalfa, SA) according to a paired 2 × 2 crossover design with 2 periods. The peNDF_{8,0mm} content of alfalfa hay was 42.1 and 14.5% for LA or SA group, respectively. Each period, goats in LA group were fed 1 d ahead of SA group and orts alfalfa of each goat was recorded before the morning feeding. The amount of alfalfa supplied to the goats in SA group was equal to the corresponding LA goats. Each period consisted of a 21-d adaptation period, followed by a 9-d sample period. Three species cellulolytic microorganisms relative abundance were measured by RT-qPCR. Rumen pH and chewing time were continuous monitored for 24 h. Milk production, composition and DMI have no different between LA and SA group. Duration time that pH below 5.80 in SA group was longer than LA group (5.08 vs. 1.65 h). Reducing dietary peNDF increased rumen total VFA (114.6 vs. 95.1 mM) and decreased chewing time (511 vs. 723 min/d), but did not affect the ratios of acetate, propionate and butyrate. Relative abundance of *Fibrobacter succinogenes* and *Ruminococcus flavefaciens* were increased with reducing dietary peNDF, but did not change the *Ruminococcus albus*. In summary, reduced dietary peNDF induced subacute ruminal acidosis and the low rumen pH was contributed to the high rumen VFA concentration which was correlated with the amount of cellulolytic microorganisms.

Key Words: peNDF, rumen fermentation, subacute ruminal acidosis

250 Visceral chemical composition and cellularity of beef cows grazing different herbage allowances of native pastures. A. Casal, A. L. Astessiano^{*}, A. I. Trujillo, and M. Carriquiry, Facultad de Agronomía, UdelaR, Montevideo, Uruguay.

Associations between food intake and mass and composition of various organs of the gastrointestinal tract (GIT) and liver in the short term were reported previously in ruminants. To study the long-term of 2 forage allowances of native pastures on mass and composition on GIT organs and liver in beef cows of different genetic groups, adult cows (n = 32) in a factorial arrangement of herbage allowances throughout the year (2.5 vs. 4 kg DM/kg BW; LO vs. HI) and cow genotype (purebred: Angus and Hereford vs. F1 crossbred; PB vs. CR) were used in a complete randomized block design. Cows were maintained in the herbage allowance treatment since May 2007 and gestated and lactated one calf every year from 2007 to 2009. At the end of the third year, cows were slaughter at 190 ± 15 d postpartum and GIT viscera and liver samples were collected to measure concentration of protein, lipid, DNA and RNA. Data were analyzed using a mixed model and means were considered to differ when P < 0.05. Expressed on an empty body weight basis, PB cows tended (P = 0.07) to present a greater relative mass of the

stomach complex than CR cows. Protein content of the abomasum and omasum was greater in HI-PB than LO-PB and intermediate in CR (HI and LO) cows. The lipid content of the reticulum-rumen and abomasum tended to be less ($P < 0.09$) in HI than LO cows. Large intestine DNA tended ($P = 0.07$) to be lower in HI than LO cows. The protein:DNA ratio of the large intestine was greater in HI-CR than LO-CR cows but did not differ between HI-PB and LO-PB cows. Although hepatic DNA concentration did not differ among cow groups, the protein:DNA ratio was lower in HI-CR than LO-CR cows but did not differ between HI-PB and LO-PB cows that presented intermediate values. Small intestine RNA concentration and RNA:protein ratios were greater in LO-CR than other 3 cow groups. Hepatic RNA and RNA:protein was greater in HI-CR than HI-PB, being intermediate in LO (CR and PB) cows. These results suggested that CR cows showed greater plasticity to adapt their visceral mass and composition to sparse environments.

Key Words: cattle, rangeland, viscera

251 Substitution of polymer coated urea for soybean meal on growth performance and blood parameters in feedlot lambs fed corn stalks. A. Chegeni^{*1,2}, Y. L. Li¹, C. G. Jiang¹, and Q. Y. Diai¹, ¹Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, China, ²Lorestan Agricultural and Natural Resources Research Center, Khorramabad, Lorestan, Iran.

The objective of this experiment was to evaluate the effects of replacing different levels of soybean meal by Optigen II (Alltech Inc. Nicholasville, KY) as polymer coated urea (PCU) on feed intake, growth performance and blood parameters of feedlot lambs. Sixty 4 thin-tailed Han × Dorper crossbred lambs were blocked by BW (27 ± 3.3 kg) and allocated in a randomized complete block design to 4 treatments. Each treatment had 4 pens with 4 lambs per pen. The treatments were control (PCU0), PCU33, PCU66, and PCU100 with 0, 33%, 66%, and 100% substitution rate of soybean meal nitrogen by Optigen II (DM basis), respectively. Four isonitrogenous (CP = 13.5%) and isocaloric (ME = 1.95 Mcal/kg) dietary treatments contained 60% concentrate and 40% corn stalk (DM basis) and were offered ad libitum as TMR to ensure approximately 5% ort. Lambs were fed 56 d after 14 d adaptations twice daily in 2 equal portions at 0700 and 1900 h. Data were analyzed as a RCBD using the GLM procedure of SAS (pen was as the experimental unit). Substitution of Optigen for 33% and 66% soybean meal nitrogen had no effect on DMI, but PCU100 significantly ($P = 0.04$) decreased DMI. There was no difference for ADG between PCU33 and CON, however, by increasing percent of Optigen II in the diet, ADG significantly decreased ($P < 0.01$). As a result, gain to feed ratio (G/F) was not influenced when 33% soybean meal nitrogen was replaced by Optigen, but G/F decreased ($P = 0.02$) in PCU66 and PCU100 compared with CON. Blood urea nitrogen tended to linearly increase ($P = 0.09$) with increasing Optigen percent in the diet. Substitution of Optigen for 33% and 66% soybean meal nitrogen had no effect on plasma total protein, but it was lowest ($P = 0.02$) in PCU100. The results showed that soybean meal could be partly replaced by Optigen in the diet of feedlot lambs. Substitution of Optigen for 33% soybean meal nitrogen had no negative effect on growth performance or blood parameters in feedlot lambs fed 40% corn stalk.

Key Words: feedlot lambs, growth performance, polymer-coated urea

252 Effect of conservation and maturity of primary growth grass/clover on chewing activity and fecal particle size in heifers. A. S. Koch^{*1}, P. Nørgaard¹, and M. R. Weisbjerg², ¹Dept. of Veterinary Clinical and Animal Science, University of Copenhagen, Copenhagen,

Denmark, ²Dept. of Animal Science, Aarhus University, Foulum, Denmark.

The study evaluated structural effectiveness of NDF from of spring harvest grass/clover forages of primary growth by assessing chewing activity and feces particles > 1.0 mm in heifers. Two batches of mixed ryegrass, red and white clover harvested in 2009 on May 9 and 25 were conserved as either silage or hay. The forages early silage (ES) and hay (EH), and late silage (LS) and hay (LH) had DM contents of 45, 84, 25 and 83%, and NDF contents of 32, 44, 42 and 50% of DM, respectively. Forages were fed as sole feed to 4 Jersey heifers of 435 ± 30 kg BW in a 4×4 Latin square experiment. Feeding level was 90% of individual ad libitum intake, divided in 2 daily meals at 0800 and 1530 h. Jaw movements oscillations (JMO) were recorded for 96 h continuously using Hall sensor fitted chewing halters. Jaw movements (JM) were identified from JMO, clustered into cycles and periods of rumination and eating and summarized into min per day. Feces were sampled 3 times daily and machine washed in nylon bags of 0.01 mm pore size. Feces particulate matter was freeze-dried and divided into small (0–1.0 mm) and large (>1.0 mm) particle fractions by dry sieving. Data was analyzed by the MIXED procedure in SAS with period, conservation, harvest time, and conservation × harvest time as fixed effects and heifer as random. Daily intake of ES, EH, LS, and LH was 8.7, 9.4, 7.2, and 7.2 kg DM and 2.7, 4.1, 3.0, and 3.6 kg NDF respectively. Early compared with late harvest caused similar NDF intake and time spent eating, but smaller mean rumination per kg NDF intake ($P = 0.002$). Hay compared with silage caused greater NDF intake ($P < 0.001$), and less mean time spent eating ($P = 0.02$) and ruminating ($P = 0.004$) in min/kg NDF intake. Feeding silage compared with hay resulted in a greater proportion of washed fecal particle DM < 1.0 mm, while harvest time hardly affected fecal particle size. Results indicate that NDF from late cut forages and silage stimulated rumination more effectively, and that heifers retain large forage particles in the rumen better with silage compared with hay.

Key Words: chewing activity, fecal particle size, grass/clover

253 Effect of weaning age and milk feeding level on pre and post weaning growth performance of Sahiwal calves. S. A. Bhatti^{*1}, A. T. Cheema¹, G. Akbar², P. C. Wynn³, M. Sarwar¹, and H. M. Warriach³, ¹Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan, ²Livestock Production Research Institute, Bahadurnagar, Okara, Pakistan, ³EH Graham Centre (NSW Industry and Investment and Charles Sturt University), Wagga Wagga, Australia.

Our objective was to evaluate pre and post weaning growth of Sahiwal calves weaned either at 8 or 12 weeks (WK) and offered milk at 10 or 15% of body weight (BW) to weaning. Forty-eight Sahiwal day-old calves born within 45 d were randomly allocated to 4 groups of 12 equalized for sex. Calves in 2 groups were offered milk either at 10 (M10) or 15% (M15) of BW up to d 28 adjusted weekly. The calculated milk intake at d35 was reduced to zero by d 56 (WK8). Calves in the other 2 groups were offered milk as for groups 1 and 2 but were weaned at d 84 (WK12) by reducing the milk for BW at d 70 to zero. Calves were offered a concentrate ration (21% CP and 80% TDN) from d 28 to 112 (16 weeks of age; WK16). Fed and fasted (12h) blood was taken fortnightly from wk 3. Data were analyzed using mixed procedures (SAS) in a 2×2 factorial design with weaning age and milk feeding level as the 2 factors. The weaning combination of WK8/M10 produced a significantly smaller calf at the least cost per kg live weight. By contrast the WK12/M15 calves were heavier, but more costly. The significant differences in fed and fasted blood glucose at WK9 showed that the calves weaned at WK12 remained in the pre-ruminant state longer

than those weaned at WK8. By WK13 both groups showed a similar glucoregulatory response. Thus early-weaning or restricted milk feeding are likely to accelerate rumen development. Offering milk at 15% of BW and weaning at 8 weeks provided the best compromise to minimize feeding cost, but maintain a growth performance commensurate with early puberty.

Table 1. Live weights, growth rates, production cost and blood glucose (mg/dL) of calves offered milk 10% or 15% (M10 or M15) of BW and weaned at WK8 or WK12

Parameter	WK8		WK12		SE
	M10	M15	M10	M15	
Live weight WK16 (kg)	60.2 ^a	70.7 ^b	72.0 ^b	88.3 ^c	20
Daily live weight gain (g/d)	350 ^a	432 ^b	450 ^b	544 ^c	2.2
Cost/kg live weight (PKR ¹)	188 ^a	232 ^b	249 ^b	313 ^c	11
Fed blood glucose WK9	86.7 ^c	87.3 ^c	120.7 ^b	135.2 ^a	6.0
Fasted blood glucose WK9	80.1 ^c	79.2 ^c	98.2 ^b	108.8 ^a	4.2
Fed blood glucose WK13	77.7	79.1	74.8	75.8	6.0
Fasted blood glucose WK13	86.9	89.6	90.1	88.9	4.2

^{a-c}Different superscripts denote significance at $P < 0.05$.

¹ US\$ = PKR 97.

Key Words: Sahiwal calves, weaning regimen

254 Investigating the nutritive value of Mexican sunflower leaves for ruminant animals. A. H. Ekeocha*¹ and A. O. Akinsoyinu², ¹Ondo State University of Science and Technology, Okitipupa, Ondo, Nigeria, ²University of Ibadan, Ibadan, Oyo, Nigeria.

An experiment was conducted to determine the proximate composition of Mexican sunflower leaves (MSL). Proximate composition of MSL was determined according to AOAC (1990). The MSL (g/100g DM) contained CP 16.3; CF 21.8; EE 2.8, ash 14.7; and GE 1.9 kcal/g. The CP content was 16.3% and this was high when compared with tropical grass species, which seldom exceed a CP level of 15% and whose protein content is satisfactory for animal production for only about 4 mo of the year. It compares favorably with that of cassava leaf meal (16.67%), and far exceeds the minimum protein requirement (10–12%) for ruminants. The CF level of 21.8% for MSL is low compared with that of tropical grass species which may be as high as 45–50% at more matured stages of growth. It is comparable to the CF level of *Amaranthus* spp. (17.01%), Siam leaf meal (16.0%), Cassava leaf meal (15.63%), deep litter manure (16.60%) and guava leaf (16.10%). The ether extract content was low (2.81%). This value was lower than the values of 5.61% reported for *Vernonia amygdalina* leaf and far lower than the value of 8.14% reported for Siam weed. The total ash content 14.68% was high and this was comparable to the ash content of *Vernonia amygdalina* leaf (13.86%) but higher than the value of 8.28% reported for *Acacia albida* used as a browse plant for sheep in the semi-arid region of Nigeria and higher than the value of 11.00% reported for *Leucaena* to feed Yankassa sheep and

11.54% reported for Siam weed leaf meal but commensurate with the value reported for cassava leaves which has an ash content of 16.07%. The gross energy (GE) value was 1900kcal/kg. This is lower than the GE value of Groundnut cake (2600kcal/kg) and *Vernonia amygdalina* leaf (2720 kcal/kg). The Nitrogen Free Extract level of 44.38% for MSL was comparable to that of Siam leaf meal (44.40%) used to feed West African Dwarf Sheep but lower than the value of 33.85% reported for *Vernonia amygdalina* leaf. On the whole, gross chemical analysis indicates that MSL contained appreciable level of nutrients that could be utilized in the diets of ruminants.

Key Words: Mexican sunflower leaves, nutritive value, sheep

812 Evaluation of a high forage total mixed ration in mid- to late-lactation dairy cows D. Gadeken*, C. Hulstein, D. P. Casper, K. Kalscheur, and J. Anderson. *Dairy Science Department, South Dakota State University, Brookings.*

Dairy producers have been asking how much forage could be included in the ration so that a lactating dairy cow can consume sufficient nutrients to support similar milk production. The production of high quality forages having high DM and NDF digestibility are needed to evaluate this feeding scenario. Twenty mid- to late-lactation lactating Holstein dairy cows were blocked on parity (10 primiparous and 10 multiparous), milk production (range 33.9 to 56.6; mean = 41.5 kg/d), and DIM (range 140 to 287; mean = 225 d) and randomly assigned within blocks to 1 of 2 rations based on ration forage concentration. Forages were 60% 2012 first-cutting alfalfa haylage and 40% 2012 corn silage blended on a DM basis and then fed at either 60% (Low Forage, LF) or 80% (High Forage, HF) of the ration DM. Experimental design was a randomized completed block design with 4 continuous weeks for data collection preceded by a 1 week covariate data collection period in which all cows were fed the LF ration. Cows were milked 3x/d and milk weights recorded at each milking and milk samples were collected at each milking once weekly for analysis of milk composition. Rations were similar in CP (16.4%), starch (20.1%), ADF (21.8%), and NDF (34.1%) concentrations. The use of a covariate was highly significant ($P < 0.01$). Milk production was reduced ($P < 0.01$) by feeding the HF diet compared to cows fed the LF (28.1 and 24.1 kg/d for LF and HF, respectively), while milk fat (3.98 and 3.96%), milk protein (3.17 and 3.11%), milk lactose (4.81 and 4.77%), and milk solids-not-fat (8.87 and 8.77%) percentages were similar ($P > 0.10$) for cows fed both rations. The forage quality and digestibility in this study was not adequate to support the milk production of mid- to late-lactation dairy cows. The digestibility of DM (DMD = 75.7%) and NDF (NDFd = 55.7%) for the alfalfa haylage was above average but, the corn silage quality was average (DMD = 72.9, NDFd = 52.3%, and starch = 32.1%) in this study. In this study, the forage quality and digestibility when fed at high rates did not support similar milk production in mid- to late-lactation dairy cows.

Key Words: forage, lactation, dairy cow