**486 Corn hybrid and plant density effects on corn silage quality and yield.** D. B. Burken,* J. L. Harding, T. C. Hoegemeyer, G. E. Erickson, and T. J. Klopfenstein, *University of Nebraska-Lincoln, Lincoln.*

The objective of this study was to evaluate corn hybrid, plant density, and harvest time effects on corn silage quality and yield. Five moderately early maturity corn hybrids (MEM; Hoegemeyer Hybrids) and 5 moderately late maturity corn hybrids (MLM; 1, Pioneer; 4, Hoegemeyer Hybrids) were planted at 4 populations (49,421, 64,247, 79,073, and 93,900 plants/ha) in a split plot design with 3 replications per hybrid × population combination. Five competitive corn plants were cut 15 cm above ground level and collected at 2 harvest dates (September 1, EH; September 15, LH). Grain, husk, and cob fractions were compiled. The remaining tissues (stalk, leaf, and shank) were chopped through a wood chipper, weighed, mixed, and subsampled at time of collection. There were interactions ($P \leq 0.001$) between hybrid, plant density, and harvest time for grain yield, grain percentage of total DM yield, and NDF concentration of the chopped subsample. Mean and standard deviation of grain yield was 12.0 ± 1.6 Mg/ha (range of 8.5 to 15.9 Mg/ha) for MEM hybrids and 12.5 ± 1.7 Mg/ha (range of 8.1 to 15.6 Mg/ha) for MLM hybrids. Grain yield as a percentage of total DM yield was 52.8 ± 3.3% (range of 42.1 to 59.2%) for the MEM hybrids and 50.6 ± 2.8% (range of 42.3 to 55.8%) for the MLM hybrids. Neutral detergent fiber concentration of the chopped subsample was 59.6 ± 5.1% (range of 50.4 to 70.7%) for the MEM hybrids and 61.7 ± 5.0% (range of 50.7 to 74.1%) for the MLM hybrids. Grain yield for corn planted at 49,421, 64,247, 79,073, and 93,900 plants/ha was 10.4, 12.5, 12.8, and 13.3 Mg/ha, respectively. Grain yield as a percentage of total DM yield was 49.7, 52.0, 52.8, and 52.4% for plant densities of 49,421, 64,247, 79,073, and 93,900 plants/ha, respectively. Chopped subsample NDF concentration was 57.3, 59.1, 62.7, and 63.4% for plant densities of 49,421, 64,247, 79,073, and 93,900 plants/ha, respectively. Grain yield as a percentage of total DM yield was 51.2 and 52.2% for EH and LH, respectively. Chopped subsample NDF concentration was 62.5% for EH and 58.8% for LH. Data from this study illustrate that corn hybrid, plant density, and harvest time affect corn silage yield and fiber characteristics.

**Key Words:** corn, corn silage, plant density

**487 Characterization of aerobic deterioration of corn silage treated with stabilizers.** C. Merrill,* A. P. T. P. Roth, M. A. Santos, M. C. Der Bedrosian, and L. Kung Jr., *University of Delaware, Newark.*

We determined how spoilage alters the nutritive value of corn silage and evaluated the ability of TMR-mate (TMR-M, containing a blend of antifungal organic acids, 0.3% wet weight basis) and a feed additive, Omnigen-WYC, (O-WYC, containing potassium sorbate and other ingredients, 0.176% wet weight basis) to slow this process. Five replicated 20 L buckets with 5 cm diameter holes drilled throughout the bucket were prepared for each treatment, and filled with 6 kg of untreated or treated silage with one of the 2 additives. Bucket silos were exposed to air at 22°C. Samples from each bucket were taken at time 0 and every 24 h for 5 d. Core temperatures were measured every 15 min and aerobic stability was calculated as the number of h before the silage mass increased 2°C above baseline. Data were analyzed as a 3 × 6 factorial arrangement of treatments with the main effects of additive and time of sampling and their interaction. In general, the chemical composition and numbers of yeasts remained constant for all treatments through 2 d of exposure. The general tendencies observed relative to time of exposure were an increase ($P < 0.01$) in pH, ammonia-N, numbers of yeasts, DM, CP, and NDF. Decreases ($P < 0.01$) in concentrations of lactic and acetic acids, ethanol, water-soluble carbohydrates, and soluble protein occurred with time. Concentrations of lactic and acetic acids decreased ($P < 0.01$) by more than 80% of initial values after 3 and 5 d, respectively. Loss of DM did not differ among treatments but averaged 11.2% after 3 d and 27.5% after 5 d. At 3 d of exposure, the number of yeasts was 6.42 $\log_{10}$ cfu/g in untreated silage but less ($P < 0.01$) in treated silages (average of 4.91 $\log_{10}$ cfu/g). Similarly, silage pH was higher (5.75, $P < 0.01$) in untreated silage than in treated silage (average of 4.75). Treatment with O-AF and TMR-M improved ($P < 0.01$) aerobic stability (average 53 h) compared with untreated silage (44 h). The extent and duration of heating was lower for silage treated with O-AF than TMR-M. The additives in this study moderately improved the aerobic stability of corn silage.

**Key Words:** aerobic stability, silage

**488 Exogenous fibrolytic enzyme effects on preingestive fiber hydrolysis and release of sugars and phenolics from bermudagrass haylage.** J. J. Romero*[1], K. G. Arriola[1], M. A. Zarate[1], C. R. Staples[1], C. F. Gonzalez[2], W. Vermerris[3], and A. T. Adesogan[1], *[1]Department of Animal Sciences, IFAS, University of Florida, Gainesville, [2]Department of Microbiology and Cell Science, IFAS, University of Florida, Gainesville, [3]Department of Agronomy, IFAS, University of Florida, Gainesville.*

The objective was to examine the effects of 12 exogenous fibrolytic enzyme (EFE) on hydrolysis of the fiber in a 4-wk regrowth of Tifton 85 bermudagrass haylage. The endoglucanase (EN) and xylanase (XY) activities (μmol/min/g) of the enzymes ranged from 9 to 3624, and 86 to 29301, respectively. The EFE were diluted in citrate–phosphate buffer (pH 6) containing sodium azide (0.02% w/v) antimicrobial agent and applied in quadruplicate to ground bermudagrass haylage (67.3, 33.5, 3.4 and 18.7% NDF, ADF, ADL, and CP, respectively) at manufacturer–recommended rates. The suspensions were incubated at 25°C for 24 h before addition of 30 mL of water, shaking for 1 h, and filtration of contents through Whatman 451 paper. The model included the fixed effect of enzyme. Compared with the Control (buffer and substrate alone), 10 EFE released more water-soluble carbohydrates (WSC, %; 3.69 ± 1.12 vs. 2.28 ± 0.04; $P < 0.01$), 10 released more ferulic acid (FER, μg/g; 263 ± 64 vs. 198 ± 2.3; $P < 0.01$), 8 released more *p*-coumaric acid (μg/g; 178 ± 13 vs. 162 ± 1.3; $P < 0.05$), and 3 solubilized more DM (%; 24.1 ± 0.5 vs. 22.0 ± 0.5; $P < 0.05$). Furthermore, compared with the control, 4 EFE-treated substrates had lower NDF (%; 64.0 ± 1.1 vs. 67.3 ± 0.6; $P < 0.05$), 5 had lower hemicellulose (31.4 ± 1.2 vs. 33.8 ± 0.45; $P < 0.01$), 1 had lower ADF (31.9 ± 0.4 vs. 33.5 ± 0.4; $P < 0.01$) and 1 had lower cellulose (28.6 ± 0.4 vs. 30.1 ± 0.4; $P < 0.01$). Prediction equations with independent variables including enzyme protein content (PR, mg) and EN, exoglucanase (EX), β-glucosidase, (BG), XY and ferulic acid esterase activities applied explained ($P < 0.01$) 64, 72, 99 and 93% of variation in NDF, HEM, WSC (%), and FER (μg/g), respectively. The greatest ($P < 0.01$) contributors to the $R^2$ for predicting NDF, WSC, and FER were EN (0.34) and BG (0.15), EN (0.65) and PR (0.14), and EN (0.17) and XY (0.71), respectively. Several promising EFE candidates that can hydrolyze bermudagrass fiber before ruminal degradation were identified as well as the critical enzyme activities responsible for such hydrolysis.

**Key Words:** forage, enzyme, fiber

**489 Indigestible NDF in predictions of grass and red clover silage digestibility.** S. J. Krizsan*[1], H. M. Alamouti[2], and P. Huhtanen[1], *[1]Swedish University of Agricultural Sciences, Department of Agricultural Research for Northern Sweden, Umeå, Sweden, [2]Zanjan University, Department of Animal Science, Zanjan, Iran.*

The objective of this study was to correct indigestible NDF (iNDF) for the loss of lignin to improve predictions of forage OM digestibility. Samples of silages, iNDF and feces were analyzed for acid detergent lignin (ADL). Feed and fecal samples were from grass and red clover silages with in vivo digestibility determined in sheep fed at maintenance level using the total fecal collection method. Silages were harvested at different maturities from primary growth (n = 12) or secondary growth (n = 14) of timothy-meadow fescue (n = 15) or red clover (n = 11) swards. Indigestible NDF was recovered from 288-h in situ incubation in the rumen of 3 lactating dairy cows. Acid detergent lignin was determined in all samples by solubilization of cellulose in sulfuric acid after extraction with acid detergent. Indigestibility of ADL was determined by the Lucas test, where indigestible ADL was calculated from the concentrations of ADL in feces or iNDF. Hypothesis testing was conducted based on the parameters 95% confidence intervals. The slopes of the Lucas test for grass and red clover silages, and for first and second cut silages based on fecal samples did not differ ($P > 0.05$), and indigestibility of ADL ($0.97 \pm 0.069$) was not different from 1 across all silages ($P < 0.05$). Indigestibility of ADL recovered in iNDF was different for grass and red clover silages (0.55 vs. 0.81; $P < 0.05$). Further, intercepts of the regression lines based on recovery of ADL in iNDF were not different from 0 ($P \geq 0.06$) and slopes were smaller than 1 ($P < 0.05$). Correcting individual samples for the loss of ADL in predictions of OM digestibility from iNDF lowered root mean square error (RMSE) from 0.0194 to 0.0179. With a general correction based on an indigestibility of 0.55 or 0.81 for grass and red clover silages RMSE increased to 0.0223. It is concluded that despite the losses of ADL in iNDF determination it is not practical to correct iNDF concentration on an individual sample level.

**Key Words:** acid detergent lignin, digestibility, indigestible neutral detergent fiber

**490 The effect of inoculants containing *Lactobacillus buchneri* on the fermentation of alfalfa silage harvested at two dry matters.** M. C. Der Bedrosian,* B. G. Case, M. C. Santos, J. Lim, and L. Kung Jr., *University of Delaware, Newark.*

The objective of this study was to evaluate the effects of microbial inoculants with *Lactobacilllus buchneri* on the fermentation of alfalfa silage. Alfalfa was wilted to 33 (low) and 50% (high) DM. Forage was chopped and treated in piles (4 each) with nothing (C), *L. buchneri* 40788, application rate of $4 \times 10^5$ cfu/g of wet forage (LB; Lallemand Animal Nutrition, Milwaukee, WI), LB and *Pediococcus pentosaceus* 12455 ($1 \times 10^5$ cfu/g; LBP), or LB and *L. plantarum* MTD1 ($1 \times 10^5$ cfu/g, Ecosyl Products Ltd., Stokesly, UK; LPLB). Forages were packed and stored in lab silos at 22°C for 3, 7, 14 and 90 d. Data were analyzed in a factorial arrangement of treatments with main effects of treatment and time and their interactions. Significance was declared when $P < 0.05$. At both DM, after 3 d of ensiling, the pH declined markedly ($P < 0.01$) and to the same extent for LBP and LPLB, and to a lesser extent for LB compared with C. The drop in pH was more marked ($P < 0.01$) in low vs. high DM silages. After 90 d, LB had lower ($P < 0.01$) concentrations of lactic acid when compared with C. Inoculation of high DM alfalfa did not affect the concentration of lactic acid at d 90. Regardless of DM, inoculation did not statistically increase acetic acid. In particular, treatment with LBC resulted in greater concentrations ($P < 0.04$) of this compound relative to C in both DM. Treatment with LB and LPLB resulted in greater concentrations ($P < 0.01$) of propionic acid when compared with C but only in low DM silages. Inoculation resulted in silages with lower concentrations ($P < 0.01$) of ethanol when compared with C in low DM silages. In high DM silage, only LPLB decreased ethanol relative to C. Treatment with *L. buchneri* altered silage fermentation but the changes were dependent on what organism it was combined with and the DM content of forage.

**Key Words:** silage, alfalfa

**491 Alfalfa/grass mixtures yield more DM, CP, NDF, and dNDF than alfalfa in monocultures.** J. Paulson,* D. Holen, and P. Peterson, *University of Minnesota, St. Paul.*

Alfalfa and alfalfa/grass mixture trials were seeded in 1x7 M replicated plots near Hutchinson, MN on 25 August 2008, and near Underwood, MN on 29 August 2008 to compare agronomic and nutrient differences. Treatments included binary mixtures of alfalfa (ALF) with 9 different perennial grasses, and alfalfa seeded alone. Three different ALF varieties were tested alone and in binary mixtures with 2 varieties of each of the 9 grass species. Four harvests cut to a 10 cm residual were obtained in 2011 (third production year) at both locations. At each harvest, subsamples of chopped herbage of selected treatments were oven-dried, ground, and analyzed for forage quality via NIRS Consortium equations at the UW Forage Testing Lab. Parameters measured included CP, NDF, 48-h NDF digestibility, ADF, and ADL. Values for RFQ, RFV, milk per ton, milk per acre, and digestible fiber yield were also calculated. At Underwood, binary mixtures of alfalfa/tall fescue or alfalfa/orchardgrass produced significantly higher amounts of NDF and dNDF compared with monocultures of alfalfa. Alfalfa/tall fescue mixtures also produced significantly greater amounts of DM and numerically greater amounts of CP. At Hutchinson, binary mixtures of alfalfa/orchardgrass produced significantly greater amounts of DM, NDF and dNDF when compared with alfalfa alone. Binary mixtures of alfalfa/tall fescue also produced significantly greater amounts of DM and numerically greater amounts of NDF and dNDF compared with alfalfa alone. Yield of CP was similar across treatments at Hutchinson. Alfalfa/grass mixtures offer agronomic and nutrient advantages compared with alfalfa monocultures.

**Table 1.** 2011 total-season DM, CP, NDF and dNDF-yields of alfalfa/grass mixtures at Hutchinson (H) and Underwood (U), Minnesota

| | DM Yld | CP Yld | NDF Yld | dNDF Yld |
|---|---|---|---|---|
| Mixture | Tons DM/ a | lb CP/a | lb NDF/a | lb dNDF/a |
| Alf/Tall Fescue - U | **5.87** | **5.87** | **5530** | **2670** |
| Alf/Orchardgrass - U | 5.41 | 2330 | **5070** | **2490** |
| Alf/Orchardgrass -H | **4.03** | 1670 | **4530** | **2430** |
| Alf/Tall Fescue-H | **4.01** | 1650 | 3920 | 2030 |
| Alfalfa Alone-U | 4.89 | 2290 | 4130 | 1710 |
| Alfalfa Alone-H | 3.60 | 1530 | 3460 | 1720 |

Bolded values: P < 0.05 differs to the largest value by location within the same data column.

**Key Words:** alfalfa, grass, dNDF

**492 Effect of land clearing and tillage methods on weed incidence under maize-cassava inter-cropping system.** A. H. Ekeocha,* *University of Ibadan, Ibadan, Oyo, Nigeria.*

Agricultural activities have been identified as the most common causes of land transformation. Such transformation results in changes in ecological features, such as weed flora succession. It is in view of this that

this work was carried out to evaluate the effect of land clearing and tillage methods on weed incidence under maize-cassava intercropping system. The experiment was carried out at the International Board for Soil Research and Management experimental site, Epemakinde, Nigeria. (40 45° E, 60 45° N) after 3 cropping years. The treatments consist of 3 land clearing methods thus, given a split plot fitted into randomized complete block design. The 3 land clearing methods: slash and burn (SB), bulldozed not windrowed (BNW) and bulldozed windrowed (BW) are the main treatments while the 4 tillage methods namely (zero, conventional, traditional, and minimum tillage) constituted the sub-treatments. Data were collected on weed incidence at 6 and 16 weeks after planting (WAP). The result indicates that weed coverage at WAP were not different ($P > 0.05$) among the land clearing treatments, although SB had the least weed coverage (55.5%) ($P > 0.05$) on the average representing 9.2% and 8.9% lower than those of BW (60.63%) and BNW (60.46%). Zero tillage and traditional practices had the highest weed coverage of 86.11% and 82.17% respectively, representing 207.5% and 193.5% increase over conventional tillage (28.00%). In conclusion, slash and burn under minimum tillage and conventional tillage treatments, which gave a reduced weed problem, appears a better option.

**Key Words:** land clearing, tillage methods, weed incidence

**493 Agronomic characteristics of pearl millet genotypes for forage production in southwestern Nigeria.** B. Ogunlolu,* A. Jolaosho, O. Onifade, B. Oduguwa, and P. Dele, *Department of Pasture and Range Management, University of Agriculture, Abeokuta, Ogun State, Nigeria.*

This study was conducted to evaluate 10 selected *Pennisetum glaucum* (L.) R. Br. genotypes for forage production in Abeokuta, South - Western Nigeria. The experiment was laid out on the field in a randomized block design. The land area of 555m $^2$ was divided into 30 plots of 3m by 2.5m each with spacing of 1m between plots. Ten genotypes of pearl millet were randomly planted at a spacing of 75 × 25 cm into 10 plots per block and replicated 3 times. Weekly observations were taken on the tiller number, number of leaves on main and secondary tillers, crown spread and leaf area from the 2nd week after planting (WAP) and plant height was taken up to 22 WAP. There were significant differences in the plant height, number of tillers and leaves, leaf area and crown spread on the pearl millet genotypes. Bunkure, Mokwa, Maiwa UI 25–2, Maiwa UI 28–1, Maiwa UI 94–2 and Dauro reached their maximum heights of 275.00 cm to 417.30 cm at 22WAP with Bunkure having the highest plant height of 417cm. Dauro and Mokwa had the highest ($P < 0.05$) leaf area at 7WAP. Dauro, Maiwa UI 94–2, Maiwa UI 25–2 and Mokwa had the highest ($P < 0.05$) number of leaves on primary and secondary tillers from 8WAP to 10WAP. Bunkure had highest number of leaves on secondary tillers, though produced fewer primary leaves. It can be concluded that Bunkure, Mokwa, Dauro, Maiwa UI 25–2 and Maiwa UI 94–2 pearl millet genotypes planted between May and October which exhibited late maturity and had the highest number of leaves, are the most desirable for forage production in Abeokuta, southwestern Nigeria.

**Key Words:** pearl millet, genotypes, forage

**494 Influence of sample preparation technique on masticate fiber content collected from esophageally fistulated cattle.** K. L. Gillespie,* J. A. Musgrave, L. A. Stalker, T. J. Klopfenstein, and S. K. Pruitt, *University of Nebraska, Lincoln.*

Diet samples collected using esophageally fistulated cattle are representative of nutrients consumed by grazing cattle. However, preparation methods may alter the nutrient composition of the masticate sample. Meadow, hay, and upland range diet samples collected using esophageally fistulated cows were used to determine the effect of squeezing masticate samples on NDF content. In study 1, nine 1-ha Sandhills upland range paddocks were each sampled twice throughout the grazing season using 3 esophageally fistulated cows each collection day. Samples were collected at 12-d intervals from May 18 to June 11 and at 28-d intervals from June 12 to August 26. In study 2, 12 esophageally fistulated cows were offered 428 g (DM) vegetative grass harvested immediately before presentation from a subirrigated meadow, and, after collection of the masticate, they were offered 1,032-g (DM) hay harvested the previous summer from a subirrigated meadow. In all studies, esophageal plugs were removed, cows were fitted with screen bottom bags and allowed to graze, and following collection, masticate samples were divided and left unsqueezed (UNSQZ) or hand squeezed until no saliva could be extracted (SQZ). Samples were frozen, lyophilized, ground to pass a 1-mm screen, and analyzed for NDF. Representative samples of the clipped meadow and hay offered in study 2 were collected, ground through a 1-mm screen, and analyzed. In study 1, squeezing increased ($P < 0.01$) NDF content from 65.9% (UNSQZ) to 69.7% (SQZ). In study 2, squeezing increased ($P < 0.01$) NDF content of clipped meadow from 43.9% (UNSQZ) to 52.0% (SQZ), and hay from 67.3% (UNSQZ) to 71.2% (SQZ). Fresh, vegetative masticate samples were affected most by squeezing. There was no significant difference ($P = 0.27$) between NDF content of hay offered at 66.2% and UNSQZ masticate sample collected at 67.3%. However, meadow sample NDF significantly increased ($P < 0.01$) under both methods, from 40.0% originally to 43.9% UNSQZ and to 52.0% SQZ. Cell solubles may be lost with saliva through screen bottom bags and further losses occur with squeezing. Squeezing masticate samples markedly increases NDF content of samples collected with esophageal fistulated animals.

**Key Words:** NDF, forage diet sample, fistulation

**495 Influence of pre-collection diet and squeezing on crude protein content of masticate collected from fistulated cattle.** J. A. Musgrave,* K. L. Gillespie, S. K. Pruitt, L. A. Stalker, and T. J. Klopfenstein, *University of Nebraska, Lincoln.*

In study 1, 12 esophageally fistulated cattle were maintained on 2 pre-collection diets: HI (24% CP, n = 6) or LO (7.7% CP, n = 6) for 8 d. On d 9, the esophageal plug was removed, screen bottom bags were attached and all cattle were presented with 428 g (DM) vegetative grass (VEG; 24% CP, 40% NDF) which had been harvested from subirrigated meadow immediately before presentation. Following VEG collection, all cows were presented with 1032 g (DM) hay (HAY; 7.7% CP, 66% NDF) harvested from subirrigated meadow the previous summer. Blood samples were collected via coccygeal venipuncture and analyzed for BUN content. In study 2, 3 esophageally fistulated cows sampled Sandhills upland range 12 times from May 21 to August 18. In study 3, 5 ruminally fistulated steers were fed vegetative smooth bromegrass harvested immediately before presentation. In all 3 studies, masticate samples were divided and each was either squeezed by hand until no more saliva could be removed (SQZ), or un-squeezed (UNSQZ). All masticate samples were immediately frozen and stored until lyophilized and analyzed for CP content. In study 1, pre-collection diet did not affect ($P = 0.49$) CP content of masticate. Type of forage offered (VEG vs. HAY) interacted ($P = 0.01$) with preparation technique, where CP was lost when VEG samples were squeezed (20.0 vs. 21.5% CP for SQZ vs. UNSQZ, respectively; $P < 0.05$) but not when HAY samples were squeezed (7.6 vs. 7.6% CP for SQZ vs. UNSQZ, respectively; $P > 0.05$). BUN levels tended to be higher for HI cows (27.6 ± 4.0 vs. 23.5 ± 3.2 mL/dL; HI vs. LO, respectively; $P = 0.08$). In this case, total amount of salivary contamination may not have been enough to influence CP

content of the masticate. In study 2, there was no difference in CP between SQZ and UNSQZ (9.5 and 9.6%; $P = 0.66$) samples. In study 3, the difference in CP between SQZ and UNSQZ (18.6 and 20.1%) samples was not statistically separable ($P = 0.16$). Previous diet did not affect CP level of masticate and squeezing affected CP levels of high quality forage but had little effect on lower quality forage.

**Key Words:** grazed diet, diet collection, sample preparation

**496 Variability and implications of indigestible neutral detergent fiber in C3 and C4 forages.** E. Raffrenato*[1,4], D. M. McNeill[2], D. G. Barber[3], M. N. Callow[3], and D. P. Poppi[1], *[1]School of Agriculture and Food Sciences, The University of Queensland, Gatton, Queensland, Australia, [2]School of Veterinary Science, The University of Queensland, Gatton, Queensland, Australia, [3]Agri-Science Queensland, Department of Employment, Economic Development and Innovation, Lawes, Queensland, Australia, [4]Department of Animal and Wildlife Sciences, University of Pretoria, Pretoria, Gauteng, South Africa.*

Rates of NDF digestion are used within models such as the CNCPS and CPM Dairy to determine optimal rations for dairy cows. These models multiply ADL by 2.4 to estimate the indigestible NDF (iNDF). The resulting iNDF can be used to estimate the rate of digestion for the potentially digestible NDF (kd, pdNDF). However, recent work in C3 forages has found considerable variability in the ratio iNDF/ADL, resulting in profound effects on the calculated pdNDF, kds and the supply of energy and microbial protein. The objectives of this work were to further characterize the variability of this ratio in C3 and C4 species grown in Queensland, Australia, and to suggest better equations to predict iNDF. One hundred and 40 forages or forage mixtures were selected out of 240 sampled across Queensland during winter 2011 to represent a wide spread of NDF content, forage groups and species. Samples were analyzed for ADL, NDF and iNDF, and results were grouped for single species. Long-term in vitro fermentations were conducted for 240 h to reach the maximum extent of digestion to determine iNDF. Within and across forage groups, the iNDF/ADL ratio ranged from 1 to 9.6, with lower values ($P < 0.05$) for C3 species (3.05 ± 1.47) compared with C4 ones (5.01 ± 1.75). Only for ryegrass, iNDF appeared similar (2.53 ± 0.76, $P = 0.33$) to that estimated using the 2.4 ratio, with, however, 75% of the samples having ratios numerically lower than 2.4 and therefore lower actual iNDF and kd. The attempt to predict iNDF within species based on the relationship between ADL/NDF and the ratio, through exponential equations, resulted in $R^2$ values between 0.15 and 0.85. This suggests that the 2.4 ratio when applied indiscriminately has potentially large errors and simply using C3 and C4 classification will not solve this issue, but possibly a grouping tht is species-specific may be more appropriate. A wider data set across species, agronomic and environmental conditions is needed to see if generalized equations with more acceptable error terms can be devised. The project was partially funded by Dairy Australia.

**Key Words:** indigestible NDF, fiber, rate of digestion

**497 Fecal NIRS relationship with intake and diet digestibility of grazed Bahiagrass by cows determined by n-alkanes.** S. W. Coleman*[1], C. C. Chase Jr.[2], and D. G. Riley[3], *[1]USDA ARS, El Reno, OK, [2]USDA ARS, Clay Center, NE, [3]Texas Agrilife, College Station.*

The objective of this study was to determine if fecal analysis by NIRS could be used to calibrate for intake determined by the alkane ratio technique in grazing cows. Dry matter intake (DMI; g/kg BW) and diet digestibility (D) was estimated in cows of various breeds in 7 trials over 7 years during different seasons. Nine to 12 cows were used in each trial and on d-1, each received a bolus that delivered a prescribed amount daily of both $C_{32}$ and $C_{36}$ n-alkanes as external markers. The bolus was designed to deliver 300 mg of marker each day over about 21 d. In 4 of the trials, actual payout was determined by collecting feces until dosed marker was not detected. Fecal samples were collected daily from the ground as marked cows defecated in presence of an observer, lyophilized, scanned by NIRS (400–2500 nm), and analyzed for n-alkane concentration following ethanolic KOH extraction and cleanup. Diet D was estimated by the ratio of naturally occurring plant cuticular wax n-alkanes (odd-chain $C_{27}$-$C_{37}$) in the forage and feces. Intake was estimated by the ratio of daily dose of external marker and fecal marker concentration corrected for forage $C_{32}$ or $C_{36}$. Bahiagrass contained sufficient $C_{31}$, $C_{33}$, and $C_{35}$ for use as markers and concentration in feces varied both within trial and across trials providing variation in D. Calibration equations were developed by PLS regression of DMI and D on fecal spectra. The equations were then used to predict values on the same spectra to determine if structural bias occurred within the data set among trials and breeds within trial. Differences between alkane estimated DMI (31.6 ± 13.6) and D (65.2 ± 7.0) and NIRS estimated DMI (31.1 ± 8.3) and D (65.5 ± 4.7) were significant ($P < 0.001$) among trials but not different due to breed within trial. When alkane estimated D was regressed on NIRS predicted D, slopes differed among trials ($P < 0.0001$) and breed within trial ($P < 0.01$). However, slopes for DMI differed among trials ($P < 0.001$) but not breed ($P = 0.60$). We suggest that NIRS can be used as a double sampling technique with n-alkanes for estimating DMI and diet D on large numbers of animals.

**Key Words:** grazing intake, diet digestibility, fecal NIRS

**498 Dry season nutrient availability of vegetation species selected by the African elephant (*Loxodanta africana*) in the Pongola Game Reserve, South Africa.** E. Cuthbert,* P. Yu, and D. A. Christensen, *University of Saskatchewan, Saskatoon, SK, Canada.*

African elephants were reintroduced to the Pongola Game Reserve (PGR), South Africa, in 1997, via translocation. Fourteen elephants established the original population and it has since grown to over 50 individuals. Elephant conservation and management has continued to increase in importance throughout the southern African countries, and along with efforts of Space for Elephants, the PGR currently monitors herd health and behavior, but information on herd nutritional status is lacking. The purpose of this research was to collect samples of plant species consumed by the elephants and analyze the chemical composition and adequacy of the general diet using horse nutrient requirements. Body condition score was assessed to determine if animals were losing condition due to lack of nutrition. Collection of plant samples occurred during the dry season in July 2011. Nutrient analyses included DM, ash, crude protein, EE, ADF, NDF, ADICP, NDICP, hemi-cellulose, CHO content, macro and micro minerals; DE was estimated using horse energy calculations; GE, ME, TDN, and estimated digestibility were calculated using NRC Beef 2000. Fecal samples were also collected and analyzed for fiber and mineral content. Estimated DE averaged 1.63 Mcal/kg for grasses, 3.01 Mcal/kg for *Aloe marlothi*, and 2.18 Mcal/kg for tree species. Grasses averaged 2.98% CP, 47.0% ADF, and 76.8% NDF, on a dry matter basis. Aloe averages 16.0% CP, 19.7% ADF, and 25.5% NDF. Tree species averaged 8.8% CP, 37.0% ADF, and 52.7% NDF. Results of this study suggest that crude protein and phosphorus (average 0.11% of DM) are available in marginal amounts and lactating female elephants and the bulls with the highest energy requirements are at risk of losing body condition. Therefore, further population control methods or herd size reduction may be required to sustain the population and avoid detrimental environmental damage from over-exploitation.

**Key Words:** African elephant, nutrition, chemical composition