

Forages and Pastures: General Topics

TH230 In vitro NDF digestion parameters differ when using a forage fiber bag. J. Goeser^{*1}, C. Heuer^{1,2}, and L. Meyer¹, ¹Rock River Laboratory, Inc., Watertown, WI, ²University of Wisconsin, Madison, Madison.

In vitro NDF digestibility (NDFD) parameters are useful in predicting TDN, microbial protein production and energy available for milk production. Ration models use either single time point measures or digestion rates; however in vitro techniques affect digestion parameter results. Prior work found no effect of rumen fluid standardization (add primer and allow fluid to produce gas before inoculation) on digestion kinetic parameters however did not evaluate sample handling techniques (TEC). Our objective was to determine if 2 different rumen in vitro TEC yield comparable results. Sorghum ($n = 1$), corn silage ($n = 3$), legume ($n = 2$), and grass ($n = 3$) samples (dried, 1mm grind) were weighed (0.5g) either into a 125-mL flask (NO) or into an Ankom F57 forage fiber bag (BAG) for in vitro digestion. Rumen fluid was collected and standardized before inoculation. Samples were analyzed in duplicate and digested for 24, 30, 48 and 120h using each TEC. NDF was analyzed by either an Ankom²⁰⁰ forage fiber analyzer or refluxing technique. NDFD (% of NDF) was calculated as $100 \times [(NDF_{0h} - NDF_{residue})/(NDF_{0h})]$. The data were analyzed using both linear and non-linear approaches. The linear model included fixed effects of time, feed type, TEC and interactions. Rate (K_d , %/h), extent (%NDF), and lag (h) were fit with a single pool non-linear model, Extent $\times (1-\text{Exp} \times (-K_d \times (\text{Time-Lag})))$, using SAS JMPv10 for each feed type. The model was fit with and without a 0h time point to assess lag differences. Parameters for NO and BAG were compared using 95% confidence intervals. Following the linear analyses, NO yielded greater NDFD estimates than BAG (46.4% vs. 40.0%, $P < 0.01$) with an interaction between TEC and feed type ($P < 0.01$). Corn silage was the greatest feed type differing by TEC (53.7% NO vs. 36.7% BAG, $P < 0.05$). The K_d did not differ by TEC when 0h was not included in the analyses (3.0%/h NO vs. 3.4%/h BAG, NS) however lag differed ($-8.8h$ NO vs. $9.5h$ BAG, $P < 0.05$). When including 0h (as is the case with routine analyses), K_d differed by TEC (3.8%/h BAG vs. 2.2%/h NO, $P < 0.05$). Results suggest the forage fiber bag slows in vitro digestion when incubated in a 125ml flask and TEC interacts with feed type.

Key Words: NDF, digestion, technique

TH231 Relationship between one-seed juniper terpene concentration and herbivory by small ruminants. R. E. Estell^{*1}, S. A. Utsumi², A. F. Cibils³, and D. M. Anderson¹, ¹USDA ARS Jornada Experimental Range, Las Cruces, NM, ²Michigan State University, Kellogg Biological Station, Hickory Corners, ³New Mexico State University, Las Cruces.

Plant secondary metabolites affect the amount of use by herbivores for several woody species. We examined the relationship between terpenoid concentrations and *Juniperus monosperma* herbivory by small ruminants. The study was part of a larger effort in which goats ($n = 10$) or mixed species (5 goats and 4 sheep) were allotted to 16 plots (20×30 m) containing one-seed juniper for 6 d during 2 seasons at 2 stocking rates. Juniper leaves were sampled from 311 saplings on the same day they were browsed. Saplings were categorized by size (small [<0.5 m], medium [$0.5-1.0$ m] or tall [>1.0 m]) and browsing intensity (low [$<33\%$], moderate [$33-66\%$] or heavy [$>66\%$] herbivory). Juniper bark was also collected from 12 saplings during spring. Leaves and bark were

analyzed for terpenoids with gas chromatography-mass spectrometry. Terpene data were pooled across species and stocking rate and ANOVA was conducted for season, sapling size, and herbivory level. The volatile profile of one-seed juniper leaves and bark consisted of 65 and 55 compounds, respectively. Total estimated terpenoid concentrations in leaves and bark were 18.3 ± 0.3 and 8.9 ± 0.8 mg/g, respectively, and the dominant terpene in both tissues was α -pinene (11.1 ± 0.2 and 7.6 ± 0.7 mg/g, respectively). Total terpenoid concentration was greater ($P < 0.001$) in spring than summer (20.6 ± 0.5 vs. 16.7 ± 0.3 mg/g, respectively) and lower ($P < 0.001$) in small saplings than medium or tall saplings (16.5 ± 0.6 vs. 19.8 ± 0.4 and 19.5 ± 0.4 mg/g, respectively). Total concentration also differed ($P < 0.001$) among all 3 browsing categories (16.1 ± 0.4 , 18.7 ± 0.5 , and 21.2 ± 0.6 mg/g for heavy, moderate, and light herbivory, respectively). Approximately 42% of the variation in browsing intensity could be explained ($P < 0.001$) by 12 compounds ([E]- β -farnesene, cis-sabinene hydrate, bornyl acetate, γ -eudesmol, germacrene A, γ -cadinene, α -pinene, [Z]- β -ocimene, terpin-4-ol, cis-piperitol, cis-p-menth-2-en-1-ol, and camphene hydrate). Our results indicate that the terpene profile of one-seed juniper is related to sapling size, season, and degree of use by sheep and goats.

Key Words: goat, sheep, terpene

TH232 In situ dry matter disappearance of bermudagrass and sudangrass hays harvested at different time of the day. G. Scaglia^{*1} and H. T. Boland², ¹LSU Agricultural Center, Iberia Research Station, Jeanerette, ²Mississippi State University, Prairie Unit, Prairie.

Rates of in situ DM degradation of forages were estimated from samples taken on d 75 of the experimental period at 7 AM and 4 PM. Forage samples from 'Hayking' and 'Piper' sudangrass and common bermudagrass were incubated in the rumen of 4 ruminally cannulated beef heifers ($BW = 460 \pm 12$ kg) for 0, 2, 4, 8, 12, 24, 36, 48, 72, and 96 h. Heifers grazed on 'Alicia' bermudagrass for 15 d prior and during the experimental period. Forage samples were ground through a 2 mm screen and 5 g placed in Dacron bags in duplicate at each time. Bags were placed in mesh bags, incubated in the rumen, taken out of it at the specified time, and frozen. All bags were then thawed and placed in a washing machine (zero-h bags too). Bags were then placed in an oven at 50°C for 48 h and weighed for DM disappearance. Degradation data for DM were fitted to the nonlinear regression model: $P = A + B(1 - e^{-Ct})$ using the NLIN procedure, where P = proportion (%) of DM degraded at time t , A = readily digested fraction, B = slowly digested fraction, $A+B$ = total potentially digestible fraction, C = rate of digestion for the slowly digested fraction, and t = time of incubation. Effective degradability was estimated as: $a + [(b*c)/(c+k)]e^{(-k*L)}$ assuming a passage rate of 0.03. Data were analyzed using PROC GLM and means separated using Tukey's. Fraction A was different ($P = 0.02$) between 'Hayking' (7.85%) harvested in the PM and bermudagrass harvested AM (4.48%). Regardless of time of day at harvest bermudagrass presented the greatest ($P < 0.05$) fraction B (63.1%), its degradability (7.7%/h), and effective degradability (ED of 48.5% at constant K_d) whereas for the other grasses these parameters were similar ($B = 52.7$ and 45.8% , $C = 5.3$ and 6.17% /h, $ED = 38.3$ and 35.7% , for 'Hayking' and 'Piper', respectively). The A fractions in 'Hayking' sudan and bermudagrass were greater ($P < 0.05$) in hay cut in the PM (7.8 and 6.4%, respectively) compared to the AM cutting (5.6 and 4.5%, respectively) but not ($P = 0.32$) for 'Piper' sudan (6.8 and 6.7% for AM and PM, respectively). No differences ($P > 0.05$) in B were detected across forages. In this study,

bermudagrass had better kinetics parameters for the slowly digested fraction than sudangrass varieties

Key Words: bermudagrass, in situ, sudangrass

TH233 Tillering dynamics in Marandu grass pasture submitted to different grazing intensities under continuous stocking. S. S. Santana^{*1}, L. F. Brito¹, P. M. de Franca¹, U. Bragiato¹, M. E. R. Santos², A. C. Ruggieri¹, and R. A. Reis¹, ¹Faculdade de Ciencias Agrarias e Veterinarias/UNESP, Jaboticabal, SP, Brazil, ²Universidade Federal de Uberlandia, Uberlandia, MG, Brazil.

The effect of grazing intensities on tillering dynamics in *Brachiaria brizantha* 'Marandu' pasture was evaluated at FCAV/UNESP, Jaboticabal City, São Paulo State, Brazil, from December 2010 to May 2011. Three grazing intensities, defined by sward heights of 15, 25 and 35 cm, were evaluated in early (ES) and late summer (LS). The heights were maintained by young Nellore bulls grazing under continuous stocking. The treatments were distributed in a completely randomized design with 4 repetitions (paddocks). Three areas (0.0625 m² each) were delimited in each experimental unit, representing the average initial condition of the pasture. At the beginning of the evaluation, all tillers within the frames were counted and marked with colored plastic coated wire. Every 30 d, all tillers were counted again and the new tillers were marked with wire of different color. These data allowed calculating the tiller appearance rate (TAR) and tiller death rate (TDR). The model for TAR and TDR included the effects pasture height and period of summer, compared using Tukey's test. Mean values for TAR and TDR were 50.3% and 16.4% in ES and 32.4% and 5.7% in LS, respectively. These results characterized higher tiller renovation in marandu pasture in the beginning of the summer ($P = 0.0220$ for TAR and $P = 0.0001$ for TDR). Grazing intensities did not affect TAR ($P = 0.3010$, mean value of 42%) since this characteristic is controlled by leaf appearance rate, insensible to defoliation. Higher stocking rates (sward of 15 cm) resulted in higher TDR ($P = 0.0213$), especially in ES. In LS, TDR in shorter sward height was higher than in the 35 cm height ($P = 0.0993$), solely. Grazing intensities affect the dynamics of the tillering with higher tiller renovation in smaller sward height.

Key Words: management, tiller appearance rate, death appearance rate

TH234 Effect of harvesting date on chemical composition and in vitro digestion of buffelgrass (*Cenchrus ciliaris* L.) during autumn in Northeastern Mexico. N. C. Vásquez Aguilar^{*1}, H. Bernal Barragán^{1,3}, R. G. Ramírez Lozano¹, M. A. Cerrillo Soto^{2,3}, M. V. Gómez Meza¹, E. Gutiérrez Ornelas^{1,3}, and M. Guerrero Cervantes^{2,3}, ¹Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México, ²Universidad Juárez del Estado de Durango, Durango, México, ³Red Internacional de Nutrición y Alimentación en Rumiantes, México.

The aim of this study was to evaluate the nutritive value of buffelgrass grown in the semiarid region of Northern Mexico. Twenty one samples were randomly collected emulating the feeding behavior of cattle, from September through December 2012, from several undisturbed grazing sites at Marin, Mexico, a county with dry climate, an annual avg. temperature of 23°C and 530 mm rainfall. Contents of crude protein (CP) and carbon (LECO), hemicellulose, cellulose, lignin, and ether extract (EE) were determined. The in vitro dry matter digestibility (IVDMD; Daisy^{II}, ANKOM), and in vitro gas production (GP, glass syringes) were measured. Metabolizable energy (ME) was calculated from GP, CP, and EE. Data were analyzed in a completely randomized design

with ANOVA. Nutritional value varied ($P < 0.05$) among samples, with extreme CP values measured in late September and November (12.9 and 3.4% DM; $P < 0.05$). Carbon content decreased ($P < 0.05$) from September to October (46.7 to 43.8% DM) and from November to December (47.0 to 45.0% DM). No differences ($P > 0.05$) were found in EE (avg. 2.1% DM). Hemicellulose decreased ($P < 0.05$) from September to December (29.2 to 23.4% DM). Cellulose was higher ($P < 0.05$) in September than October (31.4 vs. 23.8% DM) and in November than December (33.0 to 26.1% DM). Lignin was highest ($P < 0.05$) in September than thereafter (9.8 vs. avg. 6.6% DM). Values for IVDMD (mean 66.7%), in vitro gas production at 24 h incubation (mean 30.6 mL/200 mg DM), and ME (avg. 6.9 MJ/kg DM) were lowest ($P < 0.05$) in September (54.9%, 24.6 mL/200 mg DM, and 5.9 MJ/kg DM, respectively) and highest ($P < 0.05$) in December (72.6%, 36.7 mL/200 mg DM, and 7.7 MJ/kg DM, respectively). Cellulose ($r = -0.775$), C:N ratio ($r = -0.713$), and Hemicellulose ($r = -0.615$) correlated negatively ($P < 0.05$) with IVDMD. Cellulose ($r = 0.793$) and NDF ($r = 0.593$) correlated positively ($P < 0.01$) with C:N ratio. In conclusion, buffelgrass collected in December had the highest nutritional value, in terms of CP, IVDMD and ME, for grazing ruminants.

Key Words: buffelgrass, chemical analysis, in vitro digestibility

TH235 Production of *Panicum maximum* Jacq. cultivars under two defoliation strategies. V. L.N. Brandao*, D.M. Fonseca, M. Wililame, and C. G. Vitor, Universidade Federal de Viçosa, Viçosa, MG, Brazil.

Colonião and Sempre-Verde are forages that used to be widely used in Brazil, while Mombaça and Tanzânia are results of intense genetic breeding. Thus, the objective was to evaluate the production of 4 *Panicum maximum* cultivars submitted to different defoliation strategies. The experiment was conducted at Universidade Federal de Viçosa, Brazil, and it lasted 12 mo. The treatments consisted in 4 *Panicum maximum* cultivars (Mombaça, Tanzânia, Colonião and Sempre-Verde) evaluated by a pre-graze of 95% light interception (LI) by the canopy, or calendar days (28 d). The experiment was conducted as a split-plot design, in randomized blocks, with 3 replications. The forage mass was sampled on condition of pre-defoliation in representative locations of the experimental unit. For the treatments managed with 95% LI, the post-grazing residue was 50% of the canopy's height, and for the treatments based on calendar days the grazing residues were 40, 45, 35 and 30 cm for Mombaça, Colonião, Sempre-Verde and Tanzânia, respectively. The samples were manually separated into leaf, stem and dead material. Each sample was weighed and oven-dried at 55°C. Data were grouped into rainy or dry season. During the rainy season, it was observed that Colonião had the greater total dry mater (TDM) production ($P = 0.026$), and the management had influence on it, while Sempre-Verde had the greater TDM production during dry season ($P = 0.001$). Mombaça and Colonião had the greater leaf dry matter production ($P = 0.038$), especially when using 95% LI management as pre-grazing. Mombaça had the lowest stem dry matter production (SDM) during both seasons ($P < 0.05$). The dead material dry matter production was greater for Colonião ($P < 0.05$). Sempre-Verde had 80% of production during the rainy sea son and others had 90%. Therefore, while Sempre-Verde had the worst productivity, it had the lowest seasonality, which gives it an opportunity to be used during the dry season. In conclusion, it is suggested to use Colonião and Mombaça during rainy season, managed using 95% LI by the canopy as pre-grazing criteria, as this management had better results for every desirable feature.

Key Words: light interception, *Panicum maximum*

TH236 Tiller weight and tiller and branches density in tropical pastures of *Brachiaria brizantha* 'Marandu' mixed with *Arachis pintoi* 'Belmonte'. O. A. A. Lopes de Sa, G. S. Sant'ana, L. G. Freitas, A. D. Rosa, D. R. Casagrande, M. A. S. Lara, A. R. Evangelista, and T. F. Bernardes*, University of Lavras, Lavras, Minas Gerais, Brazil.

To improve the efficiency of forage production in mixed pastures it is necessary understand the interrelationships among grass tillers and legume branches in the sward. Variations in canopy structure caused by different sward height reflect in changes on dynamics of growth. The aim of this study was to evaluate the variation in tiller weight (TW) and tiller density of grass (TD) and branches of legume (BD) in sward of *Brachiaria brizantha* 'Marandu' mixed with *Arachis pintoi* 'Belmonte', mechanically harvested to 10, 20, 30 and 40 cm height, during 2012 fall, winter and spring. The experimental area was located at University of Lavras ($21^{\circ} 14'S$; $45^{\circ} 00'W$), Brazil. The experimental units (10 m^2 plots) were arranged in a randomized complete block design with 4 replications. For TW, the plants were clipped at ground level. For counting of tillers, they were divided in basal tillers (emitted from the soil), aerial (vegetative tillers formed from axillary bud), and reproductive. The PROC MIXED of SAS was used to analyze the data. The TW, TD basal, aerial and reproductive varied as a function of interaction between sward heights and season ($P < 0.05$). In fall and winter seasons the TD reproductive increased linearly with increase in canopy height. This response was similar for winter and spring in the variables TW and TD aerial, being that TW varied of 1297 mg in winter for 891 mg in spring for canopies of 40 cm height, indicating that the inflorescences increased the TW in winter. In spring, the data were adjusted in a linear equation for TD basal. The TD basal decreased with increasing sward height, indicating that pastures of palissadegrass have a compensation mechanism TW/TD where highest densities are associated with small tillers and vice versa. For the variable BD, there was effect of sward height, and the BD set up a quadratic equation, with lower values for height of 40 cm, being that while 10 cm sward had 47 branches/ m^2 , 40 cm sward had 10 branches/ m^2 . Pastures with smaller height enable better conditions for development of *Arachis pintoi* in mixed systems.

Key Words: mixed sward, tropical grass, tropical legume

TH237 Yield and nutritional quality of deferred sorghum hybrids. S. P. Lagrange¹, H. M. Arelovich^{*2,3}, J. P. Vasicek², R. D. Bravo^{2,3}, and M.F. Martinez², ¹INTA EEA Bordenave, Bordenave, Buenos Aires, Argentina, ²Departamento de Agronomia, Universidad Nacional del Sur, Bahia Blanca, Buenos Aires, Argentina, ³Comision de Investigaciones Cientificas (CIC), Bahia Blanca, Buenos Aires, Argentina, ⁴CERZOS-CONICET, Bahia Blanca, Buenos Aires, Argentina.

Forage deferral should improve winter food availability and quality for cow-calf grazing systems of semiarid Argentina. The objective was to determine morphometric characteristics, biomass yield and nutritional quality of forage harvested from sorghum hybrids (SH) as affected by deferral period through winter. SH and seed companies were: VDH 205 (grain), VDH 422 (silage), Sugargraze (forage-silage), VDH 701 (forage-photosensitive), all from Advanta; Lucero BMR (forage) from La Tijereta; and Pegual (Sudan-forage) from Génesis. SH were planted in $1.6 \times 15\text{ m}$ -plots in a complete randomized block design. Plant density was 20, 25 and 35 plants/ m^2 for grain, silage and forage SH respectively. Winter clipping intervals were 194-d (C1), 229-d (C2) and 246-d (C3) after planting on December 4. Forage was cut at 5 cm, and crude protein (CP), in vitro dry matter digestibility (IVDMD), and neutral detergent fiber (NDF) were determined. Pegual developed 44 tillers/ m^2 followed by VDH 701 with 37 ($P < 0.05$). VDH701 and Sugargraze were the

tallest with surpassing 270 cm in C1 and C2, staying taller VDH701 in C3 ($P < 0.05$), with the largest DM yield. Overall, a 32 % reduction in DM yield was found in C3. For VDH 205 and 422 prevailed heads (C1 and C2) increasing sheath fraction in C3. For VDH 701 and Sugargraze prevailed sheaths, as well as for Lucero and Pegual, with more heads compared to the other forage-SH. Sugargraze and VDH 701 exhibited the lowest DM content across cutting dates: 32 to 33% versus 50-60% for the other SH ($P < 0.05$). IVDMD decreased by cutting date: 60.7, 56.2 and 49.0 for C1, C2 and C3 respectively, being greater for VDH205, Sugargraze and VDH422. Sugargraze, VDH422 and VDH205 had the lowest NDF content which increased with cutting date. VDH205 had the highest average CP content (6.7%) followed by VDH422 (5.3 %) both steady across time; CP content only decreased in C3. Overall VDH422 had the best performance. SH can contribute with higher DM yield and better quality than other deferred forages to improve calf crop and land use efficiency

Key Words: sorghum, deferred forage, nutritional quality.

TH238 Influence of bacteriocinogenic lactic acid bacteria on the fermentation profile of elephant grass silage. M. P. Silva, T. C. Silva, L. D. Rufino, M. C. Agarassi, O. G. Pereira*, and H. C. Mantovani, Federal University of Vicoso, Vicoso, Minas Gerais, Brazil.

Lactic acid bacteria (LAB) involved in silage fermentation can produce lactic acid and compounds with proven antimicrobial activity, such as bacteriocins. In this study, bacteriocinogenic lactic acid bacteria isolated from silages of *Stylosanthes* 'Campo Grande', a tropical legume, were evaluated as potential inoculants for silages of elephant grass 'Cameroon'. The forage was ensiled in plastic bags measuring $25 \times 35\text{ cm}$ and sealed with vacuum sealer machine. The inoculants assessed were (1) control (without inoculation); (2) commercial inoculant: Sil All (Altech, Brazil), consisting of *Lactobacillus plantarum*, *L. salivarius*, *Pediococcus pentosaceus* and *P. acidilactici*; (3) isolate *P. pentosaceus* 6.16; (4) isolate *P. acidilactici* 10.4; (5) isolate *P. acidilactici* 10.6; and (6) pool of the isolates 10.6, 6.16, and 4.10. A factorial 5×6 (5 inoculants \times 6 fermentation periods) was used in a completely randomized design with 3 replications. The fermentation periods were: 1, 3, 7, 14, 28 and 56 d. For each fermentation period, the LAB population, silage pH and the concentration of organic acids were determined. Because the LAB population in the forage was $6.77 \log \text{cfu/g}$ before ensiling, the rate of inoculation was 10^8 cfu/g fresh matter (FM) for all inoculants. The largest LAB population was recorded on the first day of fermentation for the silages produced with bacteriocinogenic isolates 6.10 (9.14 log cfu/g) and 6.16 (9.22 log cfu/g). An effect of the interaction inoculant \times fermentation period ($P < 0.05$) was observed for silage pH. On the last day of fermentation, a higher ($P < 0.05$) pH value (4.19) was recorded in the silage inoculated with the isolate *P. acidilactici* 10.4. It was also observed an effect of the interaction inoculant \times fermentation period on lactic acid concentration. In the last day of fermentation, it was recorded a higher concentration ($P < 0.05$) of lactic acid in the silage inoculated with *P. acidilactici* 10.6. These results indicate that bacteriocinogenic LAB can favor the fermentation profile of elephant grass silages, particularly the isolate *P. acidilactici* 10.6.

Key Words: antimicrobial activity, lactic acid, microbial inoculant

TH239 Using near-infrared reflectance spectroscopy as a predictor of in vitro true digestibility of bahiagrass (*Paspalum notatum*). N. L. Bell^{*1}, T. A. Wickersham², and J. L. Young¹, ¹Stephen F. Austin State University, Nacogdoches, TX, ²Texas A&M University, College Station.

Our objective was to create a near-infrared reflectance spectroscopy (NIRS) calibration capable of performing predictions of in vitro true digestibility (IVTD) for bahiagrass (*Paspalum notatum*). Additionally, the calibration was developed to include predictions of moisture, NDF, ADF, and CP. Bahiagrass samples ($n = 275$) were collected from various locations across East Texas. Three ruminally cannulated Angus cattle provided a source of rumen fluid. Samples were run in duplicate in a Daisy^{II} incubator across a minimum of 2 rumen fluid batches to obtain an average IVTD for each sample. Samples with CV > 0.05 within or among fluids ($n = 12$) were removed from the study to eliminate variability associated with animal differences. Values for moisture ranged from 2.6 to 9.8% with a mean of 6.6% and 1.44% SD. Values for NDF ranged from 63.6 to 80.4% with a mean of 70.9% and 3.33% SD. Values for ADF ranged from 29.5 to 48.4% with a mean of 36.7% and 3.40% SD. Values for CP ranged from 3.9 to 17.5% with a mean of 9.3% and 2.42% SD. Values for IVTD ranged from 47.8 to 87.7% with a mean of 67.7% and 5.49% SD in a Gaussian distribution. A Unity SpectraStar RTW system spectrophotometer and UCal software, developed by Unity Scientific, were utilized to develop a calibration by merging laboratory data for $n = 152$ samples with their respective spectral scans. Regression analysis of the calibration generated R² values of 0.844, 0.845, 0.907, 0.967, and 0.887 for moisture, NDF, ADF, CP, and IVTD respectively. Samples not included in the calibration set ($n = 111$) were scanned using the developed calibration and prediction values were compared with laboratory values to validate the calibration. The validation set yielded R² values of 0.144, 0.660, 0.495, 0.918, and 0.561 respectively for the same variables. Results indicated NIRS is effective in predicting CP and less effective in predicting moisture, NDF, ADF, and IVTD of bahiagrass. Calibration may be improved by collecting samples for the lower and higher IVTD value ranges to provide an equal distribution of sample data and create a more accurate prediction equation.

Key Words: bahiagrass, digestibility, near-infrared

TH240 A survey of the expected concentrations of lactic acid bacteria, pH, elapsed time in the tank, and temperature of the inoculant-water mixes used to treat silages. M. Windle^{*1}, C. Wacek-Driver², R. Kuber³, and L. Kung Jr.¹, ¹University of Delaware, Newark, ²Vita Plus, Madison, WI, ³Connor Marketing Inc., Clovis, CA.

A previous laboratory study showed that numbers of viable lactic acid bacteria (LAB) declined rapidly when water temperature equaled or exceeded 39–40°C. The objective of this study was to determine relationships between numbers of expected LAB and pH, ambient temperature, elapsed time in the tank, and temperature of the water that they were in during application. Inoculant-water mixes from applicator tanks ($n = 53$) in WI, MN, SD, and CA were sampled on-farm and immediately plated on de Man, Rogosa, Sharpe agar to enumerate LAB. Plates were incubated for 5 d at room temperature (24–27°C). Expected numbers of LAB were calculated from mixing rates and the minimum label guarantees. The difference between determined and expected (DD-E) numbers of LAB (log cfu/mL) was calculated and expressed in log scale. There was no relationship between pH of the inoculant-water mixture and DD-E ($P > 0.05$). Most (83%) inoculants had been mixed with water in the tank for <10 h. For these samples, there was a negative linear correlation ($P < 0.01$, $R^2 = 0.36$) between time that the inoculant-water mix was in the tank and DD-E. This suggests that numbers of LAB may be declining rapidly in tanks with time but this speculation was not directly tested. There was no correlation ($P > 0.05$) between ambient temperature at the time of sampling and DD-E. However, the temperatures of the inoculant-water mixtures were negatively correlated with DD-E ($P < 0.05$, $R^2 = 0.39$). If the DD-E for a sample was –0.3 log,

this would equate to a final application rate that would be 50% less than the theoretical suggested dose. More than 30% of the samples fell into this category. Based on the current data set, a value of –0.3 log DD-E occurred when water temperatures were 33.3°C. Seven of 10 samples whose water temperature was above 33.3°C had DD-E even more negative than –0.3 log. These data support our previous findings and suggests that high temperatures of inoculant-water mixes have the potential to negatively affect the final application rate of a silage inoculant.

Key Words: forage, inoculant, silage

TH241 Biomass yield and quality of barley forage prior to ensiling as affected by fertilizer rate and harvest date. S. P. Lagrange¹, H. M. Arelovich^{*2,3}, F. X. Frache², R. D. Bravo^{2,3}, M.F. Martinez², and M. I. Amela², ¹INTA EEA Bordenave, Bordenave, Buenos Aires, Argentina, ²Departamento de Agronomia-CERZOS, Universidad Nacional del Sur, Bahia Blanca, Buenos Aires, Argentina, ³Comision de Investigaciones Cientificas (CIC), Bahia Blanca, Buenos Aires, Argentina.

Planting barley (*Hordeum vulgare* L.) for the malt industry is growing in semiarid Argentina. However, barley grazing, hay production and more recently silage making is also practiced. A reduction in quality is expected after ensiling process, which could be attenuated by harvesting material of higher nutritional value. The objective was to evaluate forage yield and nutritional quality of barley ('Josefina INTA', bred for malt attributes) as affected by N fertilizer rates (NFR) at 2 grain maturity stages milky (M1) and dough (M2). Urea was applied at tillering at the rates of 0, 50, 100 kg N/ha upon 1.4 by 5 m plots allotted to a complete randomized block design. Furrows were 20 cm apart with a plant density 220 /m². Annual precipitation was 711.4 mm with 314.6 mm falling within the crop development period. Dry matter (DM) yield and forage content, crude protein (CP), neutral and acid detergent fiber (NDF, ADF), lignin (ADL) soluble non-structural carbohydrates (SNEC), in vitro DM digestibility (IVDMD) and metabolizable energy (ME) were determined. No interaction NFR by maturity stage was found for any variables. For DM yield no differences were found between NFR. Fertilized vs. non-fertilized crops produced 900 and 2000 kg DM/ha more for M1 and M2 respectively ($P < 0.01$). Overall quality parameters were higher for M1 harvest; however, within M2, NFR100 substantially increased CP ($P < 0.01$) with a nonsignificant trend observed for increased IVDMD. A larger DM volume with acceptable quality at NFR100 could be obtained at M2; however, the best ensiling conditions (lower DM content) and nutritive value were found harvesting at M1.

Table 1. Biomass yield and quality of barley forage with 3 rates of N fertilizer (0, 50, 100 kg of N/ha) harvested at milky (M1) and dough (M2) stage prior to ensiling

	M1			M2		
	0	50	100	0	50	100
DM yield, kg/ha	6106 ^a	6989 ^b	6929 ^b	7324 ^a	9223 ^b	9562 ^b
DM, %	32.7 ^b	30.1 ^a	29.4 ^a	52.2	51.3	48.0
CP, %	8.8 ^a	10.4 ^b	12.3 ^c	4.8 ^a	6.8 ^b	8.9 ^c
NDF, %	51.8	52.9	54.0	61.9	60.3	59.7
ADF, %	25.9	26.7	26.4	33.5	27.6	29.7
ADL, %	3.0 ^a	3.3 ^b	4.1 ^b	5.1	5.5	5.8
SNEC, %	30.2 ^b	24.9 ^a	23.8 ^a	9.3	9.0	7.7
IVDMD, %	64.8	64.1	62.9	48.2	48.8	53.6
ME, Mcal/kg DM	2.3	2.3	2.3	1.7	1.8	1.9

^{abc}Differences within maturity stage ($P < 0.05$).

Key Words: barley, forage yield, forage quality

TH242 Protein precipitating phenolics change with herbivory and seed dispersal. C. E. Cooper^{*1}, H. D. Naumann², B. D. Lambert^{4,3}, and J. P. Muir³, ¹Tarleton State University, Department of Environmental and Agricultural Management, Stephenville, TX, ²Texas A&M University, Department of Soil and Crop Sciences, College Station ³Texas A&M AgriLife Research, Stephenville, ⁴Tarleton State University, Department of Animal Science and Wildlife Management, Stephenville, TX.

Protein precipitating phenolic compounds (PPP), such as condensed tannins, are hypothesized to be plant defense against herbivory. This experiment determined how PPP concentration of leaves of 2 warm-season perennial herbaceous legumes was affected by simulated herbivory. *Desmodium paniculatum* (panicked tick-clover; PTC) and *Lespedeza cuneata* (sericea lespedeza; SL) were reared in a greenhouse and subjected to one of 4 treatments: defoliation of previously undefoliated plants or successive defoliation of the upper 50, 75, and 100% of herbage regrowth of plants during vegetative stage, flowering, and seed set. The 2 species responded differently across defoliation events. Concentration of PPP remained stable or increased in PTC from vegetative stage to flowering with the exception of plants subjected to 100% defoliation in which PPP decreased ($P \leq 0.05$) compared with when they were first defoliated at vegetative stage. These plants also differed from all other treatments at flowering. All PTC treatment groups experienced a decrease ($P \leq 0.05$) in PPP between flowering and seeding. For PTC plants that had 100% of leaves removed, PPP decreased continuously and had the lowest ($P \leq 0.05$) concentration of all treatments at the third defoliation, suggesting that PTC plants defoliated at 100% might have lacked the resources to produce well-defended leaves. Concentration of PPP in SL increased ($P \leq 0.05$) in both non-defoliated control and 50% defoliated plants at flowering and remained elevated ($P \leq 0.05$) at seed set. The PPP in plants subjected to either 75 or 100% defoliation were unchanged across defoliation events. Results might correspond with seed dispersal strategies of the 2 species. Seed dispersal strategy in PTC depends primarily on epizoochory by adhering to herbivore hair, whereas SL depends on a combination of barochory and anemochory through simple seed drop. Decreasing PPP in leaves, and hence attracting herbivory, at seed maturity would be beneficial for PTC but not for SL. Results from this experiment indicate that seed dispersal strategy and stress from herbivory may play distinct roles in determining leaf PPP concentration.

Key Words: protein precipitating phenolics, herbivory, legume

TH243 Fermentation quality of maralfalfa grass (*Pennisetum* sp.) and tropical shrub foliage ensiled alone and in mixtures as feed supplements for cattle in Cundinamarca, Colombia. L. Bernal*, *Universidad de La Salle, Bogota, Colombia.*

The aim of this study was to determine the nutritional value and fermentation parameters of silages of maralfalfa (M) grass (*Pennisetum* sp) and of 3 tropical legumes *Gliricidia sepium*, *Leucaena leucocephala*, *Cratylia argentea* (G, L, C) and a non-legume shrub (T) *Tithonia diversifolia* alone and in mixtures. Nine treatments were evaluated: the 5 forages were ensiled pure (100%), and maralfalfa (40%) was mixed with shrub leaves (60%) to improve protein concentrations. Forages were harvested at the San Miguel Farm, Municipality of Paratebueno, Cundinamarca, Eastern Plains of Colombia. Treatments were stored at ambient temperature in small plastic bags of about 1 kg fresh matter in quadruplicates for a period of 42 d. At the end of the fermentation period, samples were taken for analysis of nutritional value (dry matter (DM) and crude protein (CP)) and fermentation parameters (pH, ammonia N, and relation with total N). The completely randomized trial included 9 treatments and 4 replicates of each treatment. Variables were analyzed by

the procedure GLM by SAS. Nutritional quality difference ($P < 0.001$) existed among types of forage. Concentrations of DM were higher for mixtures than for pure species. *Tithonia diversifolia* and maralfalfa grass had the lowest DM (27%). Levels of CP were higher for legumes (G, L, C) $15.06 \pm 0.39\%$ and for mixtures including legumes (GM, LM, CM) $9.57 \pm 0.48\%$ in silage compared with grass or shrub alone (M, T) $4.97 \pm 0.91\%$. Lowest pH values were achieved with *Tithonia diversifolia* and maralfalfa grass (pH 3.9 vs. 3.7), whereas *Cratylia* and *Leucanea* silages had highest pH (5.2 vs. 4.5). Mixtures had intermediate values. The legumes *Cratylia* and *Gliricidia* had highest the relationship between ammonia N/total N, and the lowest value was *Tithonia* and maralfalfa grass and their mixtures. Inclusion of tropical shrub legumes (at 60%) with maralfalfa is a good option for improving crude protein content of silages as important alternative feedstuffs to potentially enhance productivity in dual-purpose cows.

Key Words: tropical forage, nitrogen, silage

TH244 Volatile fatty acids and gas production of diets for growing calves with added yeast inoculants and fermented apple pomace. P. F. Mancillas-Flores¹, C. Rodriguez-Muela^{*1}, D. Diaz-Plascencia¹, G. Corral-Flores¹, Y. Castillo-Castillo², J. A. Grado-Ahuir¹, A. Flores-Mariñelarena¹, and A. C. Arzola-Alvarez¹, ¹Universidad Autonoma de Chihuahua, Chihuahua, Chih. Mexico, ²Universidad Autonoma de Ciudad Juárez, Juárez, Chih. México.

The objective was to evaluate the effect on in vitro fermentation of diets added with yeast inoculants (YI) and fermented apple pomace (AP) for growing calves. Treatments used were T1: 1.2 kg of oat hay, 1.7 kg of corn silage and 1.2 kg calf concentrate per day as fed basis; T2: 1.2 kg of oat hay, 1.7 kg of corn silage and 1.2 kg of concentrate + 12% of fermented apple pomace; T3: 1.2 kg of oat hay, 1.7 kg of corn silage and 1.2 kg of concentrate + 2% of yeast inoculants. The concentrate was formulated with common ingredients for growing calves with 28.8% CP and 1.26 Mcal/kg of NEg. Glass bottles with sample, rumen liquid and artificial saliva were placed in a Shaker I2400 incubator to 39° C with constant shaking (67 rpm), protecting from the light during 96 h of testing period. Evaluated variables were gas production volume; VFA, ammoniac nitrogen (N-NH₃), and lactic acid concentration and pH. Sampling times were: 3, 6, 12, 24, 48, 72, and 96 h. VFA, N-NH₃, lactic acid concentration and pH were analyzed with a model including treatment and time as fixed effects. Highest gas production volume ($P < 0.05$) was in T3. VFA concentration was higher ($P < 0.05$) in T2 and T3 than in T1 (Table 1). N-NH₃ concentration increased, lactic acid concentration decreased and pH increased ($P < 0.05$) in T2 and T3 during sampling period. We conclude that adding YI and AP to growing calves diets increased VFA and N-NH₃ concentration and decreased lactic acid content.

Table 1. Volatile fatty acids concentration of growing calves diets with yeast inoculants and fermented apple pomace

Variable	Treatment			SE
	T1	T2	T3	
Acetic acid (mmol/L)	12.06 ^b	16.0 ^a	17.19 ^a	0.90
Propionic acid (mmol/L)	3.52 ^b	6.54 ^a	6.13 ^a	0.75
Butyric acid (mmol/L)	1.21 ^b	2.63 ^a	2.67 ^a	0.41
Gas volume at 24 h (mL/0.2 g of DM)	1.97 ^b	3.40 ^a	4.20 ^a	0.22
N-NH ₃ (mmol/mL)	0.18 ^b	0.21 ^a	0.22 ^a	0.01
Lactic acid (mmol/mL)	2.30 ^a	1.46 ^b	1.37 ^b	0.20
pH	6.19 ^c	6.56 ^b	6.74 ^a	0.06

Key Words: volatile fatty acid, yeast inoculant, fermented apple pomace

TH245 Grape pomace silage characteristics and in vitro digestibility with or without recycled poultry bedding. M. Basalan*¹ and F. N. Owens², ¹Kirikkale University, Faculty of Veterinary Medicine, Department of Animal Nutrition, Kirikkale, Turkey, ²Pioneer Hi-Bred International, Johnston, IA.

To evaluate silage quality of grape pomace ensiled with recycled poultry bedding and waste (RPB) and its degradation in vitro, grape pomace samples obtained from local wineries were ensiled without or with 10, 20 or 40% RPB obtained from local broiler producers that had been processed and deep stacked. Materials were ensiled in 1 L mini-glass-silos and fermented for 45 d at room temperature. Silage characteristics measured included dry matter disappearance during ensiling, pH, acetic and butyric acid levels, and total bacteria and yeast concentrations. Additionally in vitro dry matter and neutral detergent fiber disappearance were determined with silages produced. Dry matter (DM) content of silages increased linearly ($P < 0.05$) with addition of recycled poultry bedding to grape pomace. The pH was elevated with linear effect by addition of poultry bedding and ranged from 3.97 to 4.75 with 0% to 40% RPB ($P < 0.05$). In contrast, DM loss during ensiling decreased ($P < 0.05$) with the addition of RPB. Acetic acid and butyric acid levels that reflect negatively on silage quality increased linearly ($P < 0.05$) with the addition of RPB. Total numbers of bacteria and yeast were not affected by the addition of RPB. In vitro dry matter and neutral detergent fiber disappearance were not affected ($P > 0.05$) by the addition of poultry waste. In conclusion, grape pomace ensiled with 10% to 20% recycled poultry waste should reduce acceptability problems with RPB though palatability and safety issues need further research attention.

Key Words: grape pomace, silage, recycled poultry bedding

TH246 Improvement of tall wheatgrass biomass yield and quality by intercropping with two legumes. M. Menghini¹, H. M. Arelovich*^{1,2}, S. P. Lagrange³, M. Quintana², and A. Galassi², ¹Comision de Investigaciones Cientificas, Bahia Blanca, Buenos Aires, Argentina, ²Departamento de Agronomia-CERZOS, Universidad Nacional del Sur; Bahia Blanca, Buenos Aires, Argentina, ³INTA EEA Bordenave, Bordenave, Buenos Aires, Argentina.

Tall wheatgrass (*Thinopyrum ponticum*, Pdop.) is a drought resistant perennial grass seeded in Argentina on saline soils for cattle grazing. Intake and nutritional quality are the main constraints to animal performance. The objective was to evaluate the effect of intercropping legumes in a stand of tall wheatgrass on dry matter (DM) availability (DMA) and yield (DMY), as well as quality of the grass. Treatments were: CON (control); HV, intercropping hairy vetch (*Vicia villosa*) or WS, white sweetclover (*Melilotus albus*). On March 27, 2012 a chisel plow plus a land roller were run on plots marked on the tall wheatgrass paddock. Two days later HV and MA were seeded at 13 and 7 kg/ha in 3 replicates per treatment. Two cuts were performed in spring upon all treatments at fixed dates: 176 (C1) and 219 (C2) d after seeding. Neutral and acid detergent fiber (NDF and ADF), acid detergent lignin (ADL) and in vitro DM digestibility (IVDMD) were measured by random samples of 1 m² cut at 3 cm height on each plot. The disk method was used to estimate DMA at beginning of internodes elongation. All data was analyzed by ANOVA and means were separated by LSD ($\alpha = 0.05$), except for DMA which was subjected to regression analysis. In C2, DMY increased ($P = 0.02$; SE = 145) for VH (1354 kg/ha) compared with CON (597 kg/ha). Overall DMY were: 1521, 1792 and 2583 kg/ha for CON, SW and VH respectively ($P = 0.09$; SE = 296). A higher DM content was observed for CON = 47.6% compared with 32.6 and 33.7% for SW

and HV, respectively ($P = 0.04$; SE = 3.6). Nonsignificant trends for NDF and IVDMD ($P = 0.07$ and 0.13, respectively) indicated a reduction in cell wall content of tall wheatgrass and improvement of IVDMD because of legume intercropping. No differences were observed for ADF and ADL. DMA = 129.51x – 453.92; 106.1x + 346.94 and 108.3x – 231.62, with $R^2 = 0.91$, 0.63 and 0.60 ($P < 0.01$) for CON, VH and SW, respectivel, were the calculated regression equations and respective correlation coefficients. These results suggest that overall DMY and quality of tall wheatgrass can be improved by legume intercropping. DMA seems more precisely estimated in pure stands of tall wheatgrass.

Key Words: tall wheatgrass, intercropping, legume

TH247 Agronomic performance and nutritional assessment of three varieties of *Brachiaria* and *Panicum*. M. Medina-Villacis*¹, I. Espinoza-Guerra², M. Samaniego-Armijos¹, J. Mackenzie-Alvarez¹, L. Rizzo-Zamora¹, G. Suárez-Fernández¹, and A. Haro-Chong¹, ¹Unidad de Estudios a Distancia, Quevedo, Los Ríos, Ecuador, ²Facultad de Ciencias Pecuarias, Quevedo, Los Ríos, Ecuador.

The objective of the research was to evaluate the agronomic performance and nutritional assessment of 3 varieties of *Panicum* and *Brachiaria* in different stages of maturity. A factorial arrangement 6 × 4 with 4 replications within a randomized complete blocks design (RCBD) was applied. The analyzed factors were: (A) 6 forage varieties (common forage, Tanzania, Tobiata, B. brizantha, B. decumbens and B. mulatto) and (B) 4 cutting ages in days (21, 42, 63, and 81 d). The evaluated variables were biomass feedstocks (BF) (kg DM/ha), weight of leaves (g), weight of stems (g), leaf length and width (cm), leaf:stem ratio, and chemical composition. The greater weight of leaves was shown by common forage with 159 g at 21 d, by Tobiata forage at 42 and 63 d with 1264 and 1527 g, respectively, and by common forage at 84 d with 1494 g ($P \leq 0.05$). The greater weight of stems was for Tobiata forage at 21, 42, and 63 d with 282, 1527, and 1867 g, respectively, whereas at 84 d the best results were obtained in the Tanzania forage with 2218.5 g ($P \leq 0.05$). The highest leaf:stem ratio was shown by the B. Decumbens forage at 42 d with 1.6 followed by B. brizantha forage at 21 d with 1.0, B. Mulatto forage at 63 d with 0.92, and Tobiata forage at 84 d with 0.99. The longer length of leaf ($P \leq 0.05$) was for Tobiata forage with 72.5, 89.1, 95.3, and 89.6 cm, at the 4 stages of maturity analyzed. The leaf width that stood out was for Tobiata forage at 21, 42, 63, and 84 d with 3.5, 3.0, 3.5, 3.5 cm, respectively. The B. brizantha forage presented, at 3 cutting ages, the highest number of leaves with 281 at 21 d, 489 at 42 d and 742 at 84 d whereas B. Mulatto had the highest results at 63 d ($P \leq 0.05$) with 667 leaves. The greatest level of protein was achieved by Tobiata forage (15.1%) at 21 d and by common forage at 42, 63, and 84 d ($P \leq 0.05$) with 13.5, 9.2, and 7.5%, respectively. Each of the forages examined differed in composition with advancing maturity and the relative ranking of the various forage species changed at the differing ages at harvest.

Key Words: biomass, *Panicum*, *Brachiaria*.

TH248 In situ ruminal energy degradability of three genera of tropical grasses at four regrowth ages during the rainy season in Veracruz, Mexico. H. Bernal-Barragán*¹, E. Castillo-Gallegos², N. C. Vásquez-Aguilar¹, C. A. Hernández-Martínez¹, J. Jarillo-Rodríguez², B. Valles de la Mora², and E. Ocaña-Zavaleta², ¹Universidad Autónoma de Nuevo León, Fac. de Agronomía, General Escobedo, Nuevo León, México, ²Universidad Nacional Autónoma de México,

The effect of regrowth age of tropical grasses on in situ ruminal degradability of energy was determined during the rainy season in a humid tropic area of Veracruz, Mexico. Samples of 4 grasses of genus *Brachiaria* spp. (Mulato, Chontalpo, Insurgente, and Chetumal), 3 *Pennisetum* spp. ("Cuban" king grass, Taiwan, and "Purple" king grass), and 3 *Panicum maximum* grasses (Privilegio, Tanzania, and Mombaza), cultivated in 10 m² plots with 0.5 m distance between plants, were cut at 10 (*Brachiaria* spp.) or 20 cm height (*Pennisetum* spp. and *Panicum* sp.) from 1 m² subplots at 3, 6, 9, and 12 weeks of regrowth from August to October 2008. Five gram of dried (65°C) and ground (1 mm screen) samples were weighed in triplicate into nylon bags (10 × 20 cm, 50 µm pore size) and incubated for 48 h in the ventral rumen of 3 ruminally fistulated cows. Gross energy (GE) content of the samples was measured using an adiabatic bomb calorimeter (Parr). Ruminally degraded energy was calculated considering the GE content before and after the incubation, as well as the DM-degradability of the samples. Data were analyzed as a complete randomized design with 3 × 4 factorial arrangement, (3 genera of grasses and 4 regrowth ages), utilizing SPSS. Before incubation GE of *Brachiaria* was higher ($P < 0.01$) than *Panicum* and *Pennisetum* (3900 vs. avg 3634 kcal/kg DM); GE was also highest ($P < 0.01$) at 3 and lowest at 6 and 9 weeks of regrowth (3895 vs. 3737 kcal/kg DM). There was a genus × age interaction ($P < 0.01$) for ruminal energy degradability, with values of *Panicum* decreasing from 67.4% at wk 3 to 59.0% at wk 9, and those of *Pennisetum* and *Brachiaria* remaining around ($P > 0.05$) 67.5% until wk 9, and decreasing ($P < 0.05$) thereafter to values of 58.4 and 53.6%, respectively. In situ ruminal degradability of energy (64.0%) correlated ($r = 0.988$; $P < 0.01$) with degradability of DM (64.9%). In conclusion, during rainy season in a hot-humid region, ruminal degradability of energy was lower for *Panicum* than for *Pennisetum* and *Brachiaria*.

Key Words: tropical grass, in situ ruminal fermentation, energy degradability

TH249 Nutritive value and fermentation quality of the silage of three kenaf (*Hibiscus cannabinus* L.) cultivars at three different growth stages. B. W. Kim*, K. I. Sung, J. G. Nejad, and J. S. Shin, College of Animal Science, Kangwon National University, Chuncheon, Kangwon, South Korea.

This study was conducted to evaluate the nutritive value and the quality of ensiled kenaf after fermentation with 3 cultivars at 3 different times of harvesting. Experimental plots were allocated with 3 harvest date (early; 8/3, medium; 8/15 and late; 8/28) and 3 cultivars (Tainung-a, Everglade, and Whitten). The DM yield increased with maturity in all 3 cultivars, especially in Whitten which showed the highest yield at each harvest time. The DM content in Whitten at late harvesting time was higher than other treatments (Tainung-a; 21.2 ± 1.3% DM, Everglade; 21.1 ± 1.3% DM, and Whitten; 23.1 ± 1.5% DM). The CP contents of the kenaf silage of all 3 cultivars ranged from 151 ± 9.8 to 164 ± 10.2 g kg⁻¹ DM. Highest content of NDF was observed in Everglade at medium harvesting date, but the ADF content was highest in Everglade at early harvesting date ($P < 0.05$). All treatments produced a silage pH less than 4.0, which is sufficient for stable storage. However, the pH of Tainung-a was higher (3.95 ± 0.13) than other cultivars at all harvesting times ($P < 0.05$); other cultivars ranged from 3.50 ± 0.11 to 3.75 ± 0.16. Whitten had higher content of lactic acid (25.8 ± 2.25 g kg⁻¹ DM) at early harvesting date than other cultivars; other cultivars ranged from 19.5 ± 2.07 to 22.5 ±

2.16 g kg⁻¹ DM, whereas the acetic acid content (21.1 ± 1.98 g kg⁻¹ DM) was higher in Tainung-a at medium harvesting date ($P < 0.05$); other cultivars ranged from 16.8 ± 2.01 to 18.8 ± 1.91 g kg⁻¹ DM. No significant difference was observed in ammonia-N and butyric acid concentrations among all treatments. These results indicate that a kenaf silage could be used as a fodder for ruminants. Especially, the Whitten harvested at late growing stage showed promise as a forage silage crop considering the higher yield and lower fiber contents under Korean environments.

Key Words: kenaf, silage

TH250 Effect of supplementing exogenous fibrolytic enzymes with cofactors on the preingestive hydrolysis of bermudagrass. J. J. Romero^{*1}, Z. X. Ma¹, A. A. Pech¹, C. R. Staples¹, C. F. Gonzalez², and A. T. Adesogan¹, ¹Department of Animal Sciences, IFAS, University of Florida, Gainesville, ²Department of Microbiology and Cell Science, IFAS, University of Florida, Gainesville.

The objective was to determine the effects of adding cofactors to 5 exogenous fibrolytic enzymes (E; 1A, 2A, 11C, 13D, 15D) from *Trichoderma longibrachiatum* on preingestive hydrolysis of a 4-wk regrowth of Tifton 85 bermudagrass haylage (BH). Ground BH (1 mm; 0.5 g; 67.8, 33.9, 3.7 and 18.7% NDF, ADF, ADL, and CP, respectively) was treated in quadruplicate with nanopure water alone, each E alone or with Mn²⁺, Co²⁺, Fe²⁺, Ca²⁺ and Mg²⁺. Cofactors (C, 1 mM) and 2 mL of each E solution (with 0.02% w/v sodium azide) were added to BH in culture tubes at dose rates of 4.5, 4.5, 10, 7.5 and 7.5 g /kg substrate for 1A, 2A, 11C, 13D and 15D, respectively and incubated for 24 h at 25°C. Data were analyzed as a completely randomized design with a 6 × 6 factorial treatment arrangement. The model included effects of E, C, and E × C. Water-soluble carbohydrate concentration was increased ($P < 0.05$) by adding all enzymes except 13D and further increased (E × C, $P < 0.01$) by adding Mn²⁺, Co²⁺, Fe²⁺, Ca²⁺ and Mg²⁺ to 2A (5, 6, 10, 3, and 3%, respectively) or 11C (38, 23, 24, 15 and 13%, respectively), by adding Co²⁺ and Fe²⁺ to 15D (8, and 14%, respectively), and by adding Fe²⁺ to 1A (5%). Adding Mn²⁺, Co²⁺, and Fe²⁺ to 13D increased WSC by 14, 15 and 23%, respectively. Adding 1A, 2A and 11C alone decreased ($P < 0.05$) NDF and ADF (%) but cofactor addition had no effect. Adding each E alone except 13D increased ($P < 0.05$) free ferulic acid (µg/g) and the response was further increased (E × C, $P < 0.01$) by adding Co²⁺ and Ca²⁺ to 2A (7 and 13%, respectively) and Mn²⁺ to 1A (8%). In contrast, free ferulic acid was reduced by adding all cofactors to 15D (7, 19, 15, 8, and 27%, respectively); by adding Mn²⁺, Fe²⁺, and Mg²⁺ to 2A (8, 17, 26, respectively); by adding Mn²⁺ and Fe²⁺ to 11C (3 and 9%, respectively) and by adding Mg²⁺ to 1A (10%). Cofactor addition to the enzymes increased WSC release but did not affect NDF or ADF concentrations and had variable effects on ferulic acid concentration.

Key Words: forage, enzyme, cofactor

TH251 Content of tannins and effect of polyethylene glycol on in vitro fermentation kinetics and digestibility of *Quercus hintonii* and *Quercus glaucoidea* acorns and leaves. F. A. Nova^{*1}, J. G. F. Estrada², O. A. C. Ortega³, A. R. Otero¹, and B. A. Portillo¹, ¹Centro Universitario Temascaltepec Universidad Autónoma del Estado de México (UAEM), Barrio de Santiago, Temascaltepec, Estado de México, México, ²Instituto de Ciencias Agropecuarias y Rurales (ICAR) (UAEM), El Cerrillo, Piedras Blancas, Toluca, Estado de México, México, ³Facultad de Medicina Veterinaria y Zootecnia

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This study was conducted to evaluate the content of tannins and effect of polyethylene glycol on in vitro ruminal fermentation kinetics and digestibility of leaves and acorns from the *Quercus hintonii* and *Quercus glaucooides*. The amount of total phenols (TP) was calculated as a tannic acid equivalent using the calibration curve, and total tannins (TT) were determined using polyvinyl-polypyrrolidone (PVPP), both through the Folin-Ciocalteu method. The content of condensed tannins (TC) and fiber-bound condensed tannins (FBT) was determined using the butanol/HCl/Fe³⁺ test. Fermentation kinetics, the digestibility of organic matter (IVDOM) and digestibility of neutral detergent fiber (IVDNDF) were evaluated using the in vitro gas production technique with and without the addition of polyethylene glycol (PEG 6000). A totally random design was used with a 2 × 2 factorial arrangement. With the addition of PEG, a positive effect was observed in IVDOM, IVDNDF and ME in leaves ($P < 0.001$). An increase of 60 g/kg DM in the IVDOM was noted in *Q. glaucooides* leaves. And an increase of 42 g/kg DM was noted in *Q. hintonii* leaves. The IVDNDF of *Q. glaucooides* leaves increased by 89 g/kg DM ($P < 0.001$), and in *Q. hintonii* leaves, by 38 g/kg DM ($P < 0.01$). An increase of 91 g/kg DM was observed in the IVDOM of *Q. glaucooides* acorns, and an increase of 21 g/kg DM in *Q. hintonii* acorn ($P < 0.001$). The fermentation parameters of *Q. hintonii* and *Q. glaucooides* leaves improved with the addition of PEG. The *Q. glaucooides* species demonstrated greater gas production in the soluble fraction *a* (24.5 mL) and the *Q. hintonii* species demonstrated greater gas production in fraction *b* (45.4). *Q. hintonii* acorns had greater ($P < 0.01$) content of TP (289 g/kg DM), TT (284.7 g/kg DM), and CT (16.2 g/kg DM) and *Q. glaucooides* acorns had greater ($P < 0.01$) content of NPT (5.6 g/kg DM) and FBT (7.1 g/kg DM). A positive effect was observed on the leaves and acorns of the *Q. glaucooides* and *Q. hintonii* species with the addition of PEG, improving the IVDOM, IVDDF and the fermentation parameters.

Key Words: fermentation, acorn, tannin

TH252 Tropical pasture grazing management effects on in vitro rumen degradation kinetics evaluated with a semi-automated technique of gas production. M. R. Lovaglio*, J. R. R. Dorea, M. G. M. F. Santos, L. R. D. Agostinho Neto, D. F. A. Costa, and F. A. P. Santos, *University of São Paulo, Piracicaba, São Paulo, Brazil.*

The objective of this trial was to evaluate the rumen degradation kinetics and indigestible neutral detergent fiber (NDFi) in 2 different managements of Brachiaria brizantha pasture. The treatments were 2 pre-grazing heights (25 and 35 cm) corresponding to approximately 95% and 100% of light interception, respectively, and a target stubble height of 15 cm. The experimental design was in completely randomized blocks, with 4 blocks, 2 treatments and 2 replicates per treatment, constituting 16 paddocks of 0.1 ha each. Forage samples were collected on grazing horizon (15 to 25 cm and 15 to 35 cm). The NDFi in the samples was determined after 240 h of rumen incubation, and subsequent NDF analysis. The parameters of rumen degradation kinetics were estimated using the semi-automated method of cumulative gas production. The substrate (1 g) was incubated with rumen inoculum (10 mL) and bath culture (90 mL). The pressure was measured at 1, 2, 3, 4, 6, 8, 10, 12, 14, 17, 20, 24, 28, 36, 48, 72, 96 and 120 h after incubation. The rumen degradation parameters were estimated using bicompartimental logistic model and analyzed using SAS system. The final volumes of fibrous carbohydrate (121.4 mL and 119.3 mL ± 2.7 for 25 and 35 cm respectively), non-fibrous carbohydrate (107.3 mL and 100.8 mL ± 3.4 for 25 and 35 cm, respectively) and rate degradation of nonfibrous (0.0718 and 0.0735%/h ± 0.004 for 25 and 35 cm, respectively) carbohydrate (kdNFC) were not affected by grazing management. However, the degradation rate of FC decreased ($P < 0.05$) when pasture was managed with 35 cm (0.0200 and 0.0182%/h ± 0.001 for 25 and 35 cm, respectively). This result is according to NDFi values that increased ($P < 0.05$) with 35 cm management (18.8 and 21.2% ± 1.0 for 25 and 35 cm, respectively). The lag time was greater ($P < 0.05$) with 35 cm height than with 25 cm, probably from a more difficult microbial access to feed particles (5.4 and 6.0 h ± 0.2 for 25 and 35 cm, respectively). The pre-grazing height of 25 cm resulted in pastures of greater quality, and probably better quality of fibrous fraction.

Key Words: degradation kinetic, tropical pasture