T116 Descriptive statistics for surface and core temperatures measured with infrared imaging and a digital thermometer on commercial Midwestern US silages. J. P. Goeser*, C. Heuer, and C. M. Wacek-Driver, *Vita Plus Corp., Madison, WI.*

Forage temperature is related to silage nutritional status and DM loss, however limited data exists describing commercial forage temperatures in the US. This study surveyed silage surface and core silage temperatures to calculate population statistics reflecting temperature variations on commercial Midwestern US farms. Farms with horizontal silos of corn silage (n=44) and alfalfa silage (n=33) were measured twice, once during January 14 - April 27 and again during May 25 – August 6 in 2010. Range (maximum minus minimum) in surface temperatures was measured using a thermal imaging camera (FLIR Systems model b40, Boston, MA). Core temperatures were measured at approximately 65cm depth using a digital thermometer. Three core measures were taken: 1.5m from the right and left edge (**R/L Edge**) and one in the center; all core measures were taken 1.2m from the ground. Data were summarized using simple population statistics. Results are presented in Table 1. Range in silage temperatures (measured 200mm beneath silage surface) greater than 5°C above the silage central zone has previously been related to decreased nutritional value, however we observed surface temperature ranges greater than 5°C for all silages measured with an infrared camera. The results showed a numerical interaction for season and crop, with winter temperatures higher for corn silage than summer and vice versa for alfalfa silage. Further, silage temperatures greater than 35°C suffer protein losses and we observed core and surface temperatures exceeding 35°C, suggesting commercial forages are likely suffering protein losses due to heat.

Table 1. Forage silo temperature measures (degrees C)

Season	Crop	Measure Location	Mean	Max	Min	SD
Winter	Corn Silage	R/L Edge Core	19.3	39.0	6.0	6.5
		Center Core	22.2	34.0	13.0	6.0
		Surface Range	11.5	43.0	5.0	7.0
Winter	Alfalfa Silage	R/L Edge Core	21.3	38.0	4.0	6.2
		Center Core	24.9	35.0	8.0	6.2
		Surface Range	13.1	35.0	3.0	8.3
Summer	Corn Silage	R/L Edge Core	21.6	37.0	9.0	6.1
		Center Core	20.0	43.0	9.0	6.7
		Surface Range	8.5	21.0	1.0	5.6
Summer	Alfalfa Silage	R/L Edge Core	27.1	42.0	15.0	7.7
		Center Core	27.7	44.0	15.0	8.3
		Surface Range	10.8	28.0	2.0	8.0

Key words: forage, temperature, heating

T117 Intake, digestibility, and internal marker recovery of bermudagrass fed to cattle. J. Kanani*, D. Philipp, K. P. Coffey, E. Kegley, C. West, S. Gadberry, A. Young, and R. Rhein, *University of Arkansas, Fayetteville.*

A study was conducted to evaluate intake (DMI), digestibility (DMD), and fecal recovery of indigestible NDF (INDF) and ADF (INDF) by cattle offered bermudagrass [*Cynodon dactylon* (L) Pers] hays of varied qualities. Eight ruminally cannulated cows (594±100.3 kg) were allocated randomly to 4 bermudagrass-hay diets having a wide range of nutritional value providing two replicates per diet per period(n=24). Crude protein (CP) contents of the four hays offered in each period were 6.8, 10.5, 12.3, and 14.8; 7.8, 11.0, 13.3, and 16.4; and 9.0, 11.8, 13.8, and 18.1% DM; respectively for period 1, 2, and 3. Cows were housed in individual pens and offered their respective hay at 2% of BW in equal feedings at 0800 and 1700 h for a 10-d adaptation period followed by a 5-d total fecal collection period. Duplicate samples of each of the hay, ort, and fecal samples from each period were incubated for 140 h in the rumen of two cows for each of the digestion periods, followed by a sequential analysis of NDF and ADF. Recovery of INDF and IADF was expressed as the ratio of the quantity of marker excreted in the feces per unit of marker consumed. Data were analyzed as a replicated 4 × 4 Latin square design with one period missing using PROC GLM of SAS. Effects of cow, diet, and period were included in the model. Diet affected DMI (1.35, 1.63, 1.82, 1.73% BW, $P < 0.05$) and did not affect apparent DMD (53.0, 58.2, 57.7, 59.1% DM, $P > 0.05$). Marker recovery of INDF (68.2, 77.5, 85.1, 83.3%) was affected by diet ($P < 0.05$). Mean IADF recovery followed the same pattern with a slight increase in percentage of recovery. Mean IADF recovery was 70.0, 79.7, 88.9, and 87.5%; respectively for low, medium low, medium high and high CP content diets. Indigestible NDF and ADF determined by in situ incubation appeared not to be an adequate internal marker for varying quality of bermudagrass hay fed to cattle because of low recovery (less than 95%) and drastic variability across the range of bermudagrass hays tested.

Key words: bermudagrass nutritive value, internal marker, cattle

T118 In vitro gas production and microbial efficiency of *Paulownia tomentosa*. V. Gallardo-Santillan[1], R. Luevano-Escobedo[1], V. M. Llamas-Rodriguez*[1], M. Guerrero-Cervantes[1], H. Bernal-Barragán[2], A. S. Juárez-Reyes[1], and M. A. Cerrillo-Soto[1], *[1]Universidad Juárez del Estado de Durango, Durango,México, [2]Universidad Autónoma de Nuevo León, Nuevo León, México.*

This study was performed to determine the nutritional value of *Paulownia tomentosa* using in vitro estimations. Leaves from trees at three different stages of growth: juvenile (1 year), medium (4 years) and adult (10 years old) were collected during a period of three months. The collected samples were dried and ground through 1 mm screen. The samples (500 mg) were incubated in triplicate in calibrated glass syringes at 39°C. Rumen fluid from fistulated sheep fed alfalfa hay and concentrate (75:25) was used as inoculum. Gas production was recorded at 0, 3, 6, 9, 12, 24, 48, 72, and 96h. Data were fitted to the model $p= a+b\ (1-e^{-ct})$. Additional 24h incubations were utilized to estimate purine contents. The partitioning factor was also calculated from incubation residues which were refluxed with neutral detergent fiber solution. Data were analyzed for a completely randomized design for a 3 × 3 factorial arrangement with 3 maturity levels, (juvenile, medium and adult) and 3 cutting dates (August, September and October, 2010) using the SPSS program. Mean differences were separated using Tukey's test. No interactions were registered in the partitioning factor or fermentation parameters; however, interactions ($P < 0.05$) between maturity level*cutting date for purine contents were recorded. Partitioning factor values were similar during August and September (3.6 ± 0.2 mg substrate truly degraded/mL gas produced $_{24h}$ in vitro) but higher than those registered in October (2.9). Purine content was lower in foliage from adult samples in October (6.3 ± 0.6 µmol) than in medium (13 µmol) and juvenile (14 µmol). An effect of maturity

($P < 0.001$) was registered in the gas produced from the slowly but degradable b fraction; adult samples had lower values (36.5 ± 1.27 ml/500 mg) than juvenile (42 mL) and medium (45 mL). Similarly, the constant rate of gas production c in medium samples was higher (8.7 ± 0.004% h^{-1}) than juvenile (7.5% h^{-1}) and adult (6.3% h^{-1}). Data related to the rate and extent of gas production of the foliage of *Paulownia* at medium stages of growth support the fact this foliage is a promising animal feed resource.

Key words: *Paulownia*, in vitro gas production, purines

T119 Relationships between chemical composition, in vitro dry matter, neutral detergent fiber digestibility, and in vitro gas production of corn and sorghum silages. A. Corral-Luna*[1], D. Domínguez-Díaz[1], M. R. Murphy[2], F. A. Rodríguez-Almeida[1], C. Arzola[1], G. Villalobos[1], and J. A. Ortega-Gutierrez[1], *[1]Facultad de Zootecnia y Ecología, Universidad Autónoma de Chihuahua, Chihuahua, Chihuahua, México, [2]Department of Animal Science, University of Illinois, Urbana-Champaign.*

Five corn (*Zea mays*) and 4 sorghum (*Sorghum bicolor* L. Moench) silages were used to investigate the relationship between chemical composition (CC), in vitro dry matter digestibility (IVDMD), in vitro neutral detergent fiber digestibility (IVNDFD) and in vitro gas production (IVGP). The corn hybrids were harvested at half milk line and sorghum varieties in soft dough stage and ensiled in laboratory silos. Silages were dried in a 60°C forced-air oven, ground to pass a 1 mm sieve and analyzed for CC, IVDMD, IVNDFD and IVGP. The IVDMD and IVNDFD were determined using the ANKOM Daisy^{II} incubator and the IVGP according to the Menke and Steingass technique. The amount of gas produced (AGP) was recorded at 1, 2, 3, 4, 5, 6, 9, 12, 24, 48 and 72 h of incubation using a pressure transducer. The Groot logistic model was fitted to analyze the cumulative AGP for each sample. Pearson correlations coefficients between CC and AGP parameter estimates were calculated. The capability to predict IVDMD and IVNDFD based on CC and AGP data was examined with linear regression analyses. Silage contents of NDF, ADF and lignin were negatively correlated ($P < 0.05$) with IVDMD (−0.52, −0.50 and −0.50, respectively), and CP with asymptotic AGP (−0.42), but positively correlated ($P < 0.01$) with the estimates of parameter B (Time at which the half of asymptotic AGP was reached; 0.85, 0.81 and 0.72, respectively). After 1 h of incubation, AGP was negatively correlated to lignin content ($P < 0.01$) and positively correlated ($P < 0.05$) with non-fibrous carbohydrate (NFC). After 12 h of incubation, the correlations between NDF and ADF with AGP were highest ($P < 0.01$) until 48 h (−0.56 and −0.53, respectively). The CC alone is a good predictor of IVNDFD ($R^2 = 0.66$), and combined with AGP data adequately predicted IVDMD ($R^2 = 0.93$).

Key words: in vitro gas production, chemical composition, in vitro digestibility

T120 Effect of blending ruminal digesta, and filtration procedure on in vitro gas production. M. de J. Marichal*, R. Crespi, M. de los A. Bruni, S. Furtado, and G. Arias, *Departamento de Producción Animal y Pasturas, Facultad de Agronomia, Universidad de la Republica, Montevideo, Uruguay.*

Effect of blending ruminal digesta, and filtering through two or four layers of gauze or cheesecloth on in vitro gas production was evaluated. Rumen contents from two fistulated sheep were collected two hours after the morning meal (alfalfa hay, 1.6 kg DM/d, twice daily). Contents were combined, and blended for up to 1 min or not blended. Filtration was performed using 2 or 4 layers of either gauze or cheesecloth, resulting in eight combinations of inoculum preparation procedures. Samples (500 mg, milled 2 mm) of alfalfa hay (17% CP, 45% NDF) were weighed into 125 ml bottles, and mixed with ruminal fluid (10 ml), buffer (40 ml), and reducing (2 ml) solutions. All manipulations were done at 39$/deg;C, and with consistent CO_2 flushing. Time between rumen fluid collection, and inoculation was 40 min. Three bottles with substrate and three blanks were incubated per treatment. Pressure and gas volume gas were recorded at 1, 2, 3, 4, 6, and 8 h using a pressure transducer and calibrated syringe; venting the gas after each measurement. Gas accumulated at 8 h, and volume at each fermentation time, were analyzed (PROC MIXED, SAS) in a complete randomized design with a 2 × 2 × 2 factorial arrangement of treatments. Treatment effects on accumulated gas at 8 h were observed ($P < 0.01$), but no interactions ($P > 0.15$) among treatments existed. Accumulated gas was greater ($P < 0.001$) when digesta was blended previous to filtration (65 vs. 57 mL gas/g DM, respectively), when filtering through gauze than cheesecloth (65 vs. 59 ml/g DM, respectively), and 2 layers of either material, resulted in greater ($P < 0.01$) gas than 4 (66 and 57 mL gas/g DM, respectively). In all treatments, analysis of gas production at each fermentation time suggested ($P < 0.03$) a lag time of 4 h. When gas from blanks was subtracted from alfalfa gas, results were similar; the only difference was when comparing filtration materials, where no difference ($P = 0.22$) in accumulated gas existed (56 vs. 57 mL gas/g DM, for gauze and cheesecloth, respectively). It is important to consider all aspects of inoculum processing when comparing results of in vitro gas production experiments due to the potential variability between processing methods.

Key words: alfalfa, cheesecloth, layers

T121 Predictive accuracy of near-infrared reflectance (NIR) technology for fat and fatty acids in randomly selected TMR samples. R. T. Ward*[1], S. Weaver[1], and R. A. Patton[2], *[1]Cumberland Valley Analytical Services, Maugansville, MD, [2]Nittany Dairy Nutrition Inc., Mifflinburg, PA.*

Growing realization of the negative impact that consumption of unsaturated fats in general and linoleic acid in particular can have on the production of milk fat has led to a demand for determination of fatty acids, unsaturated fatty acid and linoleic acid in total mixed rations (TMR). At present this is an intensive process. In addition to extraction problems with high fat products, fatty acids must be separated by gas chromatography (GC). Development of an accurate test using NIR could provide a cost effective alternative that would allow more precise measurement and more control of these ration inputs. The objective of this study was to test whether NIR could adequately predict total fat content, total fatty acids, and total unsaturated fatty acids, as well as the C18 saturated and unsaturated fatty acids compared with chemical and GC analysis. Correlation and mean square prediction error (MSPE) were calculated in SAS using the methodology of Bibby and Toutenburg on 17 randomly selected TMR samples submitted in January 2011. Mean fat content of TMR was 4.35 ± 1.01% with a minimum of 2.60% and a maximum of 5.80% of DM. Fatty acid content was 3.87 ± 1.25% on a DM basis. NIR displayed good ability to predict fatty acids in quantities greater than 0.3% of dry matter. Below this level, ability to predict the mean was maintained, but correlation coefficients were decreased, and MSPE as percent of mean (RPE) was increased. Observed mean total unsaturated fatty acids were 2.47 ± 0.91% of DM, while NIR predictions were 2.46 ± 0.73 with a MSPE of 0.054 and R^2 of 0.98. Mean linoleic acid was observed to be 1.64

± 0.62% of DM and NIR predicted to be 1.64 ± 0.57% with MSPE of 0.024 and R^2 of 0.97. Similar value for C18:1 and C18:3 were respectively: mean observed, 0.69 ± 0.32 and 0.26 ± 0.08; mean predicted, 0.69 ± 0.16 and 0.26 ± 0.07; MSPE, 0.035 and 0.004; R^2, 0.89 and 0.64. We conclude that NIR has the potential to adequately predict fat, unsaturated fat and individual fatty acids when quantities are above 0.3% of DM.

Key words: NIR, fat, linoleic acid

T122 Relationships of fermentation characteristics in corn forage. R. Ward*[1] and D. R. Mertens[2], *[1]Cumberland Valley Analytical Services Inc, Maugansville, MD, [2]Mertens Innovation & Research LLC, Belleville, WI.*

Our objective was to study factors affecting the fermentation characteristics of corn forage using a database of analyses from Cumberland Valley Analytical Services, Inc. The initial database contained 4712 samples over 4 years from 41 states with analyses including fermentation characteristics such as titratible acidity (TA), ammonia (NH_3), acetic (Ac), lactic (La), and propionic (Pr) acids (measured chemically). Components such as DM, CP, ash, NDF, ADL, starch (St) and sugar (Su) were determined by chemical or NIR methods. Non-ammonia N (NAN) was calculated by difference between CP and NH_3. Data was analyzed using Proc MIXED in SAS. In order, TA was affected by Ac, La, Pr, NAN, St, Su, NH_3, ash and ADL ($P < 0.0001$). Intercept, Ac and La accounted for 0.61, 0.20 and 0.18, respectively, of the variation explained by the model. The coefficients for Ac, La, and Pr were positive and all other variables had negative coefficients. Average TA was 7.2 in Oct, increased to 8.0 by Jan and was maximum (8.9) in Apr (all different $P < 0.005$). Corn silage NH_3 (% DM) was related (in order) to Ac, La, CP, St, ADL and Pr ($R^2 = 0.54$). Intercept, Ac and La accounted for 0.40, 0.22 and 0.19 of model variation, respectively. All coefficients were positive. Average NH_3 was 0.77 in Oct, increased to 0.90 by Jan and was maximum (1.08) in May (all different $P < 0.0001$). When TA replaced individual acids (La, Ac, Pr) in the model, NH_3 was related (in order) to TA, CP, St and ADL ($R^2 = 0.52$); and TA accounted for 0.73 of model variation. Expressing NH_3 as % of CP, reduced the R^2 (= 0.45) and the influence of CP ($P = 0.093$). When months in storage was added to the NH_3 model with TA, CP, St, and ADL, the R^2 increased to 0.56, and the linear and quadratic effects of storage were significant ($P < 0.0001$). When Ac was grouped by level, DM, St and Su decreased, and fiber and NH_3 increased, as group Ac increased. Region or year had limited effects on any of the results. We concluded that NH_3 in fermented corn forage is related not only to the extent of fermentation as indicated by TA or acids (Ac, La, Pr), but also to time in storage. Fermentation relationships can explain changes in corn forage that affect utilization.

Key words: fermentation, corn silage, forage

T123 Factors affecting estimation of spoilage indices in silage. 1: Effects of culture media, temperature, and duration. J. Leite[1,2], K. G. Arriola[1], N. Cavalcanti[1,2], O. C. M. Queiroz[1], E. N. Muniz*[1,3], and A. T. Adesogan[1], *[1]Department of Animal Sciences, IFAS, University of Florida, Gainesville, [2]Universidade Federal Rural de Pernambuco, Recife, PE, Brazil, [3]Embrapa Tabuleiros Costeiros, Aracaju, SE, Brazil.*

The growth of yeasts and molds reduces silage quality and bunk life and can predispose to mycotoxin production and growth of pathogenic organisms. Little is known about effects of different culture media, temperatures, and durations on the growth of these fungi in silage. This trial was conducted to evaluate effects of 3 culture media, 2 temperatures, and 2 culture durations on the growth of yeasts and molds in corn silage. Fluid was extracted from corn silage (38% DM, 8.4% CP, and 39.8% NDF) and cultured on malt dextrose agar (MEA), potato dextrose agar (PDA) or on 3M film in triplicate at temperatures of 25 or 32°C for 3 or 5 d. The experimental layout was a 3 (media) × 2 (temperatures) × 2 (durations) factorial and the model included these terms and their interactions. Counts of the fungi were log-transformed and statistically analyzed with PROC GLM of SAS. No interaction was significant for mold counts ($P > 0.1$). Mold counts were similar on MEA and PDA, fewest ($P < 0.05$) on 3M film, and unaffected by culture temperature or duration. Culture temperature and duration had no effect on yeast counts on PDA, but yeast counts were fewer when cultured on 3M film at 25°C for 3 d than with other treatment combinations and they were lower when cultured on MEA at 25°C for 5 d than at 32°C for 3 d (media x temperature x duration interaction, $P = 0.007$). On average, yeast counts on MEA were fewer than on other media and counts at 32°C for 3 d were greater than for other temperature and duration combinations. This study shows that experimental conditions markedly affect the outcome of yeast and mold enumeration on silage.

Table 1. Effects of culture temperature, duration, and media on mean counts of molds and yeasts in corn silage

	Mold			
Media	PDA	MEA	3M	
	4.84^{b}	4.40^{b}	$<2^{a}$	
Temperature (°C)	25	32		
	3.31^{a}	2.85^{a}		
Time (days)	3	5		
	3.51^{a}	2.65^{a}		

	Yeast				
	25°C		32°C		
	3 d	5 d	3 d	5 d	Mean
PDA	6.57^{c}	5.04^{bc}	6.48^{c}	5.48^{bc}	5.89^{B}
MEA	2.14^{ab}	$<2^{a}$	4.72^{bc}	2.51^{ab}	2.34^{A}
3M	$<2^{a}$	7.75^{c}	8.02^{c}	5.41^{bc}	5.89^{B}
Mean	2.9^{A}	4.26^{A}	6.41^{B}	4.47^{AB}	

Key words: corn silage, molds, yeasts

T124 Relationship between residual feed intake, performance, and carcass parameters of pasture finished cattle. J. P. S. Neel*[1], E. E. D. Felton[2], S. K. Duckett[3], and W. S. Swecker[4], *[1]USDA-ARS-AFSRC, Beaver, WV, [2]West Virginia University, Morgantown, [3]Clemson University, Clemson, SC, [4]Virginia Tech University, Blacksburg.*

In 2009 and 2010, Angus-crossbred steers (n = 39) were used to evaluate the relationship between residual feed intake (RFI), pasture-finishing performance and carcass parameters. During RFI determinations before pasture finishing initiation in mid-April, animals were fed an alfalfa hay cube diet. Animals were adapted to facilities and cubes for a 10 d period before intake measurements. Intakes were measured utilizing GrowSafe 6000 (GrowSafe Systems, Ltd., Airdrie, Alberta, Canada) feeding nodes (2009 = 30d; 2010 = 56d) for RFI classification of animals. Each animal was assigned an RFI score based on individual intake and performance relative to population. Upon classification, animals were pasture finished on mixed-species pasture until harvest and carcass data collection in early November of each year (338 ± 41kg initial BW; 500 ± 40 kg final BW). During pasture fin-

ishing animals had an ADG of 0.81 ± 0.12 kg. Mean carcass measurements were: hot carcass weight (HCW) 260 ± 24 kg, fat thickness (FT) 0.445 ± 0.177 cm, ribeye area (REA) 67.4 ± 7.3 cm2, KPH 1.1 ± 0.4%, yield grade (YG) 2.0 ± 0.4, and marbling score (MS; 400–500 = slight) 477 ± 62. Data from both years along with Pearson correlation coefficients were utilized to assess RFI relationship with performance and carcass measurements. Residual feed intake was negatively ($P <$ 0.01) correlated with ADG (r = −0.42), and tended ($P = 0.086$) to be positively correlated with KPH (r = 0.28). Residual feed intake was not correlated with initial or final BW, HCW, FT, REA, YG, or MS. Correlations with ADG and KPH need further investigation to determine impact on pasture finishing systems.

Key words: residual feed intake, pasture, finishing