

Forages and Pastures - Livestock and Poultry: Harvested Forages: Fermentation and Nutritive Quality

T132 Effects of concentrate on forage digestion *in vitro*, pH and volatile fatty acids. K. Reed*, D. J. R. Cherney, and J. H. Cherney, *Cornell University, Ithaca, NY.*

It is common practice in the dairy industry to use a mixed concentrate and forage diet. The ways in which feeds interact in the rumen at early time points to affect digestion are not characterized. Further understanding of concentrate-forage relationships could aid in the development of a more efficient diet. The objective of this study was to determine the early effects (0-6h) of concentrate type on rumen pH and forage digestion *in vitro*. An initial trial was conducted to compare the effect of buffer strength (full vs. half) on pH change during *in vitro* digestion of orchard grass (*Dactylis glomerata* L.) with or without sucrose. It was determined that using a full strength buffer allowed for sufficient changes in pH for the purposes of this study with the observed pH for the full strength buffer dropping from 6.6 to 5.4. Two forages, orchardgrass and corn (*Zea mays* L.) stover were combined with 5 concentrate treatments (no concentrate, corn meal, corn gluten meal, barley (*Hordeum vulgare* L.) and wheat (*Triticum aestivum* L.) in a 50:50 ration using 0.5 g samples. The samples were incubated *in vitro* in a 1:4 buffer to rumen fluid mixture for 420 min. The pH was measured at 30, 90, 150, 210, 270 and 420 min. Samples were collected at the end of the trial for lactic, propionic, and acetic acid analysis. Samples containing orchardgrass alone had a significantly lower pH ($P<0.05$) than those samples containing concentrate beginning at T=150 min and continuing to 420 min. The corn stover samples were significantly lower in pH ($P<0.01$) at T=270 min which correlates with a high mean lactic acid concentration (535 ppm) compared to the mean lactic acid concentration of the other four corn stover treatments (177 ppm). These preliminary results suggest that a diet containing a mixture of corn and forage minimizes the initial decline in rumen pH in comparison with forage alone, mixed barley and forage, or mixed wheat and forage. Further study to determine differences in the extent of forage digestion in forage-concentrate diets will supply additional information about the effects of mixed rations on rumen digestion.

Key Words: Rumen Digestion, pH, VFAs

T133 Fermentation profile and dry matter recovery of *Panicum maximum* cv. Mombaça silages treated with microbial inoculant at different regrowth ages. E. M. Santos, O. G. Pereira*, and C. L. L. F. Ferreira, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil.*

Dry matter recovery and fermentation profile of *Panicum maximum* cv. Mombaça silages treated with microbial inoculant were evaluated at different regrowth ages. A 4x2 factorial arrangement (four regrowth ages x with or without inoculant) was used in a complete randomized design, with three replicates per treatment. The grass was harvested at 35, 45, 55 and 65 days of regrowth and ensiled in 20-l buckets, with or without the inoculant Sil-All C4 (Alltech, Brazil). Ammonium nitrogen/total nitrogen ratio (N-NH₃), pH and volatile fatty acids profile (lactic, acetic and butyric acids) were determined in the silage aqueous extract. Silage dry matter recovery was also calculated. The

pH decreased by 0.0037 and 0.0041 units per regrowth day in silages without and with inoculant, respectively. Independently of the age, the lowest pH and N-NH₃ values ($P<0.05$) were recorded for the silages that were inoculated. Lactic acid increased linearly ($P<0.05$) with regrowth age, whereas acetic and butyric acids decreased. Lower values of acetic and butyric acids ($P<0.05$) were recorded for inoculated silages at all the ages. Levels of lactic acid increased ($P>0.05$) with inoculant addition except for the age of 65 days, at which there was no difference ($P>0.05$). Dry matter recovery increased linearly ($P>0.05$) with regrowth age, with greatest values ($P<0.05$) recorded for inoculated silages. The microbial inoculant improved the fermentation profile in silages of *Panicum maximum* cv. Mombaça plants harvested up to 55 days of regrowth.

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Key Words: Acetic Acid, Butiric Acid, Lactic Acid

T134 Microbial populations and fermentation profile of signalgrass (*Brachiaria decumbens* Stapf) silages harvested at different regrowth ages. E. M. Santos, O. G. Pereira*, C. L. L. F. Ferreira, and R. Garcia, *Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil.*

Microbial populations, pH, ammonium nitrogen/total nitrogen ratio (N-NH₃) and volatile fatty acid concentration were evaluated in signalgrass silages produced from plants harvested at different regrowth ages (30, 40, 50, 60 and 70 days), being ensiled into 2-Kg laboratory silos. A 5x6 factorial arrangement (5 regrowth ages x 6 fermentation periods) was used in a complete randomized design, with three replicates. The fermentation periods were 1, 3, 7, 14, 28 and 56 days. Lactic acid bacteria (LAB) populations ranging from 3.93 to 5.51 log colony-forming units (CFU)/g of fresh forage were detected. Maximum populations of these microorganisms were found in the silages on the seventh fermentation day (8.69 log CFU/g silage). Enterobacterium populations persisted up to the twenty-eighth fermentation day, with maximum values being found at the first day (7.89 log CFU/g silage). N-NH₃ content decreased linearly ($P<0.05$) with the regrowth age, whereas it increased linearly ($P<0.05$) with the fermentation period. The pH decreased exponentially ($P<0.05$) as fermentation period increased, reducing from 4.95 to 4.29, from the first to the last age, at the end fermentation period. The contents of lactic acid increased, whereas the butyric acid decreased linearly ($P<0.05$) with the regrowth age. However, the content of both acids increased linearly ($P<0.05$) as the fermentation period increased, with ratios of 0.031, 0.012 and 0.003 units per day of fermentation, for lactic, acetic and butyric acids respectively. Signalgrass plants harvested from the 50th day had adequate LAB populations which guarantees good fermentation, resulting in a good quality silage, considering pH, NH₃ and organic acid values.

Financial support by FAPEMIG

Key Words: Enterobacter, Lactic Acid Bacteria, Volatile Fatty Acid

T135 Silage inoculant effects on *in vitro* rumen fermentation. R. E. Muck¹, F. E. Contreras*², and D. R. Mertens¹, ¹USDA-ARS, Dairy Forage Research Center, Madison, WI, ²University of Wisconsin-Madison, Madison.

Four inoculants, B (*Lactobacillus plantarum* and *Enterococcus faecium*), C (*Lactobacillus plantarum*), D (*Lactobacillus pentosus*), E (*Lactococcus lactis*), were compared with an uninoculated treatment (A) on alfalfa (38% DM, AS), corn (36% DM, CS), and brown midrib corn (33% DM, BMR) silages. All inoculants were applied at 105 CFU/g forage. Four 1-L jars were ensiled of each treatment. Silages were analyzed for fermentation characteristics. Additionally, 100 g from each silo were wet ground (2 to 5 mm) and frozen (-20°C) until used for *in vitro* incubations. Two *in vitro* rumen fermentations were conducted per each treatment and crop. For each run, 1.0 g wet-ground silage from each silo was placed in a 160 mL serum bottle. Buffer (17 mL) and inoculum (12 mL) were added to each bottle. The bottles were sealed with butyl rubber stoppers and crimps and incubated at 39°C. Gas pressure was measured at 3, 6, 9, 24, and 48 h. At 9 and 48 h each treatment was analyzed for microbial biomass yield (MBY) and volatile fatty acids (VFA). Silage pH and lactic acid concentration were not affected by treatment across three trials. Silage pH was higher on AS (4.60) than CS (3.84) and BMR (3.89). Lactic acid concentration was similar between AS (74 g/kg DM) and BMR (73), but greater than CS (45). At 9 h incubation, gas and VFA production were different among crops (P < 0.05) but not among treatments (P > 0.05). However, MBY differed across treatment and crop. MBY in CS was similar to AS and greater than BMR (39.5, 39.3 and 32.7 mg/100 mg truly digested (TD) respectively). Among inoculants, C, D, and E (37.9, 39.0, and 38.0 mg/100 mg TD respectively) were similar and greater than A and B (35.4 and 35.5 mg/100 mg TD respectively). Similar trends in MBY were observed at 48 hr incubation. We conclude that the biggest impact of silage microbial inoculants on *in vitro* rumen fermentation was increasing microbial biomass yield, but this effect was not equal across all microbial inoculants.

Key Words: Silage Inoculants, Gas and Microbial Yield

T136 Enzyme and bacterial inoculant effects on hybrid corn (*Zea mays*) silage composition. O. Ruiz-Barrera*¹, Y. Castillo¹, C. Rodríguez¹, O. La O², R. Beltrán¹, and C. Arzola¹, ¹Facultad de Zootecnia, Chihuahua, Chih., Mexico, ²Instituto de Ciencia Animal, La Habana, Cuba.

Treating silages with fibrolytic enzymes and bacterial inoculants has been shown to improve digestibility, fermentation and aerobic stability of a variety of forages. The objective of this experiment was to evaluate the effects of three additives on chemical composition and fermentation characteristics of silage from seven different corn (*Zea mays*) hybrids: DK641TM, Eagle 238WTM, Golden Harvest EX313TM, Golden Harvest H9403TM, Pioneer 32R25TM, Pioneer 31G98TM, and Producers 725TM. Corn plants were planted in 14 experimental plots (1 ha each, replicated once) in Bachiniva, Chihuahua, Mexico and harvested at stage of maturity of 1/3 of milkline. Whole corn plants were cut and subsamples were chopped and ensiled in mini silos (1.3±0.1 kg and 4 minisilos per treatment) for 42 d. Treatments were control: CT 20 ml distilled water); SA (0.0065 g Sil AllTM 4×4 L. plantarum, P. acidilactii, E. faecium, and B. salivarius); BS (0.182 g Bio-sileTM L. plantarum and P. pentosaceus) and FB 0.31 g FibrozymeTM(xylanases and T. viride). Silage corn samples were

analyzed for dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose (CE), hemicellulose (HE), *in vitro* dry matter digestibility (IVDMD), *in vitro* organic matter digestibility (IVOMD), pH and lactic acid (LA). Inoculation with SA and BS increased content of NDF of silage of corn hybrids 31G98 and DK641 (P<0.05). Addition of SA increased CP of corn silages from H9403, 238W and EX313 (P<0.05). However, FB decreased NDF concentration of 31G98, H9403 and 238W, lowered pH of DK641 and EX313 and increased concentration of LA content of EX313 and increased concentration of LA content of EX313 (P<0.05). No effect on DM and OM digestibility was observed for FB, but when BS and SA were added a significant difference (P<0.05) was observed for the hybrids DK641, 32R25 and Producers 725. These show that when applied at ensiling certain inoculants and fibrolytic enzymes can improve various chemical characteristics of corn silage hybrids, however, effects vary depending of the particular corn hybrid.

Key Words: Silage, Fermentation, Additives

T137 Use of solid state fermentation to increase nutritious value of apple byproducts. C. Rodríguez-Muela*¹, A. Becerra², O. Ruiz¹, A. Ramírez¹, A. Flores¹, and A. Elias³, ¹Universidad Autónoma de Chihuahua, Chihuahua, México, ²Universidad Autónoma de Nayarit, Tepic, México, ³Instituto de Ciencia Animal, La Habana, Cuba.

To improve nutritious value of apple byproducts (AP) by solid state fermentation (SSF), two experiments were carried out. In experiment I, a complete random 2 × 3 factorial design with two urea levels (UR; 1.5 and 2.0%) and three ground corn levels (GC; 0, 10 and 20%) added to AP was used. In experiment II, a complete random 4 × 3 factorial design was used in an AP mix, with four times (0, 24, 48 and 72 h) of repose before fermentation (RT), with 0, 10 and 20% of GC. In experiment I, an interaction (P<0.05) on crude protein (CP) and on true protein (TP) between UR and GC was detected, where protein contents diminished as higher levels of GC were added to the mix. A greater (P<0.05) optic density (OD) of yeasts with 1.5% (10.6 UFC*1000) Vs 2% (7.3 UFC*1000) of UR was observed. Organic matter digestibility (OMD) increased as UR was increased (P<0.01; 62.2% and 73.4% for 1.5 and 2%, respectively) in the mixture. The urea level did not affect (P>0.05) NDF, but ADF values increased (P<0.05) from 36.5 to 42.9% with 1.5 and 2% of urea, respectively. The OD decreased (P<0.01) as the level of GC increased (12.9, 7.5 and 6.5 UFC*1000 for 0, 10 and 20% of GC, respectively). The OMD was improved (P < 0.01) with the addition of GC (58.7, 65 and 68.3% for 0, 10 and 20% of GC). The NDF decreased (P<0.01) with the level of GC added to the mixture (64.5, 55.5 and 47.4% for 0, 10 and 20% of GC, respectively). Also, ADF decreased (P<0.01) when GC was increased (53.2, 35.2 and 30.7% for the 0, 10 and 20% levels of GC). In experiment II, NDF was lower (P<0.01) for the 72 h (46.2%) than 24, 48 and 96 h of RT (53.8, 51.5 and 53.1%, respectively). As GC was added to the mixture NDF decreased (59.0, 52.3 and 42.0% for 0, 10 and 20% of GC; P<0.01). In conclusion, urea added to apple byproducts increased crude protein and true protein values during the solid state fermentation, if ground corn is not added to apple byproducts; however, as ground corn was increased, true protein content was reduced and the organic matter digestibility was improved.

Key Words: Apple Byproducts, True Protein, Fermentation

T138 Protein production by solid state fermentation of apple waste and pomace. H. E. Rodríguez-Ramírez*, C. Hernández-Gómez, C. Rodríguez-Muela, O. Ruíz-Barrera, and F. Salvador-Torres, *Universidad Autónoma de Chihuahua, Chihuahua, Chihuahua, México.*

In order to evaluate protein production by solid state fermentation (SSF) of apple waste (AW), apple pomace (AP) and their combinations, four treatments (t): t1 (100% AP, n=6); t2 (33.4% AW and 66.4% AP, n=6); t3 (66.6% AW and 33.4% AP, n=6) and t4 (100% AW, n=5) were evaluated. The mixtures were added with urea (1.5%), minerals (0.5%) and ammonium sulfate (0.4%). They were fermented at 32°C during 6 days (d0, d1, d2, d3, d4 and d5) in an incubator, and were mixed thoroughly every 4 h. On d5 temperature was incremented to 60 ammonium sulfate (0.4%). They were fermented at 32°C to dry the mixtures. This was considered the final product (d6). The variables measured were temperature (T, d0 to d3), pH (d1 to d5), yeast count (YC, d0 to d5), true protein on dry matter basis (TPDM, on d0 and d6) and dry matter (DM, on d0 and d5). Data were analyzed by ANOVA, using treatment, day and their interaction as main effects, on GLM procedure of MINITAB 13. T showed increment ($P < 0.01$) on t1 (from 12.2 to 35.2°C) and t2 (from 16.0 to 36.7°C) during d0 and d1, these were higher than t3 and t4 increment (from 15.2 to 29.5°C and from 16.0 to 26.4°C, respectively). After this moment all treatments showed T close to 29.5°C. pH showed an increment ($P < 0.01$) from d1 to d3 on t1 (d1=3.3, d3=5.2), t2 (d1=3.2, d3=6.5) and t3 (d1=3.6, d3=5.5); t4 showed a different behavior (d1=4.0, d3=3.3, d5=5.0) where the pH first decreased from d1 to d3 and after it was increased from d3 to d5. YC showed an increment ($P < 0.01$) on all treatments. t1 had the highest increment (d0=11.0*10⁶ Ucf/ml to d5=293.0*10⁶ Ucf/ml), and the lowest increment was for t4 (d0=2.7*10⁶ Ucf/ml to d5=83.2*10⁶ Ucf/ml). TPDM had a sustained increment ($P < 0.01$) from 4.0% (d0) to 19.6% (d6). TPDM means by treatment at d6 were 15.5, 19.3, 23.2 and 20.5% for t1, t2, t3 and t4 ($P > 0.05$) respectively; DM showed differences ($P < 0.01$) at d5 (t1=69.3%, t2=82.5%, t3=71.4% and t4=44.3%). We concluded that AW is more efficient for TPDM production; AW had the lower YC with high final protein content. Microbial population was responsible of the different T and pH differences between byproducts.

Key Words: Apple, Fermentation, Protein

T139 Temperature, dry matter, pH, yeast count and protein behavior on the solid state fermentation of apple pomace. C. Hernández-Gómez*, H. E. Rodríguez-Ramírez, C. Rodríguez-Muela, A. Flores-Mariñelarena, and C. Arzola-Alvarez, *Universidad Autónoma de Chihuahua, Chihuahua, México.*

In order to evaluate the behavior of temperature (T), dry matter (DM), pH, yeast count (YC), crude protein (CP) and true protein (TP) during the first 7 days by solid state fermentation (SSF) of apple pomace (AP); there were prepared 3 mixtures with 2,780, 3,480 and 3,500 kg of AP (M1, M2 and M3, on October 6, October 18 and October 25 of 2006 respectively). There were added 1.5% of urea, 0.5% of a mineral supplement and 0.4% of ammonium sulfate, wet basis. The temperature and samples to determine DM (at 100° C), pH, CC (cell count on Neubauer chamber), CP and TP were taken daily during 7

days (d0, d1, d2, d3, d4, d5, and d6); data were analyzed by ANOVA on MINITAB 13. The main factors were mixture and day. There were not differences ($P > 0.05$) between mixtures or days for T: M1 (28.34), M2 (25.19), M3 (30.10) and DM: M1 (22.34), M2 (23.06), M3 (26.70). M1 had a pH average of 5.48 and was lower ($P < 0.01$) than M2 and M3 (6.80 and 8.41 respectively). pH was incremented daily ($P < 0.01$) from 4.45 (d0) to 10.16 (d6). YC showed difference ($P < 0.05$) between mixture and day. The lower YC was for M1 (10.07*10⁶ Ucf/ml), M2 (30.55*10⁶ Ucf/ml) and M3 (46.73*10⁶ Ucf/ml). YC on d0 was 20.23*10⁶ Ucf/ml and on d6 was 51.29*10⁶ Ucf/ml. CP was lower for M1 ($P < 0.05$) than M2 and M3 with values of 24.53%, 32.87% and 32.14% respectively. TP did not show difference ($P > 0.10$) between mixtures. There was an increment ($P < 0.10$) of TP from d0 (13.43%) to d6 (19.12%). We conclude that solid state fermentation increment the protein content of AP. pH is changed from acid to basic trough the time and yeast quantity is incremented, but this can be distinct between mixtures. The behavior of temperature and dry matter is similar between mixtures trough time.

Key Words: Apple Pomace, Fermentation, True Protein

T140 Effect of fibrolytic enzymes and an inoculant on in vitro digestibility and gas production of low-dry matter alfalfa silage. L. K. Kozelov¹, F. Iliev¹, A. N. Hristov^{*2}, S. Zaman², and T. A. McAllister³, ¹*Institute of Animal Sciences, Kostinbrod, Bulgaria*, ²*University of Idaho, Moscow*, ³*Agriculture and Agri-Food Canada, Lethbridge, AB, Canada.*

The objective of this study was to investigate the effect of polysaccharide-degrading enzymes (a cellulase and a xylanase) alone or in a combination with a bacterial inoculant on fermentation parameters and *in vitro* degradability and gas production of low-DM alfalfa silage. First cut alfalfa (*Medicago sativa* L.), harvested at about 5% bloom stage (260 g/kg DM) was ensiled in laboratory-scale silos. Treatments were: control (water); formic acid (FA), 4 L/t fresh silage; a cellulase enzyme preparation (Cell) applied at 5 kg/t silage; a xylanase (Xyl) applied at 5 kg/t silage; a mix of Cell and Xyl, 2.5 kg/t silage of each enzyme; a lactic acid bacteria-based inoculant (Inoc) applied at a rate providing 1.0×10⁵ cfu per gram of silage; and a mix of Cell (5 kg/t silage) and Inoc (1.0×10⁵ cfu per gram of silage) (Inoc/Cell). Triplicate silos were open on d 3, 7, 15, and 60. The FA silage maintained the lowest pH through d 60 (5.21; $P < 0.05$). The inoculant- and Inoc/Cell-treated silages had lower ($P < 0.05$) pH than the control silage on d 7 and 60. Ammonia N and total free amino acids concentrations (23 and 158 g/kg silage N) were the lowest ($P < 0.05$) for the FA silage. *In vitro* degradability of silage DM was not affected ($P = 0.998$) by treatment. Compared with the control (51.3 ml/100 mg silage DM), most treatments increased ($P < 0.001$) the 24-h cumulative gas production; Inoc/Cell (65.1), Cell (64.0), Inoc (63.4), Xyl (61.7), and FA (61.6 ml/100 mg). Overall, enzyme- and lactic acid bacteria-based preparations had minor effects on silage fermentation in this experiment. The increased cumulative gas production indicates some preservation of fermentable organic matter with most treatments. This effect, however, is unlikely to trigger corresponding response in ruminal digestibility *in vivo*.

Key Words: Alfalfa Silage, Exogenous Enzyme, Microbial Inoculant

T141 The use of bacterial silage inoculants to ensile crushed corn grains and its effects on ensilability and aerobic stability. G. Böck¹, K. Schöndorfer², Y. Acosta Aragón^{*1}, A. Klimitsch¹, and G. Schatzmayr¹, ¹BIOMIN Research Center, Tulln, Austria, ²University of Applied Sciences, Krems, Austria.

The primary purpose of ensiling is the conservation of forage and crops for feed. To improve feed quality of silages especially to inhibit growth of *Clostridia*, yeasts and moulds and their production of toxins chemical and biological silage additives are used. In contrast to chemicals the usage of lactic acid bacteria (LAB) poses a natural, non-corrosive and cheaper alternative to chemicals. The objective of this experiment was to study novel mixtures of homofermentative and heterofermentative LAB under laboratory conditions. The ensiling trial was performed with crushed corn grains using product 1 and 2 at a dosage of 1×10^6 CFU/g of raw material. A control was compared to product 1 (*Lactobacillus kefir* and *Lactobacillus brevis*), product 2 (*Enterococcus faecium*, *Lactobacillus plantarum*, *Lactobacillus kefir* and *Lactobacillus brevis*), Chemical A (2.5 l/ton) and a product consisting of *Lactobacillus rhamnosus*, *Lactobacillus plantarum* and *Lactobacillus buchneri* (product 3). Three silos per treatment were opened after 2, 7, 47 and 90 days of ensiling. The following parameters were analysed: pH, sugars and organic acids (HPLC), aerobic instability and dry matter (DM) loss. As expected product 1 showed the highest DM loss after 90 days (1.42 %) followed by product 3 (1.32 %) and the control (1.14 %). Product 2 showed smaller DM losses than the control. Chemical A showed the lowest DM loss with 0.81 %. The differences in pH decrease were very small among all groups. Lactic acid fermentation was fastest in the group with product 2 and slowest in the group with product 3. Acetic acid is most abundant in the group with product 1, followed by the group with product 2. However, acetic acid content is very low in all groups ranging between 3.16 and 14.82 g/kg DM. Aerobic stability was excellent after both 47 and 91 days for all trial groups except the control, which showed instability after 5.8 and 8.5 days, respectively.

Key Words: Silage Inoculant, Corn, Aerobic Stability

T142 Liquid urea by product as an additive to improve intake and digestibility of grass hay. J. L. Rodríguez-Rivera*, E. Valencia, and A. A. Rodríguez, *University of Puerto Rico, Mayaguez Campus, Mayaguez, Puerto Rico.*

This experiment evaluated the effect of applying liquid urea (LU; 16% N) on the nutritive value of old world bluestem hay (GH; *Dichanthium annulatum*). Four male rams (31 kg) were fed during four consecutive periods with chopped GH mixed with one of four rates of LU [0 (T1), 0.2 (T2), 0.4 (T3) and 0.6% (T4), (DM basis; wt/v)]. Experimental diets were offered at 3% of expected dry matter intake based on animal body weight. In each period, the LU was diluted with 600 ml of distilled water and sprayed to the GH 24-h before feeding. For each experimental period, there was a 5 d diet adaptation and 5 d of data collection. GH on offer, orts, and feces were measured daily for each ram. GH offered, refused and 10% aliquots of feces collected in bags were used to determine GH intake (GHI) and GH digestibility (GHD). Data were analyzed using the GLM procedure of SAS in a randomized complete design and means separated with Bonferroni t-test. Crude

protein concentration increased with increasing rates of LU (2.26, 2.92, 5.49 and, 6.35% for T1, T2, T3 and T4, respectively. GHI with T3 (1160 g/d) was higher ($P < 0.05$) than for T4 (1046 g/d), T1 (1026 g/d) and T2 (987 g/d). However, GHD was similar ($P = 0.05$) for all LU rates. In summary, LU is a potential feed additive to improve the nutritive value of old world bluestem hay. Results indicate that LU-carbohydrate source combination studies are needed.

Key Words: Liquid Urea, Rams, Grass Hay Intake

T143 Effects of irrigation system and level of water on corn silage hybrid NDF digestibility in northern Italy. E. Raffenato¹, A. Formigoni², I. Fusaro^{*3}, A. Palmonari², N. Brogna², M. E. Van Amburgh¹, and C. J. Sniffen⁴, ¹Cornell University, Ithaca, NY, ²DIMORFIPA, Università di Bologna, Ozzano dell'Emilia, BO, Italy, ³Dipartimento di Scienze degli Alimenti, Università di Teramo, Teramo, Italy, ⁴Fencrest, LLC., Holderness, NH.

Increasing temperature and light with excess water has been shown to increase lignification and reduce digestibility. The objectives of this study were to assess the effects of two irrigation systems, flood (F) or sprinkler (S), and two application levels on in vitro NDF digestibility (IVNDFd) of three hybrid corn silages. Three hybrids selected to have different digestibility were provided by the Long Island Cauliflower Association (NY) and were grown in summer 2006 under similar conditions in the Po Valley, Italy. Irrigation was applied at two levels of water, low (FL and SL) and high (FH and SH), as a randomized block with a split-plot treatment and three replicates. Nitrogen was applied as urea at 350 kg per ha. The forages were harvested at 30-32% DM and ensiled in mini silos. Silages were analyzed for chemical composition and IVNDFd. There were no effects of hybrid, so hybrids were pooled by irrigation method and level. Starch and NDF content were not different by irrigation method, however, F irrigation resulted in lower CP, greater ADL, and reduced IVNDFd and rate of NDF digestion ($P < 0.05$, Table 1). These results demonstrate that excess water decreased forage nutritional values, inconsistent with the differences expected by hybrid. Thus, irrigation strategies may aid in optimizing forage quality.

Table 1. Least Squares Means

Irrigation*	FL	FH	SL	SH	se
CP, %DM	6.23 ^b	6.08 ^b	7.41 ^a	7.39 ^a	0.11
Sol. Prot., %DM	3.10 ^a	3.02 ^b	3.62 ^a	3.80 ^a	0.04
Starch, %DM	27.99 ^a	27.07 ^a	29.32 ^a	29.97 ^a	1.83
ADF, %DM	26.71 ^a	27.32 ^a	21.83 ^b	24.32 ^{ab}	1.46
ADL, %DM	3.49 ^a	3.54 ^a	2.55 ^b	2.95 ^{ab}	0.24
NDF, %DM	45.94 ^a	44.87 ^a	42.59 ^a	41.34 ^a	1.91
24h IVNDFd, %DM	48.98 ^c	49.10 ^c	56.91 ^a	53.47 ^b	1.49
Kd, %/hr	4.39 ^b	4.41 ^b	5.26 ^a	5.41 ^a	0.13

* Values within rows with different superscripts differ ($P < 0.05$).

Key Words: Corn Silage, Irrigation, Neutral Detergent Fiber Digestibility

T144 Utilization of silage of *Albizia lebbbeck* as supplement of sheep. F. Fernández, T. Clavero*, R. Razz, and O. Araujo-Febres, *Facultad de Agronomía, Universidad del Zulia, Maracaibo, Zulia, Venezuela.*

Diets with silage of *Albizia lebbbeck* were fed to sheep with the objective to study daily intake and nitrogen metabolism. Sixteen confined west african sheep were offered with different levels of supplementation of silage in a region characteristics as dry tropical forest at north west of Venezuela. The rations used were 100% *Brachiaria humidicola* hay (HBH); 75%HBH + 25% silage *A. lebbbeck*; 50% HBH + 50% silage *A. lebbbeck* and 25% HBH + 75% silage *A. lebbbeck*. Individual animals were housed in a designed crate having provision for collection of faeces and urine separately. Animals were fed during the pre-experimental period for 21 days, followed by experimental metabolic trial of 7 days. The experimental design was a randomized blocks with four replications. Silage supplementation increased total dry matter intake from 478.3 g/animal/d in the control to 712.8 g/animal/d in 50%HBH + 50% silage ($P \leq 0.01$). There were not significant ($P \geq 0.05$) differences between silages treatments. *Albizia lebbbeck* silage supplementation had a highly significant ($P \leq 0.01$) effect on nitrogen utilization by sheep. All diets resulted in a positive N balance. Nitrogen intake and nitrogen retained as percent of intake rose with increasing levels of silage until 50%. However, there were not significant differences ($P \leq 0.05$) among silages diets. Nitrogen intake and nitrogen retention were the highest (7.7 g/animal/d and 59.9%) in the 50% HBH + 50% silage diet and the lowest (3.1 g/animal/d and 12.99%) in the HBH diet. It can be concluded that supplementation with *Albizia lebbbeck* silage had potential as protein source for sheep fed with a poor quality basal diet.

Key Words: *Albizia lebbbeck*, Silage, Intake

T145 In sacco rumen disappearance of condensed tannins, fiber, and nitrogen from herbaceous native Texas legumes in goats. D. L. Pawelek*^{1,2}, J. P. Muir¹, B. D. Lambert^{1,2}, and R. D. Wittie², ¹Texas Agricultural Experiment Station, Stephenville, ²Tarleton State University, Stephenville, TX.

Condensed tannins (CT) can play a role in rumen protein and fiber degradability, especially in legumes high in CT. In order to better understand their potential role in ruminant nutrition, three legume species native to Texas, *Acacia angustissima* var. *hirta* (prairie acacia) (288 g/kg neutral detergent fiber (NDFom), 41 g/kg N), *Desmodium paniculatum* (panicked tick-clover) (480 g/kg NDFom, 25 g/kg N), and *Lespedeza procumbens* (trailing bush-clover) (401 g/kg NDFom, 22 g/kg N) were studied to determine *in sacco* rumen disappearance rates of key nutritional components compared to that of *Medicago sativa* (alfalfa) (227 g/kg NDFom, 35 g/kg N). Herbage was incubated in rumen-cannulated goats fed a basal diet of *Sorghum bicolor* x *S. sudanense* (sorghum-Sudan) hay, with disappearance measured at 0, 4, 8, 16, 28, 48 and 96 h. Among the native legumes, the highest CT concentrations were measured in prairie acacia (263 g CT/kg DM foliage) and the lowest (120 g CT/kg DM) in trailing bushclover. The lowest concentrations of acid detergent fiber (ADFom), NDFom, and sulfuric acid lignin (lignin (sa)) were measured in prairie acacia, the first two fractions being comparable to alfalfa. Proportion remaining was calculated for CT, ADFom, lignin(sa), NDFom, and N for 0, 24 and 48 h of rumen incubation. Disappearance parameters were measured for ADFom, lignin(sa), NDFom and N for the three native

legumes and compared to alfalfa. Alfalfa had the highest disappearance of all degradable fractions except lignin(sa). Potential disappearance (PD) fraction for ADFom, lignin(sa) and N were lower for the native legumes vs. alfalfa. No differences in N proportion remaining at 24 and 48 h occurred in the native legumes despite differences in protein-bound CT proportion remaining at those same times. Of the native legumes studied, prairie acacia shows the greatest potential for contributing rumen-escape protein, suggesting it may be a candidate for further development as a pasture and rangeland renovation legume.

Key Words: Proanthocyanidins, Escape Protein, Protein-Bound Condensed Tannins

T146 Season and drying method effects on condensed tannin levels in perennial herbaceous legumes. R. M. Wolfe*¹, T. H. Terrill², and J. P. Muir¹, ¹Texas Agricultural Experiment Station, Stephenville, ²Agricultural Experiment Station, Fort Valley State University, Fort Valley, GA.

Several factors affect condensed tannin (CT) levels in plants and the precision and accuracy of the butanol-HCl colorimetric assay for CT in extractable and bound forms. Six native, perennial, herbaceous legumes from Texas were harvested at three different stages of growth over a growing season; young vegetation, initial flowering, and late in the season before leaf drop. Legumes examined were Eastern prairie acacia (*Acacia angustissima*), Illinois bundleflower (*Desmanthus illinoensis*), Panicked tick-clover (*Desmodium paniculatum*), Creeping bush-clover (*Lespedeza procumbens*), Tall bush-clover (*Lespedeza steuvei*) and Tropical neptunia (*Neptunia pubescens*). The samples were subjected to oven-drying and freeze-drying and then analyzed for extractable (ECT), protein-bound (PBCT), and fiber-bound (FBCT) condensed tannin concentration using a butanol-HCl procedure with purified quebracho CT as the standard. There was a wide range of CT concentration in the legumes, but little change in ECT and total (TCT) tannin concentrations over the growing season. Oven-drying decreased ($P < 0.05$) ECT and increased ($P < 0.05$) PBCT and FBCT concentrations in the legumes compared with freeze-drying, but both methods ranked the forages similarly throughout the growing season relative to TCT. Use of quebracho tannin as a standard increased CT values for the forages compared with purified legume CT standards, but all standards ranked the forages similarly relative to tannin concentration. Quantitative CT values are affected by many factors and have limited value except to allow a relative ranking of forages. Biological activity and potential nutritional/medicinal benefits of CT in native legumes needs further evaluation.

Key Words: Legumes, Tannins, Drying

T147 Effects of individual terpenes and terpene mixtures on intake by lambs. R. E. Estell*¹, E. L. Fredrickson¹, D. M. Anderson¹, and M. D. Remmenga², ¹USDA/ARS Jornada Experimental Range, Las Cruces, NM, ²New Mexico State University, Las Cruces.

Rangeland degradation due to shrub encroachment is a major concern to livestock producers and land managers in the western United States and in arid and semiarid regions worldwide. Most invasive shrubs contain secondary compounds that reduce their consumption by herbivores, but knowledge concerning the effects of specific

compounds is limited. Four experiments were conducted to determine the effects of individual terpenes (*cis*- β -ocimene and *cis*-sabinene hydrate; Exp. 1 and 2) or mixtures of monoterpenes (borneol, camphene, camphor, 1,8-cineole, limonene, myrcene, and α -pinene; Exp. 3) or sesquiterpenes (β -caryophyllene, caryophyllene oxide, α -copaene, and α -humulene; Exp. 4) on intake by lambs. After a 10-day adaptation period with untreated alfalfa pellets, lambs ($n = 45$) were individually fed treated alfalfa pellets for 20 min each morning for 5 days. Five treatments (0X, .5X, 1X, 2X, and 10X; multiples of the concentrations of the same terpenes in *Flourensia cernua*) were applied to alfalfa pellets (637 g, DM basis) in an ethanol carrier. Except during the 20-min test, lambs were maintained outdoors and fed untreated alfalfa pellets (total mean intake = 4.7% of BW, DM basis). Day \times treatment interactions were detected ($P < 0.04$) in Exp. 1 and 4 because of greater intake for 0X than other treatments on day 1 (Exp. 1) and lower intake for the 10X treatment on day 1 and 2 in Exp. 4. A trend for decreased intake (g/kg BW) as concentration of the sesquiterpene mixture increased was observed ($P = 0.093$ for the linear contrast; Exp. 3). Although there was a tendency for the sesquiterpene mixture to decrease intake, *cis*- β -ocimene, *cis*-sabinene hydrate, and the monoterpene mixture did not appear to affect intake by lambs.

Key Words: Intake, Shrubs, Terpenes

T148 Evaluation of hay treated with acid based preservatives at two cuttings and three moisture levels on their effect on feeding value. D. Sapienza¹, F. R. Valdez^{*2}, D. Westerhaus², and W. Rounds², ¹Sapienza Analytica LLC, Slater, IA, ²Kemin Industries, Inc., Des Moines, IA.

The production of hay with high feeding value is dependent upon drying conditions. This evaluation was designed to quantify the upper limit in moisture content in hay and to evaluate the effectiveness of hay additives. Four hay additives were used, three in accordance with label and one, FRESH CUT[®] Plus brand hay preservative (FC+), outside label directions to evaluate the range of its effectiveness. Six bales were made of each treatment in two cuttings (May and October 2005). After twenty-one days, temperature measurements were taken at four locations in each bale. The data were then converted into heat units and the effects of the treatments were evaluated. There was a significant reduction ($P < 0.05$) of heat units produced in the bales made at less than 20% moisture; those bales treated with FC+ showed a significant 13-unit reduction ($P < 0.05$) in heat units when compared to bales made with no additive. FC+ also showed a significant reduction in heat units produced ($P < 0.05$) when compared to treatment with two other commercial products. All bales exhibited some heating and the internal temperature of all bales trended with the highs and lows of the environment. Over all moisture levels tested (26%, 20 to 25% and <20%), the FC+ treated bales demonstrated the ability to maintain a visual color score corresponding to normal good green bale color (score 3.2 to 2.2). It appears from the data that FC+ was able to reduce the negative effects of the normal temperature cycle of wet and dry bales observed throughout this experiment. It was also apparent that the TDN values for all of the 15 and 22% moisture bales treated with FC+ were greater than the positive control. FC+ improved TDN mainly by increasing crude protein digestibility ($r = -0.918$) and lowering % acid insoluble digestible crude protein ($r = -0.926$). No treatment was effective at 27% moisture.

Key Words: Hay Preservatives, Heat Units, Crude Protein Digestibility

T149 Loss of dry matter of pure and inoculated sugarcane (*Saccharum spp*) silage. G. S. Dias Júnior, D. C. L. Miranda, M. N. Pereira*, G. Santos, F. Lopes, and R. Spuri, *Universidade Federal de Lavras, Brazil.*

Sugarcane is a viable forage for feeding bovine, since it has a high potential for producing dry matter, of high energy content, per hectare. The ensiling of sugarcane may be an alternative to the traditional feeding management of daily harvesting fresh forage. The ensiling of the forage may facilitate the management of the herd, allows use of the forage during the rainy season, and maximizes the efficiency of cultural practices, among other advantages. However, consequences of the alcoholic fermentation of the sugarcane are the high sucrose loss and the low aerobic stability of the unloaded silage. We evaluated the loss in nutrient mass, along 767 days of ensiling, of nine 1.9 kg pure sugarcane samples. The NDF content increased from 47.0% of DM to 68.7%. Silage loss, proportional to the original, was: 32.8% for toluene DM, 44.1% for 100°C DM, 18.3% for NDF and 67.0% for the non-NDF DM. We also evaluated the loss of nutrient mass and heating following unloading of sixty 7.9 kg sugarcane samples ensiled for 40 days. The three treatments were: Control, *L. plantarum* (1×10^6 cfu/g of FW) or *L. buchneri* (6.6×10^5 cfu/g of FW). The ensiling increased the sugarcane NDF content from 47.5% of DM to 70.5%. On average, the losses in nutrient mass were: 23.9% for toluene DM, 34.0% for 100°C DM, 1.9% for NDF and 62.9% for the non-NDF DM. While *L. plantarum* reduced, *L. buchneri* increased the loss of 100°C DM loss ($P < 0.05$), in spite of the small biological magnitude of the effect (± 1.6 percentage units). There was no treatment effect on silage heating following unloading. The ensiling of the sugarcane induced a significant increase in NDF content of the fresh forage and a high nutrient loss.

Funded by Chr Hansen and CNPq

Key Words: Inoculum, *L. plantarum*, *L. buchneri*

T150 Determinants of degradability among sugarcane (*Saccharum spp*) clones in the bovine rumen. C. B. Teixeira, M. N. Pereira*, M. A. P. Ramalho, M. H. Ramos, J. F. Santos, and M. L. Chaves, *Universidade Federal de Lavras, Brazil.*

The objective of this study was to evaluate the variability of nutritive value among sugarcane clones, to estimate the correlation between plant digestibility and productivity, and to define which agronomical and chemical traits would be the most important determinants of nutritive value. Twenty sugarcane industrial clones were evaluated in a completely randomized block design with four replicates. Clones cultivated in Campos, RJ state, originated from the Plant Breeding Program for Sugar and Alcohol Production of the Federal Rural University of Rio de Janeiro. Plants were harvested when the Brix was superior to 18%, at an starting age of 370 days after the second ratoon cut. Nine agronomical traits, ten chemical traits and the ruminal NDF and DM *in situ* degradability were evaluated. Productivity was 21.2 ± 5.7 t of DM per hectare, ruminal DM degradability was $57.1 \pm 2.6\%$ of DM, and ruminal NDF degradability was $19.8 \pm 2.42\%$ of NDF (mean \pm SD). None of the variables evaluated had a significant correlation to NDF degradability ($P > 0.10$). The ADF as a % of DM (%ADF), stalk length (SL) and the percentage of stalk in whole plant DM (SP) were the only variables included in the multivariate regression model

correlating ruminal DM degradability to chemical and agronomical traits. Models were: 95.13 - 1.238 (%ADF) ($r^2=0.70$); 100.80 - 0.452 (SL) - 1.140 (%ADF) ($R^2=0.75$); 83.48 - 0.052 (SL) + 0.179 (SP) - 1.009 (%ADF) ($R^2=0.81$). There was no evidence for decreased productivity as a consequence of a possible selection of clones to achieve high digestibility, since the phenotypic as well as the genetic correlation between these traits were close to zero. The estimated h^2 for the ruminal DM degradability trait was 87.9%, for %ADF it was 19.5%, for SL it was 41.4% and for SP it was 63.1%. Improving digestibility by indirect selection did not seem justifiable, since traits indirectly correlated to the digestibility had smaller estimated h^2 values than the value obtained for the ruminal DM degradability trait.

Key Words: Digestibility, Heritability, Plant Breeding

T151 Change in dry matter content of sugarcane silage treated with chemical and microbiological additives. D. C. L. Miranda, G. S. Dias Júnior, M. N. Pereira*, R. Spuri, F. Lopes, and G. Santos, *Universidade Federal de Lavras, Brazil.*

The ensiling of sugarcane may be an alternative to the traditional feeding management of daily harvesting fresh forage. However, consequences of the alcoholic fermentation of sugarcane are the high sucrose loss and the low aerobic stability of the unloaded silage. We evaluated the use of chemical and microbiological additives in sugarcane silage. Around 9 kg forage samples were ensiled in 20 l buckets. A 4x3 factorial arrangement of treatments was adopted. Chemical additives: Control, potassium sorbate (0.05% of fresh weight, FW), urea (1% of FW) and calcium hydroxide (1% of FW). Microbiological additives: Control, *L. plantarum* and *L. buchneri* (both at 1×10^6 cfu/g of FW). Each one of the twelve possible combinations of treatments was replicated six times in each day of silage opening: 7, 14, 28 and 77 days of ensiling. There was no treatment effect on the 126-hour heating of the unloaded silage ($P>0.13$). The inclusion of calcium hydroxide reduced the NDF content from 79.9% of DM to 69.2% ($P<0.01$). Both urea and calcium hydroxide increased silage pH, being the increase more accentuated on day 77 ($P<0.01$ for the interaction between chemical additive and day of opening), and was associated to the occurrence of 39% of silages with clostridial fermentation in the urea treatment and 56% with calcium hydroxide, both only during day 77 of silo opening ($P<0.01$, Chi-Square). The association of sorbate with microbiological additives increased the DM content at 7 and 77 days of ensiling, while the association between urea and inoculum had a positive action only on day 77 ($P=0.04$ for the interaction among chemical additive, microbiological additive and day of opening). The association between potassium sorbate and microbial inoculum improved the action of homo as well as heterofermentative microorganisms. However, the effect of microbial inoculants on DM content was small. The use of calcium hydroxide in sugarcane ensiled for less than 28-day periods, may be a way to reduce the fiber content of the feed.

Funded by Chr Hansen and CNPq

Key Words: Calcium Hydroxide, Potassium Sorbate, Inoculum

T152 The effect of feeding sugar cane (*saccharum officinarum*) or corn silage to Holstein heifers on development and reproductive performance. J. A. Reyes-Gutierrez^{1,2}, J. M Palma-García², J. M. Tapia-Gonzalez*¹, I. E. Morales-Zambrano^{1,2}, and G. Rocha-Chavez¹, ¹CUSUR Univ de Guadalajara, Cd Guzman Jalisco Mexico, ²Univ de Colima, Mexico.

The objective of this study was to assess developing and reproductive performance of Holstein-Freisan heifers from weaning up to 470 days of age comparing sugar cane (*saccharum officinarum*) silage (SCS treatment 1) and corn silage (CS treatment 2). Twenty eight weaned heifers averaging 80 ± 16 days of age and initial weight of 79.5 ± 12.9 kg were used in a randomized block arrangement with weight as the blocking factor. Heifers were offered the respective silage *ad libitum* and a supplement was used to reach requirements. Body weight, BW (Kg) was measured every 30 days as well as height at cross HC (cm), body condition score BCS (1-5 scale), daily gain DG (kg), feed efficiency FE (Kg), forage intake FI (Kg), supplement intake SI (kg), and feed costs per pound of gain FCPG (US Dollars). Furthermore, age in days was registered at the time of puberty and first mating as well as BW, BCS and HC. Analysis of variance was used to compare treatments and significance was set to $P<0.05$. Growth performance of heifers at the end of the trial is described in table 1. Heifers reached puberty at 346.8 and 335.2 days old, weighing 250.6 and 279.1 kg for treatment 1 and 2 respectively (significantly different at $P<0.05$). The body condition score and height at cross for SCS and CS groups were 2.6 and 3.2 and 116.8 and 118.9 cm respectively. At first mating, heifers were 441.1 and 430.1 days old, weighing 331.9 and 332.6 kgs, with a BCS of 2.8 and 3.5 and HC of 123.8 cm and 125.6 cm respectively for treatment 1 and 2. Reproductive performance at first mating was as the following: 1.1 and 1.3 matings per pregnancy and 92.8% and 78.5% fertility rate for SCS and CS respectively. It was concluded that, under conditions of this study, the SCS-based system allows for a satisfactory daily gain and reproductive performance at a low cost compared with corn silage.

Table 1. Development performance of heifers feed on corn or sugar cane silage

	BCS	Daily Feed Gain (Kg)	Forage intake efficiency (Kg)	Supplement intake (Kg)	Feed costs per pound of gain (USD)	
Sugar cane silage	2.7 a	.666	7.1 a	3.1	1.6	0.58
Corn silage	3.11 b	.743	9.2 b	5.3	1.6	0.63

Different letter in the same column differ significantly ($P<0.05$)

Key Words: Heifers, Sugar Cane, Silage

T153 Evaluation of the nutritive value of traditional forages collected during the growing season for improving livestock production in Mali. B. Dembele*¹, S. Fernandez-Rivera², B. Simpson³, and M. Yokoyama³, ¹Institut Polytechnique Rural de Formation et de Recherche Appliquee, Katibougou, Mali, ²International Livestock Research Institute, Addis Ababa, Ethiopia, ³Michigan State University, East Lansing.

Mali is a landlocked, semi-arid country in West Africa and one of the ten poorest countries in the world. Poor animal nutrition is the

limiting constraint to increased livestock productivity and the major contributory aspects of the problem are feed availability and quality. Livestock are fed natural grasses, fodder and farm residues during the dry season, which are poor in quality. The inability of the market place to meet the demand for feed places increasing pressure on existing natural resources. Changes in the nutritive value of forages over the growing season are unknown. In this study, traditional forages were randomly collected monthly from the beginning of the rainy season to the dry season (July, 2004-February, 2005) and analyzed for their nutritive value (DM, CP, Ether Extract, Ash, NDF, ADF, ADL, Gross Energy, In Vitro Dry Matter Digestibility) and mineral content (Ca, P, K, Fe, Mg, Cu, Zn, Na, Mn). The dominant forages during the growing season were *Angropogon pseudapricum*, *Loudecia togoensis* and *Pennisetum pedicellatum*. Many forages disappeared late in the growing season. Mean CP of the forages decreased from 12.6% to 1.9%

(range:12.6-1.3%) during the growing season. Mean ADF increased from 33% to 48% (range:33-50%). Mean ADL increased from 4.6 to 5.3% (range 4.6-6.1%). Mean NDF increased from 50% to 73% (range: 50-76%). Mean OM% increased from 89.9% to 95.5% (range 89.9-95.5%). Mean Ash decreased from 10.1 to 4.5% (range 10.1-4.5%). Mean Ether Extract % decreased from 1.28% to 0.76% (range: 1.28-0.68%). Mean In Vitro Dry Matter Digestibility decreased from 73% to 65% (range:73-60%). Mean Ca, P, K, Mg, Na, Cu, and Zn content all decreased, while Mn increased. The data indicates that traditional forages decline in nutritive value during the growing season in Mali. (Supported by USDA, ISE Competitive Grant No. 2005-51160-02276).

Key Words: Mali, Forages, Nutritive Value

Goat Species II

T154 In vitro volatile fatty acid profile of shrub and cacti species selected by grazing goats. M. Guerrero-Cervantes^{1,2}, R. G. Ramirez-Lozano², R. Montoya-Escalante¹, A. S. Juárez-Reyes¹, and M. A. Cerrillo-Soto*¹, ¹Universidad Juárez del Estado de Durango, Durango, Dgo., Mexico, ²Universidad Autónoma de Nuevo León, Monterrey, N.L., Mexico.

Samples from species commonly selected by range goats in the semiarid region of North Mexico were collected to study their *in vitro* volatile fatty acid production. Samples from *Quercus grisea*, *Acacia shaffneri*, *Proposis leavigata*, *Opuntia leucotricha*, *O. leptocaulis* and *O. imbricata*, were collected. Five hundred mg DM were incubated in triplicate in calibrated 100 ml glass syringes using rumen fluid from two sheep fed alfalfa hay: concentrate (75:25) as inoculum. Incubations were terminated after 24 h. The syringe contents were then centrifuged and 5 ml of the supernatant were mixed with 1 ml of 25% metaphosphoric acid. Volatile fatty acid determination was performed using gas chromatography. Data were analyzed by ANOVA according to a completely randomized design. Total VFA concentrations were highest for *Opuntia leucotricha* whereas lowest values were recorded in *Acacia shaffneri* ($P < 0.05$). A similar trend was observed for acetate concentrations among species. *Opuntia leucotricha* produced 24.2% more acetate than *Acacia shaffneri*. Intermediate values were obtained in *O. leptocaulis* and *O. imbricata* ($P < 0.05$). Propionate concentrations were different among species ($P < 0.05$). *O. imbricata* recorded the highest values, *Proposis leavigata* was intermediate and *Acacia shaffneri* the lowest. Regarding butyrate values, a similar pattern as propionate was observed. *O. imbricata* produced 42.5% more butyrate than *Acacia shaffneri* ($P < 0.05$). *Opuntia leucotricha* resulted in higher valerate values, *O. imbricata* and *Q. grisea* ranked intermediate and *A. shaffneri* the lowest ($P < 0.05$). A higher A:P ratio was observed in *O. leucotricha* and lowest in *P. leavigata*. Results indicated that cacti species, specially *O. leucotricha* represents a good energy source and an important emergency feed in harsh semi-arid areas.

Table 1. In vitro VFA profile (mM L⁻¹) of shrub, tree and cacti species

	Total	C:2	C:3	C:4	C5	A:P
<i>Q. grisea</i>	14.17 ^c	8.91 ^{cd}	1.44 ^{cd}	1.17 ^c	0.96 ^b	6.10 ^c
<i>A. shaffneri</i>	10.88 ^c	6.05 ^d	1.10 ^d	0.94 ^c	0.86 ^d	5.53 ^c
<i>P. leavigata</i>	16.14 ^{bc}	9.49 ^{cd}	3.13 ^b	1.03 ^c	0.92 ^c	3.00 ^d
<i>O. leucotricha</i>	30.25 ^a	24.95 ^a	1.99 ^{cd}	1.82 ^b	1.03 ^a	12.6 ^a
<i>O. leptocaulis</i>	23.00 ^{ab}	17.90 ^b	2.12 ^c	1.72 ^b	0.87 ^d	8.45 ^b
<i>O. imbricata</i>	23.44 ^{ab}	14.36 ^{bc}	4.35 ^a	2.23 ^a	0.99 ^b	3.22 ^d
Mean	19.65	13.61	2.35	1.48	0.94	6.50
SEM	3.46	2.76	0.43	0.15	0.01	0.74

Means within columns with different superscript differ ($P < 0.05$)

Key Words: Goats, *In vitro*, Volatile Fatty Acids

T155 Methane emission by goats consuming a condensed tannin-containing lespedeza, alfalfa and sorghum-sudangrass. G. Animum*¹, R. Puchala¹, A. L. Goetsch¹, A. K. Patra¹, T. Sahlul¹, V. H. Varela², and J. Wells², ¹E (Kika) de la Garza American Institute for Goat Research, Langston, OK, ²US Meat Animal Research Center, Clay Center, NE.

Twenty four Boer × Spanish (1/2 Boer; initial BW of 38.3 ± 0.69) wethers six per treatment were used to assess effects of a condensed tannin (CT)-containing forage (sericea lespedeza, *Lepedeza cuneata*; S) with or without polyethylene glycol (PEG), a legume (alfalfa, *Medicago sativa*; A), and grass (sorghum-sudangrass, *Sorghum bicolor*; G) on ruminal methane emission. Treatments were S, S plus 25 g/d of PEG mixed with 50 g/d of ground corn (P), A, and G. Forages harvested daily were fed at 1.3 times the maintenance energy requirement. The experiment lasted 15 d, 7 d for adaptation and 8 d for measurement.