FORAGES AND PASTURES: FORAGES AND PASTURES 1: SILAGES AND FORAGES IN DAIRY PRODUCTION SYSTEMS

1068 (M085) The influence of wilting on the quality of *Leucaena leucocephala* silage. T. Clavero[*1], and R. Razz[2], [1]*Universidad Del Zulia, Maracaibo, Venezuela,* [2]*Universidad del Zulia, Maracaibo, Venezuela.*

An experiment was conducted in the northwest of Venezuela in order to evaluate the ensiling properties of *Leucaena leucocephala* using laboratory silos. Factors studied were wilting for 0 and 3 h and ensiling time of 0, 7, 14, 21, and 35 d.The silos were kept in the room set at 25ºC and samples were taken from three silos at each sampling time for chemical analyses. Data were analyzed as a randomized design with a 2 x 5 factorial of wilting and ensiling time, respectively, with three replications. Means were compared by Tukey test. Response variables were: DM, cellulose (C), pH , total nitrogen (TN), ammonia (NH_3) and NH_3/TN. Increasing ensiling time of high moisture *Leucaena* resulted in losses of DM in the silage, unwilted silage contained 52.3% DM at the end of ensiling time while wilting silage showed 59.9% of DM. Ensiling *Leucaena* from 0 to 35 days resulted in decreased ($P < 0.05$) C content in 9.5% for high moisture silage in contrast to 6.5% for wilted. This could have been due to the cumulative activity of plant cell respiration and some facultative bacteria in the fresh ensiled forage. The pH increased ($P < 0.05$) while TN, NH_3 and NH_3/TN decreased ($P < 0.05$) with reduced moisture content of ensiled *Leucaena.* The concentrations of fermentation end-product decreased with wilting, showing that low moisture restricted fermentation. The reduction in TN content in wilted silage was expected due to breakdown of true protein during sun-drying and ensiling process. Wilting resulted in decreased ($P < 0.05$) NH_3 and NH_3/TN when compared to high moisture silage. Concentrations of NH_3 and NH_3/TN in high moisture silage were 35.3 and 24.6% greater, respectively than wilted silage. However, levels of NH_3 were less than 80-100 g/kg TN which is commonly used to represent well fermented silage. All silages in the current experiment achieved satisfactory preservation.

Key Words: *Leucaena leucocephala*, wilting, silage, quality

1069 (M086) Comparison of milk fatty acid profiles of dairy cows grazing cool-season perennial ryegrass or birdsfoot trefoil pasture on a commercial organic dairy farm. R. G. Christensen[1], J. S. Eun[*1], V. Fellner[2], A. J. Young[1], and J. W. MacAdam[1], [1]*Utah State University, Logan,* [2]*North Carolina State University, Raleigh.*

This experiment investigated milk fatty acid (FA) profiles of grazing dairy cows on a commercial organic dairy farm during 2 grazing seasons in 2012 and 2013. Eighteen multiparous cows in mid-lactation were assigned to one of 2 intensively rotated grazing treatments in a completely randomized design: cool-season perennial ryegrass (RGP) vs. birdsfoot trefoil pasture (BFTP). Cows received 2.27 kg of concentrate (flaked barley grain and vitamin and mineral supplement) twice per day following milking. Experiment lasted a total of 10 wk, with 2 wk for adjustment to pasture treatments and 8 wk for data and sample collection. Samples of pasture forages and milk were taken at wk 2 and 6 and were analyzed to determine their FA profiles. In 2012 and 2013, averaged concentration of C18:3 n-3 (42.6 and 53.5 g/100 g) was the greatest in pasture forage FA followed by C16:0 (20.5 and 15.7 g/100 g) and C18:2 n-6 (13.9 and 13.5 g/100 g), respectively. The most noticeable difference of pasture forage FA profiles in 2012 and 2013 was that in 2012 proportion of C18:3 n-3 in RGP increased from wk 2 (39.8 g/100 g) to wk 6 (47.1 g/100 g), whereas its proportion in BFTP was similar at wk 2 and wk 6. In contrast, proportion of C18:3 n-3 in RGP and BFTP decreased from wk 2 (57.3 and 55.1 g/100 g) to wk 6 (51.9 and 49.6 g/100 g), respectively. Concentration of *trans*-11 C18:1 in milk was very low in RGP and BFTP in both grazing seasons, suggesting limited impacts of pasture on the biohydrogenation activity for the pastures tested. Dairy cows grazed on RGP and BFTP showed similar concentrations of *cis*-9, *trans*-11 conjugated linoleic acid in milk fat throughout grazing seasons. Cows grazed with BFTP increased concentration of C22:6 (n-3; docosahexaenoic acid) at wk 6 in 2012 and 2013 compared to those grazed with RGP. However, pasture treatment did not affect ratio between polyunsaturated FA and saturated FA in two grazing seasons. Overall results in this experiment indicate that source of pastures did not affect major milk FA profiles, and some minor changes in FA profiles may have resulted from pasture FA profiles in two grazing seasons.

Key Words: birdsfoot trefoil pasture, lactating dairy cows, milk fatty acids

1070 (M087) Lactational response of Holstein cows to brown midrib or leafy-floury corn silage.

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The objective of this experiment was to measure the response of lactating Holstein cows to total mixed rations containing either brown midrib-3 (BMR; Mycogen F2F387) or an experimental leafy-floury hybrid (LF; Healthy Herd Genetics HHG39HF13) bred for improved NDF and starch digestibility compared with similar leafy corn hybrids. Sixteen cows (6 primiparous; 10 multiparous) averaging 130 ± 16 days in milk were assigned to one of two dietary sequences in a crossover design with 28-d periods (21 d adaptation and 7 d collection). Each diet contained 49% BMR or LF corn silage, 9.8% haycrop silage, and 41.2% concentrate mix (DM basis). The BMR silage contained 30.2% DM, 7.3% CP, 41.5% NDF, 60.2% 24-h NDF digestibility, 31.0% starch, and 77.5% 7-h starch digestibility (DM basis). The LF silage contained 31.9% DM, 7.8% CP, 42.6% NDF, 47.5% 24-h NDF digestibility, 30.3% starch, and 73.0% 7-h starch digestibility which was unexpectedly low. The BMR diet contained 17.2% CP, 32.2% NDF, and 24.6% starch, and the LF diet was similar with 17.8% CP, 33.5% NDF, and 23.0% starch. Data were analyzed as a crossover design using the PROC MIXED of SAS with model effects of diet, sequence, and period, with cow within sequence as a random effect. Compared with the LF diet, the BMR diet resulted in greater DMI (29.7, 27.2 kg/d, SE = 0.9; $P < 0.001$), greater SCM yield (47.0, 41.7 kg/d, SE = 1.4; $P < 0.001$), and greater SCM/DMI (1.59, 1.54, SE = 0.04; $P < 0.01$). Chewing during eating and ruminating was greater for the LF versus the BMR diet (89, 84 min/kg NDF intake, SE = 3; $P < 0.001$). Compared with the LF diet, the BMR diet resulted in greater total tract OM and NDF digestibility (81.4, 77.7%, SE = 0.6; 63.8, 55.4%, SE=0.8; $P < 0.001$), although starch digestibility was similar for the LF and BMR diets (99.0, 98.9%, SE = 0.1; $P < 0.001$). Compared with the BMR diet, the LF diet resulted in higher fecal pH (6.92, 6.71, SE = 0.03; $P < 0.001$), lower fecal starch (0.82, 1.15%, SE = 0.09; $P < 0.008$), and lower fecal P (0.53, 0.63, SE = 0.02; $P < 0.001$). The LF hybrid assessed in this experiment constrained DMI and milk production compared with the BMR hybrid. To achieve dietary fermentable carbohydrate content similar to BMR, a LF hybrid will require higher NDF and starch digestibility than the hybrid evaluated in this experiment.

Key Words: leafy-floury corn silage, brown midrib corn silage, dairy cattle

1071 (M088) Production response of lactating cows to diets based on corn or forage sorghum silage produced from first or second harvest.

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The objective of the trial was to compare the production response of lactating Holstein cows to corn or forage sorghum silage produced from two crops. Corn was planted in April and harvested in July (CS1). A second crop was planted in July and harvested in November (CS2). A brachytic dwarf forage sorghum was planted in April, harvested in July (FS1), fertilized, and harvested a second time in November (FS2). All forage was ensiled in plastic bags and stored until the production trial began. Silages contained (DM basis) 8.0, 8.5, 9.0, and 9.5% CP; 39.0, 38.3, 54.2, and 55.1% NDF; 3.55, 2.83. 7.72, and 7.77% acid detergent lignin; and 48.1, 47.7, 31.5, and 29.1 NFC, for CS1, CS2, FS1, and FS2, respectively. Forty-eight mid-lactation Holstein cows (153.5 DIM, 36.5 kg milk, and 3.2% fat) were assigned randomly to one of for diets differing in forage source. Cows were fed individually once daily behind Calan doors for 5 wk. Diets were balanced to provide equal concentrations of protein, fiber, and energy. No differences were observed in DMI, milk yield, or milk composition among treatments: 23.1, 21.1, 21.0, and 19.9 kg/d DMI; 34.5, 34.4, 34.9, and 35.1 kg/d milk; 3.34, 3.22, 3.40, and 3.52% fat; and 2.73, 2.63, 2.61, and 2.65% protein for CS1, CS2, FS1, and FS2, respectively. Concentrations of MUN (mg/dl) were higher ($P = 0.03$) for FS1 and FS2 compared with CS1 and CS2 (16.2, 16.3, 11.6, and 13.9, respectively). Results of this trial suggest that brachytic forage sorghum silage can support similar as corn silage. Forage harvested from the regrowth of brachytic forage sorghum also supported similar performance as the first harvest. The higher MUN observed for diets based on forage sorghum reflects most likely reflects differences in fermentable carbohydrate compared with corn silage diets.

Key Words: corn silage, forage sorghum, milk yield

1072 (M089) Feeding strategy and pasture quality relative to nutrient requirements of grazing dairy cows in the Northeastern U.S.

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Pasture samples ($n = 229$) collected during the grazing season from 14 organic dairy farms in 2012 (*P*A, ME, NY, NH, VT) and from 11 of the same farms in 2013 (PA, ME, NY, NH) were analyzed for nutritional composition. Frequency analysis was used to determine the proportions of pasture samples that met minimum NE_L, CP, and macro-mineral requirements according to the NRC (2001) model for a 680 kg Holstein, producing

25 kg milk/d with 3.5% milk fat and 3.0% milk protein. The Large Ruminant Nutrition System (LRNS, Version 1.0.24) was used to describe feeding strategies that accompanied grazing on eight of the participating farms. Four farms had moderate conserved feed input (> 20% diet DM not from pasture; MF), and fed corn silage, grass/legume balegae or haylage, and/or a grain mix and dry hay, two farms supplemented pasture with a grain mix (GS), and two farms fed forage only (*P*asture and dry hay; FO). Management and production information used in the LRNS model were specific to environmental conditions, nutrient concentrations of feeds, cow type, and level of production for each farm. If pasture was the only diet component, energy was the most limiting nutrient, with 39% of pasture samples failing to meet the minimum NRC NE_L requirement. Only 7% of pasture samples did not meet the minimum CP requirements. Calcium, P, and S did not meet minimum NRC requirements in 35, 18, and 10% of pasture samples, respectively. Average concentrations of Mg and K were in excess of 156 and 1,113% of dietary requirements. Milk production was observed to be higher on MF farms (23 kg/d), but was comparable on GS and FO farms, averaging 15 kg/d for both. Proportion of DMI from pasture was related to feeding strategy and ranged from 51 to 79% on MF farms, 84 to 96% on GS farms, and 91 to 100% on FO farms. Metabolizable protein provided by the total diet (*P*asture and supplementation) exceeded the requirements at the specified level of production and environmental conditions except for 1 farm (the MF farm with the lowest amount of DMI coming from pasture). Rumen N balance was negative for both GS farms (-18 and -33 g/d). Overall, the forage quality of pastures evaluated was high. Additionally, varying feeding strategies allow farmers to use resources such as pasture, homegrown forages, and grains to meet individual goals of milk production.

Key Words: pasture, grazing, dairy

1073 (M090) Use of biological additives to improve lactic fermentation tropical silages.

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The objective of this study was to assess different biological additives to favor lactic acid fermentation. This trial aimed also to obtain the optimal proportions of sorghum/soybean to ensure good fermentation quality for silage making using a fast in vitro fermentation test (Rostock fermentation test; RFT). Different combinates of a grass (*Sorghum bicolor* L. variety H70) and legume (soybean *Glycine max* variety Panorama 29) were tested against biological additives. Test used sorghum and soybean and their combinations (100/0, 33/67, 67/33, 0/100) with or without biological additives. Inoculates were evaluated for their acidification ability: enzymatic complex from anaerobic rumen fungi (*Orpinomyces* sp), clarified rumen fluid, Lactic acid bacteria (LAB)-epiphytic S738 (from sorghum), LAB-epiphytic S739 (from soybean), LAB from CIAT bacteria collection (S66.7), commercial silage inoculant (SilAll4×4-Brazil) and a control. Fifty grams of fresh minced material and 200ml of distilled water of forage were incubated into sterile glass in triplicate at 37°C for 48 hours and the pH was measured at 0, 20, 28, 44, and 48 hours to determine the dynamics of fermentation. Completely randomized in a 4x6 factorial design was used. Forage inclusion level (four levels) and the type of additive (six additives and control) were arranged. Significant difference ($P < 0.001$) was found at the level of forage inclusion and the additive used ($P < 0.05$). The treatments including biological additives showed lower pH value than control treatment (5.5). Best results were obtained (pH = 3.7) for the sorghum/soybean at 100/0% inclusion, followed by the mixture of sorghum/soybean 67/33 (pH = 4.2) while the pH for the rest of treatments value were above 5.0. The best additive was the bacterial strain (S738) (pH <4.0). The enzymatic complex (pH 5.0), clarified rumen fluid (pH 5.3) and silall4x4 (pH 5.2) have reasonable pH values for ensilability. The highest pH value (5.7) was for soybean 100% ($P < 0.05$). Results show that biological additives such as epiphytic bacterial strains isolated from sorghum have potential to improve fermentability. Larger sorghum inclusion in the mixture facilitated lactic fermentation for silage making.

Key Words: pH, Rostock fermentation test, grass, legume.

1074 (M091) Quality evaluation of five varieties of corn for silage production in crop-livestock-forest integration system in the Cerrado region.

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The intercropped of corn within the integrated crop- livestock-forest system can be seen in the establishment of forage with lower costs and diversify, producing silage for animal feed. Thus, we evaluated the qualitative characteristics of five cultivars of maize intercropped with *Brachiaria brizantha* cv. Marandu for silage production in integrated crop-livestock-forest system. The experimental design was a randomized block with three replications and five treatments. Maize cultivars used were: EMGOPA 501, AL Bandeirantes, BRS Caimbé, PL 6880, BRS 1060. To assess the qualitative characteristics were estimated: number of grains per ear; number of kernels per row; number of rows per ear; grain weight per ear and weight of 100 grains. There were no significant differences in the variables studied. The intercropped of forage maize cultivars do not influence on the qualitative characteristics of corn for silage.

Key Words: intercropped, Marandu, tropical region

Table 1074. Means for number of grains per ear (NE); number of kernels per row (NR); number of rows per ear (NRE); grain weight per ear (GWE) and weight of 100 grains (W100G).

	NE	NR	NRE	GWE (g)	W100G (g)
EMGOPA501	532.6	358.0	12.6	178.34	34.09
AL BAND[1]	479.8	366.0	13.2	187.24	38.80
BRS CA[2]	540.0	349.7	15.6	179.98	32.64
PL 6880	443.4	316.0	14.0	171.13	37.54
BRS 1060	549.6	386.0	14.2	189.39	34.44
CV (%)	12.8[ns]	11.5[ns]	12.4[ns]	12.1[ns]	5.68[ns]

ns - non significant.
[1]Cultivar- AL Bandeirantes.
[2]Cultivar - Caimbé.

1075 (M092) Impact of hybrid and growing location on yield and composition of corn plants harvested for silage. D. Bolinger[1], L. Nuzback[*2], and F. N. Owens[2], *[1]DuPont Pioneer, Perrinton, MI, [2]DuPont Pioneer, Johnston, IA.*

Relative effects of hybrid, growing location, and DM at harvest on corn silage yield and composition have not been clearly defined. Their impacts on yield, plant and grain composition at silage harvest, and potential milk yields were examined using corn plants and grain from five Pioneer hybrids grown in each of 15 environmentally diverse Michigan locations in 2013 all harvested at silage maturity. Nutrient compositions were determined at a commercial laboratory; milk yields were predicted from Milk 2006 equations. Relationships were evaluated using regression and GLM procedures of SAS. Whole plant DM, grain DM, starch, and NDF ranged from 24.2 to 47.8, 49 to 76, 17.2 to 39.6, and 37.1 to 49; 24 hour NDF disappearance ranged from 36.3 to 55.6 percent of NDF; DM yield ranged from 8 to 23 metric ton (MT) per hectare while milk ranged from 1444 to 1873 kg per MT. Growing location altered ($P < 0.01$) every measurement. Harvest DM had quadratic effects on milk per hectare and on yields of DM, starch and NDF, each peaking at 41% DM; hence relative nutritional values can be biased if hybrids differ in DM content even when harvested on the same date. Among environmental measures, growing degree days prior to harvest (range 1916 to 2367) was related ($P < 0.05$) negatively to sugar but positively to starch content of plants. Precipitation (36 to 65 cm during the season) was related ($P < 0.02$) positively to yield and milk per hectare but negatively to crude protein content and NDF digestibility. Locations that received less than 41 cm of rain had lower ($P < 0.05$) plant yields and milk per hectare but greater ($P < 0.05$) NDF digestibility (48.3 versus 45.8 percent of NDF) and CP, fat, and prolamin content of grain. Greater plant weight was associated with increased kernel density and yield of milk and DM per hectare. Hybrids with greater drought tolerance had greater ($P < 0.04$) starch content of plants and grain and greater starch availability from grain but lower NDF digestibility. The growing environment and harvest DM generally had greater impact on silage yield and nutritive value than hybrid choice among the corn silage hybrids tested.

Key Words: corn silage, location, harvest

1076 (M093) Impact of corn plant maturation and planting density on nutrient composition and potential milk yield. L. Brown[*1], L. Nuzback[2], B. Redenius[2], P. M. Walker[3], and F. N. Owens[2], *[1]DuPont Pioneer, Bloomington, IL, [2]DuPont Pioneer, Johnston, IA, [3]Illinois State University, Normal.*

Stage of maturity and planting density can alter weight and nutrient composition of corn plants within the silage harvest window and thereby alter both yield and the nutritional value of corn silage. To appraise effects of maturity and plant density on yield and nutrient composition, nine Pioneer silage hybrids (109- to 115-d relative maturity) were planted in a single field near Lexington, IL, with 69000 and 84000 plants per hectare. Duplicate sets of five representative plants were harvested at 3 to 4 day intervals within the silage harvest window (28 to 42 percent DM), weighed and chopped. Duplicate subsamples were dried (48 h at 15 C) and assayed by calibrated NIR procedures for CP, starch, sugars, NDF, and NDF digestibility. Averaged across harvest dates, hybrids differed ($P < 0.01$) in all measurements. The 21 percent increase in plant density decreased ($P < 0.05$) starch content of plant DM by 1.5 percentage points and milk per ton by 2.5 percent, but increased ($P < 0.01$) yields of DM, milk, NDF, digestible NDF, and indigestible NDF per hectare by 7.2, 7.0, 9.0, 8.0, and 10 percent. Across hybrids, linear and quadratic regressions against harvest DM were significant ($P < 0.05$) for starch content, protein content, milk per ton (each increasing at a decreasing rate), and sugar content (decreasing to a plateau). As plant DM percentage increased, yield of DM increased but NDF digestibility declined ($P < 0.01$) slightly (0.09 points for each 1 percentage increase in plant DM. In corn silage test plots, all hybrids typically are harvested on a single date regardless plant moisture content. Among these nine hybrids, ranking for milk per hectare remained reasonably similar across this DM range; milk per ton ranking changed markedly, especially when plant DM was below 34 percent, although rank of the top (a BMR) and bottom hybrids remained similar. In conclusion, increasing planting density increased corn silage yield with some sacrifice in starch percentage. Hybrid ranking for milk per ton differed with harvest DM. To prevent ranking bias, hybrids in silage test plots should be harvested at multiple moisture contents.

Key Words: corn plant maturity, planting density, hybrid ranking

1077 (M094) Gas production and volatile fatty acids of corn stover silage added with yeast culture and fermented apple pomace. C. Rodríguez-Muela*, N. H. Ruiz, P. F. Mancillas-Flores, O. Ruiz-Barrera, A. Corral, C. Arzola-Alvarez, A. Ramírez-Godínez, and E. Santellano, *Universidad Autónoma de Chihuahua, México.*

Silage is a forage conservation method based on fermentation of carbohydrates to produce lactic acid under anaerobic conditions. Solid state fermentation (SSF) is a process of microbiological growth on solid materials under aerobic conditions. With the objective of improving the nutritional value of corn stover through the combination of SSF and silage, three treatments were driven during 28 d using 48 plastic bags as a microsilos each with 2 kg of: (T1) corn stover alone; (T2) corn stover + yeast culture produced by SSF (10% as feed basis) and (T3) corn stover + fermented apple pomace produced by SSF (69% as feed basis). Treatments were added with water to obtain 35% of DM during the ensilage. Gas production (GP) and volatile fatty acids (VFAs) were determined in the samples obtained on 14d of the ensilage, following 96 h incubation in buffered rumen fluid using the in vitro fermentation technique. Data were analyzed by PROC GLM of SAS. Results are shown in Table 1077. The addition of yeast culture and apple pomace increased GP volume ($P < 0.01$) with values of: 58.17 ± 0.69, 63.57 ± 0.69 and 85.96 ± 0.69 ml*0.2g^{-1} MS of T1, T2 and T3, respectively. VFA´s differed between treatments ($P < 0.01$). Acetate-propionate ratio increased from 1.8:1 to 2.4:1 ($P < 0.05$) during the in vitro fermentation. Results may be derived from a change in rumen fermentation. It was conclude that the addition of fermented apple pomace or yeast culture improve GP and VFAs parameters of corn stover silage.

Key Words: yeast culture, silage, corn stover

Table 1077. Parameters of gas production and volatile fatty acids, determined in the samples obtained on 14 d of the ensilage, following 96 h incubation in buffered rumen fluid using the in vitro fermentation technique

Evaluated Variables	T1	T2	T3
Total Gas Volume (ml*0.2g^{-1} MS)	58.17 ± 0.69^{c}	63.57 ± 0.69^{b}	85.96 ± 0.69^{a}
Parameter A (ml*0.2g^{-1} MS)	30.05 ± 1.30^{b}	30.21 ± 1.30^{b}	39.42 ± 1.30^{a}
Parameter B (h)	3.46 ± 0.07^{a}	3.03 ± 0.07^{b}	2.55 ± 0.07^{c}
Parameter C (mL/h)	0.026 ± 0.00^{b}	0.028 ± 0.00^{a}	0.028 ± 0.00^{a}
Acetic Acid (mM/mL)	103.06 ± 0.09^{c}	114.06 ± 0.09^{b}	120.26 ± 0.09^{a}
Propionic Acid (mM/mL)	43.33 ± 0.07^{c}	46.70 ± 0.07^{b}	48.59 ± 0.07^{a}
Butiric Acid (mM/mL)	16.12 ± 0.06^{c}	17.60 ± 0.06^{b}	18.16 ± 0.06^{a}

^{a,b,c} Means with literal different between columns indicate statistical difference ($P < 0.05$), Parameter A = asymptote of gas production, Parameter B = average time of gas production after incubation, Parameter C = constant determining the change of profile.

1078 (M095) Effect of a chemical additive on fermentation and aerobic stability of high-moisture corn. T. C. Da Silva, M. L. Smith*, S. A. Polukis, A. M. Barnard, and L. Kung Jr., *University of Delaware, Newark.*

The objective of this experiment was to evaluate effect of a chemical additive on fermentation and aerobic stability of high moisture corn (HMC). Ground HMC (~63% DM) was untreated, or treated with 2 L of Safesil (SAFE, sodium nitrite, potassium sorbate, and sodium benzoate, Salinity Agro, Halmstad, Sweden)/t of fresh HMC, 3 L of SAFE/t, or 4 L of SAFE/t. Lab silos (7.5 L, 4 silos/treatment/time point) were prepared (density of 672 kg of DM/m^3) and ensiled for 21 and 90 d at 22 ± 2 °C. Data were analyzed as a 4 × 3 factorial arrangement of treatments with main effects of Safesil (4 levels) and days of ensiling (0, 21 and 90 d), and their interaction, using the software JMP, version 10. Numbers of yeasts were similar ($P > 0.05$) among treatments in fresh HMC (log 6.9 to 7.1 log cfu/g) but decreased ($P < 0.01$) substantially after ensiling (< 3.3 log cfu/g). Numbers of yeasts were similar ($P = 0.33$) among treatments after 21 d of ensiling but after 90 d they were lower ($P < 0.01$) in HMC treated with SAFE (< 2 log cfu/g for all levels) compared to untreated HMC (3.22 log cfu/g). Compared to untreated HMC, addition of SAFE to HMC at all levels did not affect the concentrations of organic acids (lactic, acetic, and propionic) or pH at any ensiling time. In contrast, treatment with SAFE markedly decreased ($P < 0.01$) the concentrations of ethanol in HMC after 21 and 90 d (< 0.25% of DM for all SAFE levels) when compared to untreated HMC (1.02 and 0.76% of DM, respectively at d 21 and 90). Treatment with SAFE markedly improved ($P < 0.01$) the aerobic stability of HMC after 30 d (89 h for untreated HMC vs. > 500 h for HMC treated with SAFE at all levels) and after 90 d of ensiling (77 h for untreated HMC vs. > 500 h for HMC treated with SAFE at all levels). This was the first evaluation of Safesil on HMC in North America and it showed that this additive, even when added at a relatively low level (2 L/t) effectively improved the aerobic stability of HMC and reduced concentrations of ethanol without altering the concentrations of organic acids or pH.

Key Words: high moisture corn, fermentation

1079 (M096) The effect of chemical additives with antifungal properties on the fermentation and aerobic stability of corn silage. M. C. Windle*, C. Merrill, M. C. N. Agarussi, L. O. Rosa, and L. Kung Jr., *University of Delaware, Newark.*

The objective of this study was to evaluate chemical additives with antifungal properties on the fermentation and aerobic stability of corn silage harvested at two maturities: 32% DM (LDM) and 38% (HDM) whole-plant DM. At each harvest, plants were obtained from five random locations within the

field and further divided into four piles and treated with a) no additive, b) 1.5 L of Safesil (Salinity Agro, Halmstad, Sweden; active ingredients of sodium nitrite, potassium sorbate, and sodium benzoate)/t of fresh forage, c) 2 L of Safesil/t, or d) 2 L of Crop Saver (CS, CNH America LLC, Racine, WI; 64.5% propionic acid). Each pile was treated with a total volume of 0.03% vol/wt of liquid (water alone for the no additive treatments). Forage from each pile was ensiled in 7.5-L lab silos (packing density of about 220 kg of DM/m^3). Silage data were analyzed as a 2 (maturity) × 4 (additive) factorial arrangement of treatments after 120 d of storage (22 ± 2°C) using the software JMP. At both harvest DM, compared to untreated silage, treated silages had similar ($P > 0.05$) concentrations of lactic and acetic acids, CP, ADF, NDF, starch and pH. Treatment with CS increased ($P < 0.01$) the concentrations of propionic acid silage in silage in both maturities compared to other treatments. In LDM silages, treatment with Safesil did not affect ($P > 0.05$) the concentrations of ethanol but treatment with CS resulted in a higher ($P < 0.01$) concentration of ethanol when compared to untreated silage. In HDM silage, concentrations of ethanol were lower ($P < 0.01$) in a dose dependent manner for silages treated with Safesil but unaffected by CS. Compared to untreated silage, aerobic stability was improved ($P < 0.01$) for both maturities treated with CS (66 vs. 93 h in LDM silage and 59 vs. 116 h for HDM silages). Treatment with Safesil was even more effective resulting in aerobic stabilities ($P < 0.01$; average of > 450 h in LDM silages and average of > 350 h in HDM silages) that were markedly better than both untreated and CS. This study was the first to show that Safesil has the potential to markedly improve the aerobic stability of corn silage in North America.

Key Words: silage, aerobic stability, corn silage

1080 (M097) Effect of *Lactobacillus plantarum* MTD1, potassium sorbate or their combination on production of volatile organic compounds and aerobic stability of corn silage.

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Silages have the potential to contribute to poor air quality through emission of volatile organic compounds (VOC), especially ethanol. Silage additives may be useful for reducing VOC production, but few studies have evaluated them for this purpose. The objective of this experiment was to test the effects of a biological and a chemical additive on production of VOC and aerobic stability of corn silage. Whole plant corn (37.5% DM) was chopped, processed and treated with *L. plantarum* MTD1 (LP, Ecosyl, Ltd., Stokesly, UK) at a rate of 1 × 10^5 cfu/g fresh forage basis, potassium sorbate (0.1% fresh forage basis, PS), a combination of LP and PS (LPPS), or distilled water (untreated, CTRL). Forage was packed in 7.5 L bucket silos at a density of about 230 kg DM/m^3, in quadruplicate, and ensiled at 21-23°C for 119 d. Silage data were analyzed by analysis of variance as a completely randomize to design using the software JMP. Measurements with a headspace GC method showed that both PS and LPPS reduced ($P < 0.05$) production of ethanol and ethyl acetate by more than 75% below CTRL. Treatment LPPS also reduced production of three other significant VOCs: 1-propanol, methyl acetate, and valeraldehyde. Lactic acid was slightly elevated by LPPS ($P < 0.01$) compared to other treatments, but the concentration of acetic acid was similar among treatments. Compared to CTRL, the additives had no effects ($P > 0.05$) on CP, soluble CP (% of CP), ADF and NDF. Due to contaminated media, the numbers of yeasts in silage could not be accurately determined and thus are not reported. However, there was a trend ($P < 0.07$) for improved aerobic stability (48, 49, 169 and 218 h, respectively, for CTRL, LP, PS, and LPPS). In conclusion, a combination of *L. plantarum* MTD1 and potassium sorbate appears to be a very effective additive for reducing production of several important VOCs (including the most important compound: ethanol) in corn silage. Potassium sorbate alone appears to have nearly the same effect on overall VOC production.

Key Words: corn silage, inoculant, volatile organic compounds

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1081 (M098) The effects of strains of yeasts or *Lactobacillus buchneri* 40788 on the fermentation, production of volatile organic compounds (VOCs) and aerobic stability of corn silage.

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Several yeasts and *Lactobacillus buchneri* 40788 were evaluated for their effects on the fermentation, production of VOCs and aerobic stability of corn silage. Freshly chopped and processed corn plants were treated with a) no additive, b) *Saccharomyces cerevisiae* -1, c) *S. cerevisiae* - 2, d) an experimental yeast known to produce acetaldehyde under aerobic conditions, or e) *L. buchneri* 40788 (LB, 4 x 10^5 cfu/g of fresh forage). Yeasts were inoculated at 1 x 10^6 cfu/g of fresh forage. All microbes were from Lallemand Animal Nutrition, Milwaukee, WI. Silos (7.5 L, forage density of 224 kg of DM/m^3) were ensiled for 70 and 151 d between 21 to 23 °C. Five replicates were opened for each treatment at each time point. Silage data were analyzed by analysis of variance as a 2 x 5 factorial arrangement of treatments with main factors of days of ensiling, inoculation and their interaction. Silages were analyzed for numbers of yeasts, fermentation end products, aerobic stability and VOCs (d 151 only). The VOCs were determined by solid phase microextraction (SPME) coupled to non-targeted, comprehensive two-dimensional gas chromatography-time-of-flight mass spectrometry (GC´GC-ToFMS). Relative to silage with no ad-

ditive, treatment with yeasts did not affect any of the measured parameters. In contrast, when compared to all other treatments, treatment with LB resulted in a higher concentration ($P < 0.05$) of acetic acid (1.58 vs. 0.52 to 0.81% at d 70 and 2.24 vs. 0.94 to 1.22% at d 151) and 1,2 propanediol at both openings, and lowered the concentration ($P < 0.05$) of ethanol (0.37 vs. 1.18 to 1.52%) after 151 d. The VOC profile of corn silage was markedly altered by LB. Approximately, 25% of the volatile compounds detected in corn silage differed in the LB treated silage ($P < 0.0067$). Decreases were observed in several ethyl esters of medium chain fatty acids along with increases in various esters of acetic acid. Aerobic stability was numerically greater for LB than other treatments after 70 d of ensiling and statistically greater ($P < 0.05$, > 450 h) than other treatments (50 to 120 h) after 151 d of ensiling. This is the first study to show that not only does inoculation with LB improve aerobic stability in corn silage, but it has marked effects on VOC compounds.

Key Words: corn silage, volatile organic compounds, *Lactobacillus buchneri*

1082 (M099) Isolation and identification of lactic acid bacteria in forage peanut silage. L. D. Rufino[1], E. S. Leandro[1], K. G. Ribeiro[1], H. C. Mantovani[1], T. C. Silva[1], and O. G. Pereira[*2], *[1]Universidade Federal de Viçosa, Minas Gerais, Brazil, [2]Universidade Federal de Viçosa, Minas Gerais, Brazil.*

Cultivars of *Arachis pintoi* species are widespread in tropical and subtropical areas in Brazil. There are a limited number of reports about the use of tropical leguminous for ensiling process mainly with regard to the autochthonous population of lactic acid producing bacteria (LAB). Therefore, the objective of the present study was to isolate and identify the LAB by the partial sequencing of the 16S rDNA gene in silage of *Arachis pintoi* cv. Belmonte with 0, 3, 7, 14, 28, and 56 days of fermentation. Forage was ensiled in triplicate by vacuum packing the forage in plastic bags and stored at room temperature. Silage samples were mixed with 225 mL of saline solution and serial dilutions were performed. The dilutions were then plated in MRS agar by using Pour plate technique. Plates were incubated at 37°C for 48 h. After incubation period 40 colonies were randomly selected for streak in MRS agar and then incubated at 37°C for 48 h. Selected isolates were tested for catalase, Gram staining and morphology analysis. The isolates characterized as catalase negative and gram positive were selected to be identified by 16S gene rDNA sequencing. The PCR analysis was performed by using GoTaq DNA polymerase kit and a set of primers 1378/P027. The amplified fragment was purified and sequenced. Among the 40 isolates, only 17 isolates had sequences with identity equal to or greater than 97% with sequences already available in GenBank database. From these 17 sequences the *Lactobacillus plantarum, Lactobacillus paraplantarum, Pediococcus pentosaceus,* and *Lactobacillus casei subs. Casei* were detected. The majority of the isolates were identified as *Pediococcus pentosaceus*. The sequence of isolates obtained in the current study was not matched with the sequences of 16S rDNA of *L. plantarum* or *Pediococcus pentosaceus* already available at Genbank. The lack of matching among the sequences of the isolates obtained in this study with the sequences available at Genbank does not mean that they are not from the same specie. Microorganisms are susceptible to constant mutations varying according to the environment conditions. The accumulation of these mutations may be the reason of the difference among the sequences of different strain. *Sponsored by FAPEMIG, CNPq and INCT-CA.*

Key Words: *Lactobacillus plantarum*, legume silage, *Pediococcus pentosaceus*

1083 (M100) Evaluating top losses in Argentine corn silages. L. O. Abdelhadi[*1], G. Marley[2], and J. M. Barneix[3], *[1]Est. El Encuentro, Research & Extension in Ruminant Nutrition, Brandsen, Buenos Aires, Argentina, [2]Sil-All Global Product Manager, Gloucestershire, United Kingdom, [3]Sil-All Argentine Product Manager, Lincoln, Buenos Aires, Argentina.*

The aim of the study was to quantify how much of the quantity and quality is being lost from the top of corn silages when compared with silo mass across Argentina. Fifty corn silages were sampled in Buenos Aires, Santa Fe and Entre Rios provinces. Composite samples (three sub-samples each) were taken in each silo (from 44 to 488 d since the silages were done), from the core (CS: between 50 to 100 cm inside) or the top (TS: within 50cm), refrigerated until freezing and analyzed for pH, DM, OM and Ashes. Measures of packing density was done by sampling site plus particle size separation using the PSP and finally OM losses were calculated as the difference between % and tons found in the top compared with the core. Data were analyzed as RCB design, using each silo as Block (50), within each block the treatment was the sampling location (CS and TS) and ANOVA by variable was obtained using α 0.05. Of total sampled silages 33, 16 and 1 were storage in stack, bunker and pile silos, respectively; most covered using white and black (36) or black (7) standard plastic and seven uncovered. No one used additives or special covering systems for the surface. Results are presented in Table 1083.

From silos which originally had as a mean 8382 m^3, exposed surface averaged 1398 $m^{3,}$ which involved about 291 tons of OM within each silo. Of exposed OM, we estimated that 23.9% is being lost in the top, averaging 69 tons of OM in each of the sampled silages. When we tried to relate OM losses with days after ensiling or packing density, low relationships were detected; suggesting that practices around covering and uncovering were responsible of top losses.

Key Words: corn silage, top losses

Table 1083.

Item	Top n = 50	Core n = 50	*SE*
DM, %	32.4	31.9	0.112
OM, as %DM	78.7b	93.2a	0.141
ASHES, as %DM	21.3a	6.8b	0.141
pH	5.44a	3.84b	0.002
PS, % >0.75 in	13.41	13.50	1.06
PS, % 0.31 to 0.75 in	70.26	69.41	1.07
PS, % 0.07 to 0.31 in	15.89	16.65	0.22
PS, % <0.07 in	0.43	0.44	0.003
Packing density, kgDM/m^3	264.7b	294.2a	11.86

[ab] Means within a row with unlike letters differ ($P < 0.01$). PS = Particle size.

1084 (M101) Corn silage analysis as influenced by sample size. I. M. Malebana[1], D. J. R. Cherney[*2], and W. J. Cox[2], *[1]Agricultural Research Council, Pretoria, South Africa, [2]Cornell University, Ithaca, NY.*

Sampling variability is a major concern when dealing with chopped corn forage that contains as much as 50% grain. Commercial laboratories prefer to minimize the quantity of corn forage that needs to be processed for analysis. Sample size and particle size of chopped forage will influence sampling variability. Our objective was to evaluate the effect of sample size collected for processing, on variability of results of forage analyses. Samples of chopped corn forage were collected from four field replicates of seven corn hybrids, in 8.3 m^2 plots at four sites in NY. The 112 fresh samples collected were mixed and subsampled to produce samples of 50, 100, 150, 200, 400 and 600 g. Subsamples were immediately ensiled in vacuum-sealed polyethylene bags for 30 d. An additional 600 g fresh subsample was immediately dried at 60 °C, and another 600 g subsample was ensiled for 30 d and then evaluated for particle size distribution. The pH of all ensiled samples was < 3.9, indicating proper ensiling. Particle size distribution using the Penn State particle separator was similar to the distribution recommended for corn silage. Crude protein, NDF, ADF, IVTD and NDFD values were analyzed using SAS PROC MIXED. Standard deviations were calculated for each site/species/size combination to evaluate variability due to sample size collected. Ensiled samples (600 g) were not different from fresh samples (600 g) for NDF, but were significantly higher ($P < 0.05$) in ADF and CP, and significantly lower ($P < 0.01$) in IVTD and NDFD. Crude protein, NDF, ADF, and NDFD all decreased quadratically with increased sample size, while IVTD increased quadratically with increased sample size. Standard deviations for all variables decreased quadratically with increased sample size. Based on both actual values and variability, a 400 g sample produced similar results to a 600 g sample, but smaller sample sizes produced both different and more variable values for all parameters evaluated.

Key Words: neutral detergent fiber digestiblity, sampling variation, vacuum-sealed mini-silos

Table 1084.

	Standard deviations (%)				
Size, g	CP	NDF	ADF	IVTD	NDFD
50	0.61	3.09	1.76	2.35	4.88
100	0.58	2.52	1.56	2.03	4.07
150	0.56	2.23	1.43	2.06	3.84
200	0.55	2.18	1.32	1.96	3.89
400	0.52	2.27	1.36	1.72	3.87
600	0.52	2.25	1.42	1.77	3.54

1085 [Withdrawn]

1086 (M103) In situ degradation characteristics of sorghum silage treated with fibrolytic enzymes. A. Coronado[*1], K. C. McCuistion[1], J. L. Foster[2], G. Schuster[1], and Z. Lopez[3], *[1]Texas A&M University - Kingsville, Kingsville, [2]Texas A&M AgriLife Research-Beeville Station, Beeville, [3]Dow AgroSciences, Knoxville, TN.*

Sorghum (*Sorghum bicolor* L.) silage utilization in beef and dairy cattle diets has increased in recent years due to the increased water efficiency and acceptable feeding values when compared to corn silage. The objective of this study was to determine if fibrolytic enzymes would improve the rate and extent of in situ disappearance of photoperiod sensitive sorghum and hybrid silage varieties with or without the brown midrib (BMR) trait: forage sorghum (FS), BMR forage sorghum (FS-BMR), sorghum-sudangrass (SS), and BMR sorghum-sudangrass (SS-BMR). The experiment was a 4 × 2 factorial design with two replicated periods. Each sorghum silage variety ($n = 4$) was grown, harvested, chopped, and treated with water (control) or a fibrolytic enzyme (50:50 mixture of Cellulase Plus and Xylanase Plus) prior to the ensiling process. Mini-silo buckets were sealed, maintained at 23ºC for 150 d, dried, subsampled, ground to 4 mm, and weighed into duplicate Dacron bags for the in situ trial. An additional silage subsample was taken and stored at -20ºC for subsequent pH determination. Three ruminally cannulated Angus steers (308 ± 24 kg) had ad libitum access to sorghum-sudangrass hay ('Haygrazer'), mineral, and water for 14 d prior to incubation periods. Sorghum silage samples were incubated in situ for 0, 4, 8, 16, 24, 48, or 72 h to determine rate and extent of DM disappearance. Sorghum silage yields were low due to drought. SS yielded the most ($P < 0.01$; 5.3 Mg of DM/ha) compared to SS-BMR (3.8 Mg of DM/ha), FS (3.8 Mg of DM/ha), and FS-BMR (3.7 Mg of DM/ha). All silage reached a pH between 3.1 and 3.5, suggesting that proper ensiling did occur. There were no interactions between treatment and forage variety for DM ($P \geq 0.21$) in the in situ trial. The lag and undegraded residue fraction was not different between varieties ($P > 0.81$). Non-BMR silage had a greater potentially degradable fraction ($P < 0.01$); however, BMR varieties had a

greater wash loss (A; $P < 0.01$) and extent of digestion (ERD; $P < 0.01$). Enzyme treated forage also had a greater A fraction ($P = 0.03$) and ERD ($P = 0.03$), indicating that fibrolytic enzymes can improve silage ruminal degradation. Selecting a sorghum variety containing the BMR trait or using a fibrolytic enzyme can improve silage degradation characteristics.

Key Words: sorghum silage, brown midrib, fibrolytic enzymes

1087 (M104) Effect of ensiling time on fermentation profile and starch digestibility in whole plant corn silage from two different hybrid types.

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The objective of this study was to evaluate the effect of ensiling time and hybrid type on fermentation profile, soluble CP (% CP), ammonia-N (% N) and ruminal in vitro starch digestibility (ivStarchD; 7 h incubations on dried and 6 mm ground samples) in whole plant corn silage (WPCS). Samples from 8 hybrids (4 leafy [LFY] and four brown midrib [BMR]; Mycogen Seeds, Dow AgroSciences LLC, Indianapolis, IN) were collected at harvest, vacuum-sealed in plastic bags and ensiled for 0, 30, 120 and 240 d. Samples were stored at room temperature in the dark and immediately frozen to stop the fermentation until processed for analysis. Samples were analyzed for fermentation profile, CP, soluble CP, ammonia-N, starch and ivStarchD at Dairyland Laboratories Inc. (Arcadia, WI). Data were analyzed using Proc Mixed of SAS with the Fixed effects of ensiling time, hybrid type and their interaction. Regressions to determine linear relationships between ivStarchD and ammonia-N and soluble CP contents were performed using Proc Reg in SAS. Contents of DM and starch (DM basis) were unaffected ($P > 0.10$) by ensiling time or hybrid type and averaged 39.3% and 40.0%, respectively. Fermentation profile, ammonia-N, soluble CP and StarchD were similar ($P > 0.10$) between hybrid types. Measurements of pH did not differ ($P > 0.10$) even though lactate, acetate and total VFA concentrations were greater ($P < 0.01$) for WPCS fermented for 30, 120 and 240 d compared to unfermented samples. Gradual increases were observed ($P < 0.001$) from 0 to 240 d for Soluble CP (33.5, 41.2, 48.9 and 54.5% of CP for 0, 30, 120 and 240 d, respectively) and ammonia-N (2.6, 4.6, 6.0, and 7.9% of N for 0, 30, 120 and 240 d, respectively). Likewise, the ivStarchD measurements increased with ensiling time ($P < 0.001$; 50.2, 58.5, 65.8, 71.4% of starch for 0, 30, 120 and 240 d, respectively). Positive relationships between ivStarchD and ammonia-N ($R^2 = 0.67$; $P = 0.001$) and soluble-CP ($R^2 = 0.55$; $P = 0.001$) were observed. Fermentation profile, ammonia-N, soluble CP and ivStarchD were influenced by ensiling time but not hybrid type. Ammonia-N and soluble CP were both good indicators of ivStarchD in WPCS.

Key Words: corn silage, ensiling time, starch digestibility

1088 (M105) Fermentation profile, chemical composition and microbial population in silages of Stylosanthes Campo Grande with microbial inoculant and pelletized citrus pulp.

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We evaluated the chemical composition, fermentation profile and microbial population of silages of Stylosanthes cv. Campo Grande with and without microbial inoculant and different levels of pelletized citrus pulp (0, 3, 6, 9 and 12% fresh forage basis), in different fermentation periods. The plant was harvested at 120 days after sowing, in the flowering stage. Subsequently, this material was chopped in a stationary forage machine and the combinations between the treatments were applied. Treated forages were packed in bag silos that were vacuumed to remove air, heat-sealed, and stored for 1, 3, 7, 14, 28 and 56 d. The microbial inoculant utilized was Sil All C4 (Alltech, Brazil), containing *Lactobacillus plantarum*, *Pediococcus acidilactici, L. salivarius* and *Enterococcus faecium*, at a rate of 1×10^5 cfu/g fresh forage basis. Data were analyzed by analysis of variance as a $5 \times 2 \times 6$ factorial arrangement of treatments with main effects of pelletized citrus pulp (PCP), the presence or absence of inoculant (I), time of ensiling (T) and their interaction, using the procedure MIXED of SAS software, version 9.1. The DM content increased linearly ($P < 0.05$) as the PCP levels were increased. The PCP × I interaction had an effect ($P < 0.05$) on the CP content, with highest values observed in the inoculated silages. Interactions PCP × I and PCP × T affected ($P < 0.05$) the NH₃-N content of silages. The pH and the concentrations of lactic, acetic, propionic and butyric acids were affected ($P < 0.05$) by the PC × I × T interaction. Maximum population of lactic acid bacteria (9.59 cfu/g) was recorded on the first day of fermentation in the non-inoculated silage, whose population decreased linearly over the fermentation period ($P < 0.05$). The population of enterobacteria was greater on the first day after ensiling, but from the fourth day its presence was not detected in all treatments. Interactions PCP × I and PCP × T affected the CP content of the silages, whereas the NDF and ADF levels of the silages were only affected ($P < 0.05$) by the PCP levels. Addition of inoculant and pelletized citrus pulp to Stylosanthes at ensiling increases lactic fermentation and restrict the butyric fermentation, providing better quality silage. Sponsored by FAPEMIG, CNPq and INCT-CA.

Key Words: acetic acid, lactic acid, lactic acid bacteria

1089 (M106) Recombined, late harvested ensiled alfalfa leaves and stems give comparable performance to normally harvested alfalfa silage. R. D. Hatfield*[1], M. B. Hall[1], R. E. Muck[1], W. J. Radloff[1], and K. J. Shinners[2], *[1]U. S. Dairy Forage Research Center, USDA-ARS, Madison, WI, [2]Biological Systems Engineering, University of Wisconsin, Madison.*

Increased use of the perennial forage, alfalfa, on dairy farms could be accomplished by reducing the number of harvests, separately storing leaves and stems, and feeding at a ratio that maintains lactation performance. More use of alfalfa could also decrease the environmental impact of dairies. We compared the impact on lactation performance of normally harvested alfalfa silage (early bud stage) with a blend of separately harvested and ensiled alfalfa leaves and stems obtained from more mature plants (full bloom stage). Forty-four primiparous cows were randomly assigned to one of two diets using a randomized complete block design with a 2-week covariate period followed by a 3-wk experimental period. Lactation performance was measured in the last week of each period. Experimental diets were formulated to provide similar concentrations of crude protein (CP) and neutral detergent fiber (NDF) by blending two whole-plant alfalfa silages (WP), or by blending separately ensiled alfalfa leaves and stems (LS). Urea (0.27%), as diet dry matter (DM), was added to LS to give equivalent CP. Diets were 60% forage, 17.2% CP, 24% starch, 26% ensiled alfalfa, and 34% corn silage on a DM basis. Milk production, energy-corrected milk production, and efficiencies of use of DMI and N did not differ between treatments. Milk urea nitrogen differed between treatments, but by less than 1 mg/dl. This may be due to slightly lower digestibility of LS vs. WP, or to the addition of urea, which likely differed from the soluble protein present in WP. Blending leaves and stems gave similar production performance as normally harvested alfalfa silage, but with the advantage that harvesting alfalfa leaves separate from stems allows large biomass accumulation in the field and fewer harvests.

Key Words: forage, alfalfa, dairy

Table 1089.

Measure	WP	LS	SED	*P*-value
DMI, kg	23.8	23.9	0.62	0.82
Milk, kg	42.5	41.1	1.11	0.23
ECM, kg	45.2	44.3	1.37	0.52
MUN, mg/dl	10.7	11.5	.26	<0.01
ECM/DMI	1.92	1.86	0.09	0.50

1090 (M107) Changes in the structural carbohydrates of corn stover silage added with yeast culture and fermented apple pomace. N. H. Ruiz*, C. Rodríguez-Muela, D. Díaz-Plascencia, O. Ruiz-Barrera, A. Corral, A. Ramírez-Godínez, and C. Arzola-Alvarez, *Universidad Autónoma de Chihuahua, México.*

With the objective of improving the nutritional value of corn stover silage by adding yeast culture or solid-state fermented apple pomace, three treatments were evaluated during 28 d using 48 plastic bags as microsilos each 2 Kg of: (T1) corn stover alone; (T2) corn stover plus yeast culture (10% as feed basis) and (T3) corn stover plus fermented apple pomace (69% as feed basis). Treatments were added with water to obtain 35% (DM). Values for DM, pH, temperature (t), in vitro dry matter digestibility (IVDMD), NDF, ADF, cellulose and lignin were obtained at d 0, 7, 14 and 28 of ensiled time. Data were analyzed by PROC GLM of the SAS. Table 1090, shows the values at 28 d of ensiled. The addition of yeast culture or fermented apple pomace decreased ($P < 0.01$) the pH, increased ($P < 0.01$) the temperature and the DM decreased ($P < 0.01$) across the sampling time. The IVDMD was highest ($P < 0.01$) with the addition of fermented apple pomace. NDF, ADF, cellulose and lignin concentrations decreased with the ensiled time; and the lowest values were shown in T2 and T3. We conclude that the addition of yeast culture or fermented apple pomace improved the nutritional value of silage corn stover.

Key Words: yeast culture, fermentation, silage

Table 1090. Means of the structural carbohydrates of corn stover silage by adding yeast culture or solid-state fermented apple pomace at 28 d of ensiled

Variables	T1	T2	T3
pH	5.18 ± 0.07[b]	4.73 ± 0.07[c]	5.32 ± 0.07[a]
Temperature (°C)	26.00 ± 0.49[b]	26.73 ± 0.5[a]	27.17 ± 0.49[a]
Dry Matter (%)	37.85 ± 0.44[a]	30.68 ± 0.44[c]	35.56 ± 0.44[b]
In vitro Dry Matter Digestibility (%)	48.09 ± 0.34[c]	52.10 ± 0.34[b]	56.06 ± 0.34[a]
NDF (%)	82.76 ± 1.14[a]	77.10 ± 1.14[c]	80.56 ± 1.14[b]
ADF (%)	65.01 ± 0.58[a]	59.44 ± 0.58[c]	62.33 ± 0.58[b]
Cellulose (%)	57.24 ± 0.77[a]	54.30 ± 0.77[b]	55.05 ± 0.77[b]
Lignin (%)	7.0 ± 0.48[a]	3.0 ± 0.48[b]	2.3 ± 0.48[b]

[a,b,c.] Means with literal different between columns indicate statistical difference ($P < 0.05$)

1091 (M108) Effects of different additives on chemical composition, fermentation characteristics and aerobic stability of barley silage. Y. Joo[1], D. Kim[1], H. Lee[1], S. M. Amanullah[1], S. C. Kim[*1], and I. H. Choi[2], *[1]Division of Applied Life Science (BK21Plus, Insti. of Agri. & Life Sci.), Gyeongsang National University, Jinju, South Korea, [2]Dep. of Companion Animal and Animal Resources Science, Joongbu University, Geumsan-gun, South Korea.*

This study was carried out to determine the effect of various additives on chemical composition, fermentation quality, and aerobic stability of barley silage. Youngyang barley was grown at Animal Research Unit, Gyeongsang National University, Jinju, South Korea, and harvested at 31% DM. Approximately 500 kg of barley forage were chopped and divided into 4 piles and applied with one of four treatments which were *L. plantarum* (LP, $1.2x10^3$ cfu/g), *L. buchneri* (LB, $1.2x10^3$ cfu/g), fermented persimmon extract (FPE, 1% of fresh forage) and essential oil (EO, 1% of fresh forage). Barley forage was ensiled into 10 L bucket silo in quadruplicate for 0, 1, 3, 7, 48 and 100 day periods. The ANOVA followed by Tukey test was performed using SAS 9.3. The concentrations of CP and ether extract were highest (7.23, 3.83% of DM, respectively, $P < 0.05$) in FPE silage ensiled for 100 days, while crude ash, NDF, ADF and hemicellulose concentrations were highest (51.8, 30.0, 21.8% of DM, respectively, $P < 0.05$) in LB silage. The in vitro digestibility of DM was highest in EO silage (62.5%, $P < 0.05$), while *in vitro* NDF digestibility was highest ($P < 0.05$) in LB (33.7%) and FPE silages (34.5%), respectively. The pH was not affected, but ammonia-N was highest ($P < 0.05$) in EO silage (0.22%), followed by FPE (0.20%), LB (0.17%) and LP (0.13%) silage. The LP silage had highest ($P < 0.05$) lactate but lowest acetate from the early stage of fermentation (3, 7 and 48 d) to the end (100 d), and so happened in the case of lactate to acetate ratio. In contrary, LB silage showed the reverse pattern in lactate and acetate compared to LP silage. Together with acetate (5.17%), LB silage also had highest ($P < 0.05$) propionate concentration (0.42% of DM) and thus resulted in highest aerobic stability (348 h, $P < 0.05$) in this silage. The yeast count was highest (5.25% of DM, $P < 0.05$) in LP silage with concomitant lowest aerobic stability (254 h, $P < 0.05$). The lactic acid bacteria (LAB) were highest (6.45 $\log_{10}$cfu, $P < 0.05$) in EO silage. The mold was not detected in any treatments. In conclusion, LB efficiently improves the aerobic stability, while LP has lowest aerobic stability as well as in vitro digestibility of NDF. On the other hand, FPE and EO substantially improve aerobic stability, preserved protein efficiently as well as improved the in vitro digestibility of DM and NDF.

Key Words: barley silage, additives, aerobic stability, fermentation quality

1092 (M109) Effects of bacterial inoculation on the fermentation and aerobic stability of whole crop soybean silage. B. D. Nkosi[*1], R. Meeske[2], T. Langa[1], T. F. Mutavhatsindi[1], and I. M. Malebana[1], *[1]ARC-Animal Production Institute, Irene, South Africa, [2]Outeniqua Research Farm, Western Cape Dep. Agric., George, South Africa.*

This study was done to evaluate the effects of microbial inoculation on the fermentation and aerobic stability of whole-plant soybean. Soybean cultivars, Pannar [333 g dry matter (DM)/kg, 64.3 g water-soluble carbohydrate (WSC)/kg DM, 177 g crude protein (CP)/kg DM] and Link [268 g DM/kg, 70 g WSC/kg DM and 170 g CP/kg DM] were harvested at R6 growth stage and chopped to 20 mm theoretical length. The materials were treated with or without Lalsil Fresh LB, a heterofermentative lactic acid bacteria (LAB) inoculant. Treatments were produced in a 2X2 factorial design as: 1) pan control (no additive), 2) link control (no additive), 3) Pan Lalsil and 4) Link Lalsil. The treatments were ensiled in 1.5 L anaerobic jars and kept in room for 90 d. Triplicate samples per treatment were collected on d 0, and 90 for determination of chemical composition and fermentation characteristics. Samples of d 90 were subjected to aerobic stability test where 500 g of sample from each jar was loosely packed in an open plastic jar that was covered with two layers of cheesecloth and kept at 28°C. A temperature probe was placed in the geometric centre of the silage mass for each jar and also in the room where the jars were stored to record temperature. The room temperature and the temperature in each jar were simultaneously recorded at 1 h intervals for 5 d and CO_2 production was measured after the 5 d exposure. The CO_2 production and number of hrs silage remained stable were indicators for aerobic stability. The inoculated silage had lower ($P < 0.005$) contents of DM, fibre and lactic acid compared to the control. The pH, ammonia-N and acetic acid content of the inoculated silage were higher ($P < 0.05$) compared to the control. The aerobic stability of silage was improved ($P < 0.05$) with inoculation as indicated by reduced CO_2 production and increased number of hrs compared to the control. The interaction between cultivars and treatments were significant ($P < 0.05$) in all parameters measured, except for the pH and energy content. Further work is needed to test these silages on ruminant growth and nutrient digestion.

Key Words: inoculant, heterofermentation, silage

1093 [Withdrawn]

1094 (M111) Quality and fermentation profile of sugar cane silage treated with chemical and microbial additives. L. L. Cardoso, M. I. Marcondes*, K. G. Ribeiro, O. G. Pereira, T. E. Silva, and D. G. Ferreira, *Universidade Federal de Viçosa, Minas Gerais, Brazil.*

The objective of this study was to evaluate the composition and fermentation profile in sugar cane silage treated with chemical and microbial additives. The treatments consisted of sugar cane silage (SCS); Sugar cane silage with *Lactobacillus buchneri* (SCSLB); Sugar cane silage with *Lactobacillus plantarum* and *Pediococcus pentosaceus* (SCSLPPP); Sugar cane silage with *Lactobacillus plantarum* and *Propionibacterium acidipropionici* (SCSLPPA); Sugar cane silage with 0.5% lime (SCSCaO0.5); sugar cane silage with 1.0% lime (SCSCaO1.0); Sugar cane silage with 0.5% urea (SCSU0.5); sugar cane silage with 1.0% urea (SCSU1.0). Additives commonly used by Brazilian producers were studied. A completely randomized design was used, with eight treatments and four replicates, with inoculants before ensiling. The sugar cane was chopped and ensiled in 20 kg buckets containing Bunsen valves, and opened 180 days after ensiling. It was observed that the sugar cane silage treated with urea markedly increased protein levels and reduced levels of insoluble nitrogen in acid detergent in the silage. However, the concentration of ammonia nitrogen was also increased ($P < 0.05$). Lime 0.5% and urea 0.5% (5.8 and 5.6, respectively) promoted minor gas losses ($P < 0.05$) in relation to the addition of *Lactobacillus plantarum* and *Pediococcus pentosaceus* in the sugar cane silage (9.8% DM). Effluent average production was not affected by treatments ($P > 0.05$), but it can be considered high in comparison to other works using sugar cane silage. Increased dry matter recovery ($P < 0.05$) was observed in the control silage (87.2%) and SCSCaO0.5 (87.2%) compared to SCSLPPP (81.9%), possibly due to increased gas production seen in this treatment. SCSCaO0.5 (9.21% DM) also promoted the highest yield of lactic acid ($P < 0.05$). The addition of 1% lime increased production of propionic and butyric acids ($P < 0.05$). It was found that the inoculation with *Lactobacillus plantarum* and *Propionibacterium acidipropionici* increased ethanol ($P < 0.05$) content (3.55% DM), and the lowest ethanol concentration was observed in SCSCaO0.5 (0.69% DM). Yeast population ($P < 0.05$) was lower in SCSU1.0 (1.4 log cfu/g) compared to SCSLPPP (4.6 log cfu/g), but both did not differ from control (3.9 cfu/g). Therefore, none of the treatments was effective in controlling yeast. It is concluded that the silages studied presented appropriate profile for fermentation, low yeast population concentration, low ethanol concentration and high recovery of dry matter.

Key Words: effluent, ethanol, yeast