W254 Effects of aerobic exposure of corn silage on fermentation end-products and intake. A. A. Rodríguez*, D. Luciano, E. Pacheco, and L. C. Solórzano, *University of Puerto Rico, Mayaguez Campus, Mayaguez, Puerto Rico.*

Aerobically exposed silage has been associated with a decrease in its nutritional value and animal intake. The objective of this experiment was to determine the effect of length of aerobic exposure (LAE) on pH, fermentation end products, and intake by meat-type goats. Corn was ensiled in 5 kg sealed plastic silos. After a 60-d fermentation period, corn silage was aerobically exposed for 72, 48, 24, or 0 h in a 4-compartment wooden feeder before measurements. At the 0 h time point, DMI was determined during one day using 4 goats that previously had not consumed silage. Silage consumption was monitored at 2, 5, 8, and 24 h (ITP) after the goats had access to the silages. The experiment was replicated 4 times. Fermentation end products and pH were analyzed as a completely randomized design with 4 replicates. Intake was analyzed as a completely randomized design with 4 (LAE silages) × 4 (intake time points) factorial arrangement of treatments. Tukey test was used for mean separation. Total acidity (4.54 vs. 4.24), lactic acid content (2.92 vs. 4.08%), and the ratio of lactic acid:acetic acid (5.19 vs. 7.06) tended to be lower ($P < 0.15$) in corn silages exposed to air for 72 h than in fresh silage, but were similar to those in silages exposed for 48 and 24 h. Acetic acid content (0.79 vs. 0.41%) was higher ($P < 0.05$) in fresh corn silage vs. that exposed for 72 h, but was similar to silages exposed for 24 or 48 h. Regardless of LAE, propionic and butyric acid contents were similar ($P > 0.05$). Corn silage exposed during 48 h had higher ($P < 0.05$) NH3-N/Total-N % than those exposed for 24 or 72 h (8.72 vs. 6.24% or 6.77%, respectively), but similar to that exposed for 0 h (5.41%). Silage intake as a proportion of total silage offered was similar ($P > 0.05$) among treatments for LAE, ITP, and their interaction, and averaged 68.3%. In summary, LAE affected the fermentation end products of corn silage, but did not influence silage intake by goats.

Key Words: aerobic exposure, corn silage fermentation, intake

W256 Biological and chemical additives on the fermentation and aerobic stability of corn silage. N. Da Silva, I. De Oliveira, M. Bastos, A. Do Rego, C. Avila, and T. Bernardes*, *University of Lavras, Lavras, Minas Gerais, Brazil.*

In warm climates, the aerobic stability of silage is a very important factor in determining its quality. Thus, the objective of this study was to evaluate 2 Lactobacillus buchneri strains (a commercial product and an indigenous specie) and sodium benzoate in improving aerobic stability of corn silage. A corn hybrid was grown at University of Lavras (21°14′S; 45°00′W) and harvested at 50% milk line stage (36.8% DM). Chopped forage was treated with (1) deionized water (CON); (2) a commercial *L. buchneri* (CLB; strain CNCM-4323); (3) an indigenous *L. buchneri* (ILB), which was isolated from tropical forages; or (4) sodium benzoate at 0.2% (SB). Both inocula were applied at a rate of 1×10^6 cfu of bacteria/g of forage. Five replicates of each treatment were ensiled in 15-L plastic jars for 103 d. At silo opening, silage was removed and subsamples were taken. Aerobic stability was defined as the number of hours the silage remained stable before rising more than 2°C above room temperature. Aerobic deterioration was defined as the sum of the daily temperature increases above the reference temperature in the first 5 d of aerobiosis. Data were analyzed by using the GLM procedure of SAS according to a completely randomized design. Silages inoculated with ILB had greater pH value (4.05) than other treatments ($P < 0.05$). Acetate was higher in ILB silages (0.85% DM, $P < 0.05$) compared with CON silages (0.36% DM), and CLB and SB silages showed intermediate concentrations (0.67 and 0.48%, respectively). SB silages showed higher lactic acid concentration (5.86% DM, $P < 0.05$) than ILB silages (2.17% DM), and CON and CLB silages had intermediate values. The number of yeasts and molds was similar among treatments. However, SB tended to affect yeasts number ($P = 0.069$). SB silages differed in aerobic stability and aerobic deterioration than other silages. SB was the most effective additive, producing well-fermented silage and a long aerobic stability (161 h).

Key Words: aerobic deterioration

W257 Effect of applying potassium sorbate or sodium benzoate at two rates on the fermentation and aerobic stability of corn silage. I. De Oliveira[1], N. Da Silva[1], J. Dos Santos[1], O. Pereira[2], A. Evangelista[1], and T. Bernardes*[1], *[1]University of Lavras, Lavras, Minas Gerais, Brazil, [2]University of Viçosa, Viçosa, Minas Gerais, Brazil.*

Tropical climate provides conditions for the growth of aerobic spoilage microorganisms, which reduce silage quality. For silage producers in warm environments, adherence to management practices is critical to prevent or minimize aerobic deterioration, particularly in corn silages. Thus, the objective of this study was to evaluate the efficacy of 2 chemical additives (sodium benzoate or potassium sorbate), applied at 2 rates (0.1 or 0.2%), in improving aerobic stability of corn silage. A corn hybrid was grown at University of Lavras (21° 14′ S and 45° 00′ W) and harvested at 50% milk line stage (36.8% DM). Chopped forage was treated with potassium sorbate (PS) or sodium benzoate (SB). Both additives were applied at a rate of 0, 0.1 (D1) or 0.2% (D2) of fresh forage. Four replicates of each treatment were ensiled in 15-L plastic jars for 88 d. At silo opening, silage was removed and subsamples were taken. Aerobic stability was defined as the number of hours the silage remained stable before rising more than 2°C above room temperature. Aerobic deterioration was defined as the sum of the daily temperature increases (°C) above the reference temperature in the first 5 d of aerobiosis. Treatments were arranged in a 2 (type of additive) × 3 (dose of additive) factorial design. The GLM procedure of SAS was used to analyze the data. No interactions were observed between types of additive and their doses. Regarding additives, both produced silages with high standard of fermentation, combined with an intermediate aerobic stability (on average 146 h). With relation to doses, when the additives were applied at 0.2% silages were more stable (256 h, $P < 0.05$) than D1 and untreated silages (119 and 61 h, respectively). Aerobic deterioration was more pronounced in untreated silages (16.6°C, $P < 0.05$) compared with D1 and D2 silages (2.7 and 1°C, respectively). PS or SB applied at 0.2% was more effective in improving aerobic stability.

Key Words: silage additive

W258 Feeding corn silage improves nursing performance of Awassi ewes when used as a source of forage. B. S. Obeidat*[1,2], M. S. Awawdeh[1], R. T. Kridli[1], H. J. Al-Tamimi[1], M. A. Ballou[2], M. A. Abu Ishmais[1], F. A. Al-Lataifeh[1], and H. S. Subih[2], *[1]Jordan University of Science and Technology, Irbid, Jordan, [2]Texas Tech University, Lubbock.*

Objective was to evaluate the effect of using corn silage (SILAGE) or wheat hay (HAY) as a source of forage on nursing performance of Awassi ewes. Forty ewes (BW = 43.5 ± 1.58 kg) and their single lambs (BW = 6.3 ± 0.28 kg) were randomly assigned to 2 diets; SILAGE vs. HAY (4 pens/diet; 5 ewes/pen). Concentrate feeding was restricted to 1.1 kg DM/ewe/d, whereas forage was offered ad libitum. The study lasted for 8 weeks. Ewes and lambs were weighed at the beginning and at the end of the study. Milk yield and blood samples were collected on wk 2, 3, 4, 5, 6, 7, and 8. Intakes of forage and total DM were greater ($P < 0.05$) in ewes fed SILAGE compared with those fed HAY. Intakes of crude protein, ether extract and energy were greater ($P < 0.05$) in SILAGE compared with HAY group. However, neutral and acid detergent fiber intake was greater ($P < 0.05$) in the HAY than in the SILAGE group. At the end of the study, SILAGE-fed ewes gained more BW and their lambs had greater ($P < 0.05$) average daily gain compared with HAY-fed ewes. Glucose concentration was greater ($P < 0.05$) in the SILAGE compared with the HAY group, while serum urea N did not differ between diets. Daily milk and milk protein yield was greater ($P < 0.05$) in the SILAGE group than in the HAY group during wks 6, 7, and 8. Total solid yield was greater ($P < 0.05$) for the SILAGE than for the hay during wks 6 and 8; whereas fat yield was greater for the SILAGE than for the HAY diet on wk 8. Total energy output was greater ($P < 0.05$) for the SILAGE compared with the HAY diet. In conclusion, replacing wheat hay by corn silage in the diet of early lactating Awassi ewes improved intake, yields of milk and milk components, ewe body weight, and lamb average daily gain.

Key Words: Awassi ewe, corn silage, wheat hay

W259 The effects of an exogenous protease on the fermentation and nutritive value of poorly processed or well-processed corn silage. M. Windle*[1], C. Merrill[1], M. Agarussi[1], L. Rosa[1], K. Freedman[1], C. Asay[1], N. Walker[2], and L. Kung Jr.[1], *[1]University of Delaware, Newark, [2]AB Vista, Marlborough, United Kingdom.*

The objective of this experiment was to evaluate the effects of an experimental protease on silage fermentation and 7 h in vitro starch digestibility (ST-D) of whole plant corn with different degrees of kernel processing. Chopped whole plant corn (37% DM) was either poorly processed (PP, processing score of 53.9%) or well-processed (WP, processing score of 91.3%) and untreated (CTR) or treated with 2000 ppm of an experimental protease (ENZ, AB Vista, Wiltshire, UK). Forages were ensiled in vacuumed and heat-sealed bag silos at 21–23°C for 45 d. Data were analyzed as a 2 × 2 × 2 factorial arrangement of treatments with main effects of processing (PP and WP), enzyme treatment (CTR and ENZ), time of ensiling (0 and 45 d), and their interactions. Treatment with ENZ and degree of processing did not affect the concentrations of lactic and acetic acids ($P > 0.05$) in silage. However, treatment with ENZ resulted in higher concentrations ($P < 0.01$) of ammonia-N, soluble protein (% of CP), and ethanol in both WP and PP. The concentration of starch was less in WP-ENZ after ensiling compared with d 0 (45 vs. 36%, $P < 0.01$) but only numerically lower for other treatments (ave. 44 vs. 41%). Higher ethanol and lower starch may have been an indication that treatment with enzyme increased available substrate for fermentation. Prior to ensiling, the ST-D of freshly treated forage was between 60 and 65% for PP-CTR, WP-CTR, and PP-ENZ ($P > 0.05$) but was 74% for WP-ENZ ($P < 0.05$) suggesting some immediate effect of the enzyme. After 45 d of ensiling, ST-D was 75, 77, 84, and 89% for PP-CTR, WP-CTR, PP-ENZ and WP-ENZ, respectively. Treatment with ENZ increased ST-D in silages regardless of degree of processing ($P < 0.01$). Although the concentrations of ammonia-N, soluble protein, and ST-D were numerically greater in WP-ENZ vs. PP-ENZ, these differences were not statistically different.

Key Words: protease, starch digestibility, corn silage

W260 The effect of an exogenous protease on the fermentation and nutritive value of corn silage. M. Windle*[1], C. Merrill[1], L. Rosa[1], M. Agarussi[1], R. Savage[1], C. Asay[1], N. Walker[2], and L. Kung Jr.[1], *[1]University of Delaware, Newark, [2]AB Vista, Marlborough, United Kingdom.*

Previous work from our lab showed that adding high levels (2000 ppm) of exogenous proteases improved 7-h in vitro ruminal starch digestibility (ST-D) in ensiled corn silage. The objective of the current experiment was to test a range of levels of an experimental protease to more precisely determine an optimal level of treatment. Whole plant corn (37.5% DM) was chopped and processed without protease (CTR), or treated with 20 ppm (E1 ×), 200 ppm (E10 ×), 1000 ppm (E50 ×), or 2000 ppm (E100 ×) of protease (AB Vista, Wiltshire, UK). Forages were ensiled in vacuumed and heat-sealed bag silos, and stored at 21–23°C for 45 d. Data were analyzed as a 5 × 2 factorial arrangement of treatments with main effects of protease (levels) and time (0 and 45 d), and their interaction. After 45 d of ensiling, treatment with protease did not affect the concentrations of lactic or acetic acids ($P > 0.05$). Concentrations of ethanol were higher in E50 × and highest in E100 × silages as compared with CTR ($P < 0.05$). Silages that were treated with E1 × , E50 × and E100 × had more yeasts ($P < 0.02$) as compared with CTR. Silages that were treated with E50 × and E100 × had higher concentrations of ($P < 0.01$) ammonia-N as compared with CTR and E1 × . Concentrations of soluble protein (% of CP) on d 0 ranged from 28 to 37%, but after ensiling, were highest for E100 × (72%), followed by E50 × (68%), and E10 × (59%), and were lowest in E1 × (46%) and CTR (44%) ($P < 0.01$). The ST-D on d 0 ranged from 60 to 67% but after ensiling it was higher ($P < 0.01$) in E100 × (84%), E50 × (83%), and E10 × (81%) compared with E1 × (75%) and CTR (74%). These data indicate that a 200 ppm dose of protease was able to statistically improve ST-D after 45 d of ensiling. Protease treatment may be beneficial in accelerating the increase in ST-D that is normally observed in corn silage during time in storage.

Key Words: protease, starch digestibility, corn silage

W261 Impact of grain deposition on maize plant composition and feeding value. P. Walker*[1], M. J. Faulkner[1], T. D. Kaufman[1], L. Brown[2], and F. N. Owens[2], *[1]Illinois State University, Normal, [2]DuPont Pioneer, Bloomington, IL.*

Grain content of maize silage can be limited by management, environmental, and genetic factors. Impacts of lower grain content on nutrient yield and plant composition were studied in 2 trials. In trial 1, 2 tropical maize hybrids that failed to produce grain were compared with 6 temperate grain-bearing silage hybrids. Sets of whole plants were harvested at 7 d intervals starting 102 d after planting. Dry matter content of tropical hybrids plateaued at 25% DM. Across harvest dates, tropicals averaged 37% less dry matter per plant, in vitro digestibility of NDF was lower (34 vs. 45%; $P < 0.01$), but soluble sugar content was greater (17 vs. 9%; $P < 0.01$). Calculated production (milk or beef) per ton and per acre were 50 and 74% lower for tropical hybrids. In trial 2, pollination was prevented in subsets of 3 different temperate commercial grain-bearing silage hybrids by covering emerging ear silks with paper bags. Replicate sets of 5 plants per hybrid harvested on 16 different harvest dates were assayed for nutrient content. On the first harvest date (28%

DM for pollinated plants), dry plant weights and compositions were similar for pollinated and non-pollinated plants, but dry weight was 45% lower for plants without grain when the DM of pollinated plants reached 40%. Non-pollinated plants remained below 30% DM though their sugar content exceeded 20% of DM. Averaged across harvest dates, DM, starch, NDF, ADF and ash as a fraction of DM and in vitro NDF digestibility all were lower ($P < 0.01$) for non-pollinated plants. NDF and ADF yields declined with harvest date. Preventing pollination reduced beef and milk per ton and per acre by 50 and 65%. Factors that inhibit grain production, through reducing the sink for sugar, will increase the sugar content of plants but retard increases in plant DM content. Reducing the grain content of maize plants or premature harvest will reduce potential beef and milk production through reducing yields of digestible nutrients.

Key Words: grain, maize silage, tropical

W262 Impact of orientation of planted maize seeds on composition and feeding value of maize plants. T. D. Kaufman*[1], P. Walker[1], L. Brown[2], L. Nuzback[2], and F. N. Owens[2], *[1]Illinois State University, Normal, [2]DuPont Pioneer, Bloomington, IL.*

When planted with the tip downward, maize seeds emerge earlier and the first leaf emerges on the germ side of planted seeds. Through altering shading among plants, spatial seed orientation may alter yield and composition of maize plants. In 2011 using a 2 × 2 × 3 factorial design, 16 rows of 2 Pioneer silage hybrids at 2 populations (69,000 and 84,000 plants per hectare) were planted at 3 seed orientations [randomly (R) with a mechanical maize planter or manually with kernel points downward with the germ of each kernel either facing other seeds within the same row (W) or facing adjacent rows of maize (A) in an alternating fashion]. Harvested at 33% plant DM, plant DM and starch yields did not differ between W and A, but yields from oriented kernels (average of W and A) were 16 and 27% greater ($P < 0.05$) than for R. When harvested at 42% DM, plant and starch weights were 29 and 20% greater ($P < 0.05$) for W than R leading to 15% greater ($P < 0.05$) predicted milk and beef per acre. In 2012 using a 3 × 2 x 3 factorial design with 3 Pioneer hybrids, 2 plant populations, and 3 seed orientations, plants were harvested on a single date (41% plant DM). Angles of leaves relative to the germ were measured for 160 plants at each seed orientation. The first leaf emerged parallel to the germ azimuth (0.7 ± 32.8 degrees). Plant dry weights were greater for A than W. Compared with R, yields from A were 25% greater ($P < 0.05$) while ADF and NDF contents were 5 and 3% lower ($P < 0.05$). Silage and starch yields were 25 and 29% greater for A than R leading to estimates of 2% more beef and milk per tonne and 29% more ($P < 0.05$) beef and milk per hectare. At harvest, the number of dead leaves and husks was greatest ($P < 0.05$) for R plants. Through altering plant competition and capture of sunlight by leaves, spatial orientation of planted maize seeds altered projected beef and milk yield through increasing plant mass without markedly altering nutrient composition.

Key Words: maize silage, seed, orientation

W263 Effect of different silage additives on the fermentation and aerobic stability of corn silage. K. G. Arriola[1], O. C. M. Queiroz[1], J. J. Romero[1], M. A. Zarate[1], L. G. Paranhos[1], E. Muñiz[2], Z. X. Ma*[1], and A. T. Adesogan[1], *[1]Department of Animal Sciences, University of Florida, Gainesville, [2]Embrapa Tabuleiros Costeiros, Aracaju, SE, Brazil.*

The aim of this study was to compare the efficacy of different experimental silage additives on the fermentation and aerobic stability of corn silage. Corn forage was harvested at 35% DM, chopped and ensiled in mini silos after application of (1) water (T1), or with inoculants containing (2) 1.5×10^5 cfu/g of *Lactobacillus buchneri* (T2), (3) 1.5×10^5 cfu/g of *Lactobacillus plantarum* (20%), *Enterococcus faecium* (30%), and *Lactobacillus buchneri* (50%) (T3), (4) 1.5×10^5 cfu/g of *L. plantarum* (30%), *E. faecium* (40%), *Lactococcus lactis* (30%), and sodium benzoate at 0.4 g/kg forage (T4), (5) 1.5×10^5 cfu/g of *L. plantarum* (30%), *E. faecium* (40%), and *L. lactis* (30%) (T5), (6) 1.5×10^5 cfu/g of *L. plantarum* (40%), *E. faecium* (30%), and *L. lactis* (30%) (T6), and 7) 1×10^5 cfu/g of *L. plantarum* (T7). Five replicates of each treatment were weighed (11 kg) into 20-L mini silos, sealed and stored for 100 d at ambient temperature. Five additional replicates of each treatment were weighed (3 kg) into polyethylene bags and stored for 2 d. After silos were opened, aerobic stability, chemical composition, and yeast and mold counts were determined. By d 2 of ensiling, the pH of T5, T6 and T7 silages were lower than those of the Control silage (4.05 vs. 4.11, $P < 0.05$). After 100 d of ensiling, chemical component concentrations were unaffected by treatment except that ash concentrations were greater in T2, T3, and T5 silages than in Control silages. The T2, T3, and T5 silages had greater pH than other silages (3.89 vs. 3.83, $P < 0.001$). Treatments T4, T5, and T6 had greater aerobic stability than T1 and T3 (36.8 vs. 13.5 h). Silages T2, T3 and T4 had lower total VFA than T1, T6 and T7 (8.8 vs. 11.6% of DM, $P < 0.05$) and had the lowest isobutyric acid (1.73 vs. 2.43% of DM) concentrations. Treatments T3 and T7 had greater DM loss compared with other treatments (9.1 vs. 6.1%, $P = 0.04$). Treatment T5 was the most promising because it reduced silage pH within 2 d of ensiling, did not increase DM losses or decrease total VFA concentration and it increased aerobic stability.

Key Words: corn silage, bacterial inoculant, aerobic stability

W264 Comparison of nutritional and digestive differences of corn cultivars grown in cooler climates and harvested as fresh forage in western Canada. S. Abeysekara, K. Theodoridou*, D. A. Christensen, and P. Yu, *Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.*

This study investigated the nutritional value of corn varieties grown in cooler climates. Corn grown in Canadian prairies is known as cool season corn, and is different by agronomical factors from warm season corn varieties. Samples from 6 corn cultivars (Pioneer and Hyland) with 4 fields which reached target crop heat units (>2000) were compared for major nutrients and digestive characteristics by means of wet chemistry, rumen in situ degradability, CNCPS, NRC and PDI feed evaluation methods. Based on the chemical composition, fresh forage from corn cultivars were nutritionally dissimilar and Hyland cultivars had some nutrients (NDF, 50.0% DM; CP, 7.4% DM) higher than Pioneer but not starch (21.1% DM). Diverse CNCPS fractions were found among both groups. Hyland had higher levels of CA4 (16.2% CHO), CB2 (47.0% CHO) and CC. Pioneer 7443R and Hyland SR06 had similar protein fractions which were higher than other cultivars. NRC energy calculations favor Pioneer (TDN, 67.8% DM; DE, 2.9%) over Hyland. In situ rumen degradability of DM was not affected by cultivar, however, Hyland had higher soluble (S, 22.8%) fractions than others. High effectively degraded organic matter (385.3 g/kg DM) was found in Pioneer 7535R. NDF degradability was not affected; however, Hyland SR22 and Pioneers had high effective degradability of crude protein (>200 g/kg DM). Hyland SR06 had higher absorbable microbial synthesis in the rumen and higher truly absorbable rumen undegraded protein in the intestines. Based on detailed results of nutrient content, degradability, and digestive

characteristics, these fresh corn forages are equally nutritious to use as ruminant feed.

Key Words: corn forage, chemical profile and degradability, metabolic characteristic

W265 Effects of varying silage inoculant technology on fermentation characteristics of corn silage during short and long term storage in mini-silos. . Z. Sawall*[1], L. Roth[2], and N. B. Litherland[1], *[1]University of Minnesota, St. Paul, [2]Provimi, Elk River, MN.*

Eighty PVC mini silos were used to evaluate corn silage fermentation characteristics after short and long-term fermentation with 4 homo- or heterofermentative inoculants. Corn silage (DM 40.4%, Starch 36.8%, NDF 38.7%) was harvested using a John Deere pull type chopper equipped with a kernel processor and inoculants, Control (CON), Promote HN-3 (PHN), Promote LC-1000 (PLC) and Vigorsile EBL II (VEBL) were administered before packing and stored at room temperature. Silos were opened at d 30, 60, 90 and 120. Temperature was taken immediately and samples were frozen until further analysis using NIR and wet chemistry. Data were analyzed using PROC MIXED with 5 reps per treatment and lsmeans with pdiff for mean separation. We hypothesized that inoculant would lower % dry matter loss, decrease pH and increase lactic acid %. Final temperature and dry matter % recovery were similar among treatments and decreased with time. PLC tended to increase ($P = 0.09$) aerobic stability (AS) at 72 h. Addition of PLC and VEBL decreased pH over time. Lactic acid % was greater for PLC and there was no difference in acetic acid % among treatments. Neutral detergent fiber digestibility (NDFd) was similar among treatments. PLC had greater 7-h starch digestibility (IVSD) and increased with time. Mold count was similar among treatments and the addition of inoculants reduced yeast counts. In summary, PLC and VEBL reduced the pH and PLC had greater lactic acid % and starch digestibility.

Table 1. Effects of inoculants on corn silage fermentation

	Treatment					*P*-value		
Variable	CON	PHN	PLC	VEBL	SEM	Trt	Day	Trt × Day
Temp, °C	20.76	20.82	20.77	20.76	0.07	0.90	<0.01	<0.01
Aerobic stability, °C	20.74	20.51	20.32	20.50	0.22	0.63	<0.01	0.04
pH	3.73[a]	3.70[ab]	3.64[c]	3.69[bc]	0.01	<0.01	<0.01	0.20
Lactic, %	5.04[a]	5.24[a]	5.92[b]	5.20[a]	0.13	<0.01	<0.01	0.37
Acetic, %	0.84	0.80	0.78	0.85	0.04	0.54	0.16	0.02
NDFd, %	48.71	48.70	48.95	48.48	0.40	0.87	0.71	0.21
IVSD, %	86.98[a]	87.37[a]	88.04[b]	87.10[a]	0.17	<0.01	<0.01	0.03

Key Words: corn silage, silage inoculant, fermentation

W266 Effect of bacterial inoculants on the fermentation, aerobic stability and spoilage losses of corn silage produced in farm-scale silos. O. C. M. Queiroz[1], F. C. Basso[2], R. Daetz[1], A. Schlaefli[1], and A. T. Adesogan*[1], *[1]Department of Animal Sciences, University of Florida, Gainesville, [2]Department of Animal Sciences - UNESP, Jaboticabal, Sao Paulo, Brazil.*

This project aimed to determine the effects of applying 2 bacterial inoculants on the quality, aerobic stability and spoilage losses of corn silage produced in farm-scale silos. Corn forage was harvested at approximately 35% DM, chopped and treated with nothing (Control), M inoculant (M) containing *Lactococcus lactis* SR 3.54, *L. plantarum* CHCC6072, and *Enterococcus faecium* M74, or with A inoculant (AC) containing *Lactobacillus buchneri* Lb1819, *L. plantarum* CHCC6072 and *E. faecium* M74 (Chr. Hansen, Denmark). Both inoculants were applied at 150,000 cfu/g fresh forage. Forty-five tons of corn forage were packed into each of four 3.7 m-wide replicate bags per treatment and ensiled for 186 d. Silage was removed from the bags at the rate of 1000 kg/d for 42 d and separated into good or spoiled (visibly moldy, darkened or hot silage) silage, weighed and analyzed for DM. Weekly composites were analyzed for chemical composition, aerobic stability and fungal counts. The experiment had a completely randomized design and the statistical model included effects of treatment, time (repeated), and the interaction. Inoculation did not affect DM recovery (97.9%; SEM = 0.42), in vitro true digestibility (82.6%; SEM = 0.38), NDF digestibility (60.6; SEM = 0.77), or chemical composition of good silage. However, M treatment increased the percentage of good (98.6 vs. 97.2%; SEM = 0.35) and decreased that of spoiled silage by 50% (1.39 vs. 2.81%; SEM = 0.35). Inoculation did not affect pH (3.8; SEM = 0.02), ammonia-N (0.09%; SEM = 0.01) or organic acid concentrations of good silage, except that M silages tended to have greater butyrate concentration (0.03 vs. 0.01%; SEM = 0.01) than others. Inoculated silages had similar yeast population (2.83 cfu/g, SEM = 0.47). However, A silages had greater aerobic stability than the Control silage (106 vs. 77; SEM = 7.09). In conclusion, applying the inoculants did not affect the chemical composition of good silage but M reduced the percentage of spoiled silage and A increased the aerobic stability.

Key Words: inoculant, silage, aerobic stability

W267 A mixture of homo- and hetero-fermentative lactic acid producing-bacterial strains enhanced the fermentation characteristics of sugar cane silage. A. A. Rodríguez*, P. Ramos, and L. C. Solórzano, *University of Puerto Rico, Mayaguez, Puerto Rico.*

Fermentation characteristics and aerobic stability were determined on sugar cane (SC) ensiled with the microbial inoculant SiloSolve AS (Chr. Hansen Inc., Milwaukee, WI). Chopped SC (31.3% DM) was ensiled in 1.8 kg micro-silos and assigned to 1 of 3 treatments (TRT); no additive (C), or SiloSolve AS applied at the recommended rate of 10^5 or at 10^6cfu/g fresh forage (AS1 and AS2). After 3 and 60 d of ensiling (DE) 5 silos from each TRT were emptied and silage analyzed to determine pH and fermentation products. Statistical analysis was performed according to a completely randomized design with a 2 (DE) by 3 (TRT) factorial arrangement. Aerobic stability was determined after 60 d of ensiling. Temperature was monitored every 6 h from 0 to 96h after opening in 5 samples (800 g) from each treatment. Statistical analysis was performed as a split plot design with a 3 (TRT) by 16 time points (hours of aerobic exposure) factorial arrangement, using the silo as repetitive measurement. For both rates of inoculation SC silage treated with SiloSolve AS had lower ($P < 0.05$) pH (C= 3.96, AS1 = 3.65, and AS 2 = 3.64), acetic and butyric acids % (1.50, 0.70, and 0.75 and 0.13, 0.07, and 0.05% for C, AS1 and AS2, respectively), and NH_3-N/Total-N (C = 2.51, AS1 = 1.48, and AS2 = 1.51) and higher ($P < 0.05$) lactic acid and lactic acid:acetic acid ratio (2.28, 1.68; 3.84, 8.24; and 4.24, 12.52 for C, AS1, and AS2, respectively) than untreated silage. No differences ($P > 0.05$) were detected in the temperature of SC among treatments during aerobic exposure. In summary, SC inoculated with SiloSolve AS applied at 10^5 or 10^6 cfu/g of fresh forage enhanced the fermentation characteristics, but not aerobic stability.

Key Words: sugar cane, inoculant, fermentation

W268 Effect of alfalfa as hay or silage and roughage:concentrate ratio on in vitro fermentation. Y. J. Tian[1,2], Z. J. Cao[1,2], and S. L. Li*[1,2], *[1]College of Animal Science and Technology, China Agricultural University, Beijing, China, [2]State Key Laboratory of Animal Nutrition, Beijing, China.*

Alfalfa in early bloom stage was harvested from the same area and managed either as dry hay or as silage. The objective was to study the effects of that alfalfa as either hay (AH) or silage (AS) at various roughage:concentrate (R:C) ratios on in vitro fermentation characteristics. Comparisons of fermentation patterns of total gas, ammonia-N (NH3-N) and microbial protein (MCP) production were conducted using an in vitro batch culture. Three healthy Chinese Holstein heifers similar in age and weight, each with a permanent rumen fistula were used as rumen fluid donors. AH or AS was mixed with concentrate at 6 R:C ratios: i.e., 0:100, 25:75, 45:55, 55:45, 75:25, and 100:0, respectively. Ten ml rumen fluid, 20 mL buffer fluid, and 200 mg feedstuff were mixed for 24-h incubation at 39°C for each tube, with 6 replicates per treatment. Data were analyzed by ANOVA and GLM analysis procedures (SAS 9.1). Content of MCP, concentrations of NH_3-N, and total gas at 24 h were significantly affected by form (AH vs. AS) of alfalfa forage ($P < 0.05$) and by the R:C ratio ($P < 0.05$), respectively. Alfalfa as silage (AS) resulted in greater MCP, NH_3-N, and total gas than AH treatments. Interactions of forage type and R:C ratio were significant ($P < 0.05$) for MCP and NH_3-N.

Table 1. The effect of forage type, R:C ratio, and interactions on fermentation

Item	Ratio (R:C)	MCP (total purine, mmol)	Ammonia-N (mg/100 mL)	24-h gas (ML/g DM)
Alfalfa hay	0:100	5.38	23.94	134.38
	25:75	5.30	25.54	110.62
	45:55	5.43	26.04	107.49
	55:45	3.56	25.28	94.15
	75:25	4.00	25.99	87.12
	100:0	3.80	26.51	88.27
Alfalfa silage	0:100	5.38	23.94	134.38
	25:75	6.86	27.09	121.38
	45:55	5.01	25.15	112.63
	55:45	4.70	29.06	112.47
	75:25	3.34	27.72	104.01
	100:0	4.97	27.23	84.13
SEM		0.63	1.50	11.15
Forage	AH	4.53^{b}	25.49 ^{b}	103.67^{b}
	AS	5.02^{a}	26.52^{a}	113.45^{a}
Ratio	0:100	5.38^{ab}	23.94^{b}	134.38^{a}
	25:75	6.08^{a}	26.16^{a}	116.00^{b}
	45:55	5.22^{b}	25.59^{a}	110.06^{bc}
	55:45	4.13^{c}	26.79^{a}	103.3^{cd}
	75:25	3.67^{c}	26.85^{a}	95.57^{de}
	100:0	4.39^{c}	26.94^{a}	86.72^{e}
P-value	Forage	0.0437	0.0036	0.011
	Ratio	<0.0001	<0.0001	<0.0001
	Forage × Ratio	0.0220	0.0163	0.2058

$^{a–e}$Values with different small letter superscripts mean significant difference (PP.

Key Words: alfalfa hay:silage, roughage:concentrate ratio, rumen fermentation

W269 Interaction effects of a *Salix babylonica* extract with exogenous enzymes on in vitro gas production of a total mixed ration. A. Z. M. Salem*[1], H. Gado[2], H. Ammar[3], M. A. Rodriguez[1], L. M. Camacho[4], M. M. Y. Elghandour[1], and N. Odongo[5], *[1]Facultad de Medicina Veterinaria, Universidad Autonoma del Estado de Mexico, Mexico, [2]Animal Production Department, Faculty of Agriculture, Ain Shams University, Qalubia, Egypt, [3]Ecole superieure dagriculture de Mograne, Mograne-Zaghouan- Tunisia, [4]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Guerrero, Cd. Altamirano, Guerrero, Mexico, [5]Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria.*

An in vitro gas production (GP) technique was used to investigate the combination effects of *Salix babylonica* extract (SB) with the exogenous fibrolytic enzymes cellulase (C) and xylanase (X), or their mixture (1:1, vol/vol) on in vitro fermentation characteristics of a corn and sorghum grains- based total mixed ration (208 CP and 364 NDF g/kg DM). Four levels of extracts (i.e., 0, 0.6, 1.2, and 1.8 mL/g DM) and 4 fibrolytic enzymes (1 µL/g DM; Control, X, C and XC (1:1, vol/vol)) were used in 4 × 4 factorial arrangement. The GP was recorded at 2, 4, 6, 8, 10, 12, 24, 36, 48, and 72 h of incubation. After 72 h, the incubation was stopped and supernatant pH was determined and then filtered to determine digestible dry matter (DDM). Fermentation parameters, such as the 24-h gas yield (GY_{24}), metabolizable energy (ME), and short chain fatty acid concentrations (SCFA) were estimated. There were significant ($P < 0.001$) interactions (extract × enzymes) associated with addition of SB extract at 1.2 mL/g DM with either enzyme compared with other SB levels in combination with individual enzymes. Those interaction effects included: decreased pH (6.63 vs. 6.67, SEM = 0.008); increased GP during all incubation times, with asymptotic GP (187 vs. 157 mL/g DM, SEM = 4.64); and increased GY_{24} (182 vs. 152 mL gas/g DDM, SEM = 5.28). The SB extract, C, and X effectively improved the in vitro fermentation, and the combination of enzyme with SB extract at the level of 1.2 mL/g DM was more effective than the other treatments.

Key Words: exogenous enzyme, in vitro rumen fermentation, *Salix babylonica* extract

W270 Aerobic stability, pH and yeast population of sugarcane ensiled with different particle sizes. A. F. Campos*[1], G. R. Siqueira[1,2], N. M. Jeronimo[2,3], F. D. Resende[1,2], and R. A. Reis[1], *[1]Sao Paulo State University, Jaboticabal, Sao Paulo, Brazil, [2]Agencia Paulista de Tecnologia dos Agronegocios, Colina, Sao Paulo, Brazil, [3]Centro Universitario de Barretos, Barretos, Sao Paulo, Brazil.*

The trial aimed to evaluate the aerobic stability, pH values, and yeast population of sugarcane silage with different particle sizes (0.61; 1.07; 1.37 and 1.63 cm). Different particle sizes were estimated by the method of Penn State Particle Size Separator. Variables were evaluated in 0, 4, 8 and 12 d after silos opening, with 56 d of fermentation. Temperature of each silage was measured with digital dataloggers, during total period of 12 d. Aerobic stability was calculated as the time spent in hours for the silage mass increased 2°C compare with ambient temperature. Results were analyzed in a completely randomized design with 3 replications, with time repeated measures. Statistical analyzes were performed using PROC MIXED procedure of SAS 9.0. There were no differences ($P > 0.05$) among treatment in pH or yeast populations after 56 d of fermentation. However, after opening, pH increased ($P < 0.001$) from 3.59 to 6.21 after 12 d of exposure. This is due to the use of silage soluble components such as sugars and organic acids as substrate for aerobic microorganisms. Yeasts

growth over exposure time was also significant ($P < 0.001$) from 6.10 to 7.74 cfu/g of silage. Breakage of aerobic stability occurred 38, 12, 13 and 35 h after the start of air exposure for treatments 1, 2, 3 and 4, respectively, but did not observe statistical differences ($P = 0.4256$). When observing the maximum temperature of each silage and time spent to achieve it, significant response was observed ($P < 0.05$) for the maximum time, resulting quadratic effect, but was not significant for temperature, averaging 41°C. Thus, it is concluded that the average particle size of silage sugarcane does not interfere with aerobic stability, pH and yeast growth.

Key Words: aerobic exposure, microorganism, temperature

W271 Chemical composition, fermentative losses, and the dynamics of yeasts and lactic acid bacteria populations of sugarcane ensiled at different particle sizes—Year 2. A. F. Campos*[1], G. R. Siqueira[1,2], N. M. Jeronimo[2,3], F. D. Resende[1,2], and R. A. Reis[1], *[1]Sao Paulo State University, Jaboticabal, Sao Paulo, Brazil, [2]Agencia Paulista de Tecnologia dos Agronegocios, Colina, Sao Paulo, Brazil, [3]Centro Universitario de Barretos, Barretos, Sao Paulo, Brazil.*

Study aimed to evaluate the chemical composition, gas production, recovery of dry matter, and population dynamics of yeasts and lactic acid bacteria (LAB) in silage sugarcane with different mean particle sizes (0.61, 1.07, 1.37, and 1.63 cm), estimated using a Penn State Particle Size Separator. Plastic buckets were used as experimental silos. Losses and microbial population dynamics were evaluated during the storage period of 0, 3, 7, 14, 28, and 56 d with chemical composition measured at 56 d. Results were analyzed in a completely randomized design with 3 replications, with time as a repeated measure. Statistical analyses were performed to using PROC MIXED of SAS 9.0 ($P \leq 0.05$). Differences were observed in concentrations of dry matter (DM), acid detergent fiber (ADF) and lignin, being 27.01; 46.17; 8.48 for 0.61 cm; 31.01; 43.25; 7.56 for 1.07 cm; 32.68; 43.50; 7.45 for 1.37 cm and 26.58, 45.78, 8.79 for 1.63 cm, respectively, in % of DM, giving a quadratic effect ($P < 0.05$), probably due to losses of soluble compounds affecting DM and fiber concentrations. There were no differences in ether extract (EE), with mean of 0.98% of DM, and in vitro dry matter digestibility (IVDMD, 55.42% of DM). The smallest particle size (0.61 cm) resulted in highest values of gas losses (% of DM) with means of 9.49 vs. 6.60; 7.47; 7.41 for 0.61 vs. 1.07, 1.37 and 1.63 cm of particle size, respectively, and lower final DM recovery ($P < 0.05$). There was no treatment effect for lactic acid bacterial population ($P > 0.05$) indicating independence of particle size. Compaction intensity was effective in maintaining the anaerobic environment favorable to microbial growth. There was an effect of days of storage with greater amounts of CFU observed at 3 days. Ensilage of sugarcane with small particles (0.61 cm) had greater losses, so larger sizes are recommended.

Key Words: fibrous fraction, gas production, microorganism

W272 Ensiling characteristics and aerobic stability of guinea grass fermented with microbial inoculants. A. A. Rodríguez*, E. Martínez, C. Rosario, A. Almeida, C. Ocasio, E. Delgado, and L. C. Solórzano, *University of Puerto Rico, Mayagüez, PR.*

We evaluated the ensiling characteristics and aerobic stability of guinea-grass (GG, *Panicum maximum* 'Tanzania') fermented with commercial additives containing combinations of the lactic acid-producing bacterial strains: *Lactobacillus plantarum* DSM 16568; *Enterococcus faecium* DSM 22502, *Lactococcus lactis* DSM 11037 and NCIMB 30177, and *Lactobacillus buchneri* DSM 22502. Guinea-grass (25.9% DM) was chopped at 2.5 cm and ensiled with one of 4 additives: control (no additive), SiloSolve-AS (Chr. Hansen Inc., Milwaukee, WI), SiloSolve EF, and SiloSolve MC. Additives were added to weighed portions of GG and packed into PVC micro-silos (1.8 kg) to ferment for 3 or 45d at 25–27°C. Three silos from each treatment and fermentation day were analyzed for pH, organic acids, and NH_3. Statistical analysis was performed as a completely randomized design with a 4 (additives) by 2 (3 and 45 d of fermentation) factorial arrangement. For aerobic stability, temperature was monitored every 6 h in 3 samples (800 g) from each treatment during 120 h. Statistical analysis was performed as a split plot design with a 4 (additives) by 21 (time points of aerobic exposure) factorial arrangement using the silo as repetitive measurement. Tukey's test was used for mean separation. Microbial additives did not influence pH and lactic acid content in GG silage. After 45 d of ensiling forage treated with SiloSolve MC and SiloSolve EF had lower ($P < 0.05$) acetic acid (2.91 and 3.32 vs. 3.96 and 3.72%), butyric acid (1.27 and 1.35 vs. 1.68 and 1.77%), and NH_3-N/total-N (8.60 and 7.80 vs. 15.20 and 10.80%) than control silage or GG fermented with SiloSolve AS. All silages were stable to aerobic conditions after 120 h of aerobic exposure. In summary, addition of SiloSolve MC and SiloSolve EF improved the ensiling characteristics of GG silage ensiled at 25.9% DM. Guinea Grass fermented with or without the microbial additives resulted in silages stable to aerobic conditions.

Key Words: guinea-grass silage, microbial additive, fermentation

W273 Characterization of nutritive value and aerobic stability of passion fruit (*Passiflora edulis*) rind silage. I. Espinoza-Guerra*[1], J. Avellaneda-Cevallos[1,2], A. Sánchez-Laiño[1,2], L. Montenegro-Vivas[1], G. Quintana-Zamora[1,2], D. Zambrano-Gracia[1], M. Medina-Villacís[3], M. Peña-Galeas[1,2], and L. López-Intriago[1,2], *[1]Facultad de Ciencias Pecuarias, Quevedo, Los Ríos, Ecuador, [2]Dirección de Investigación Científica y Tecnólgica, Quevedo, Los Ríos, Ecuador, [3]Unidad de Estudios a Distancia, Quevedo, Los Ríos, Ecuador.*

The objective of this study was to evaluate the effect of the addition of commercial inoculants on chemical composition and fermentation characteristics in passion fruit (*Passiflora edulis*) rind silage stored in PVC experimental microsilos with 3 kg of capacity. Treatments were: T1) passion fruit rind silage without inoculant; T2) passion fruit rind silage + inoculant (Lacto Silo) and T3) passion fruit rind silage + inoculant (Sil-All 4x4), evaluated during 3 periods of fermentation (7, 14, and 21 d). Samples of each treatment were collected to determine dry matter, organic matter, ash, protein, fat, nitrogen-free extract, pH and temperature. Aerobic stability was analyzed throughout the temperature variation of the microsilos and pH using a potentiometer in the aqueous extract of 10 g of silage in 100 mL of distilled water after a 30-min rest period. The results obtained showed that the pH in the silos of T2 and T3 (3.8 and 3.9), when opened at 7 d, was significantly higher ($P < 0.05$) than the pH of the silage without additive (T1: 3.7). The pH and temperature of the silos opened at 14 and 21 days had no statistical differences between treatments ($P > 0.05$). Also, silages treated with inoculants or without inoculants had similar nutritional composition ($P > 0.05$). In conclusion, while there were minor effects on pH, there was no effect of adding inoculants on the aerobic stability or nutritional composition of the passion fruit rind silages in this study.

Key Words: passion fruit rind, microsilo, microbial inoculant

W274 Effects of different shoot height on fermentation quality and digestibility of barley silage. D. H. Kim*[1], S. C. Kim[2], H. J. Lee[1], S. M. Amanullah[2], Y. J. Jae[1], Y. M. Song[3], H. Y. Kim[3], and I. H. Choi[4], *[1]Division of Applied Life science, Gyeongsang National University, Jinju, South Korea, [2]Department of Animal Science (Inst. Agric. Life Sci.), Gyeonsang National University, Jinju, South Korea, [3]Department of Animal Resource Technology, Gyeongsang National University of Science and Technology, Jinju, South Korea, [4]Department of Companion Animal & Animal Resource Science, Joongbu University, Geumsan, South Korea.*

This study was conducted to investigate the effects of shoot height on fermentation quality of barley silage and nutrient digestibility of total mixed ration formulated with barley silage. Barley forage (Yuyeon) was grown at Research farm, Sabong, Jinju, South Korea. Forage was harvested at 37% DM with 3 different shoot height (5, 10 and 15 cm), ensiled to bale silage (500 kg) for 200 d. The nutrient digestibility was estimated using 12 Hanwoo steers (average 455kg) assigned randomly into 3 treatments. The treatments contained total mixed ration prepared with one of either barley silage (5, 10 and 15 cm shoot height), and concentrate mixture. The animals were housed individually into the metabolic cage and fed 8 kg of diet for 3 weeks consisted 2 wk of adaptation and 1 wk of collection period. Feces were weighed daily and sub-sampled during the collection period. The mean concentrations of DM, CP and NDF of barley forage at 5, 10 and 15 cm of shoot height were 37.4, 5.5 and 67.3%, respectively. The concentrations of DM, CP, EE and crude ash of barley silage ensiled for 200 d were greater in 5 cm than 10 cm and 15 cm ($P < 0.05$). Acetate concentration was greater 15 cm than 5 cm and 10 cm silage (1.13 vs. 0.40 and 0.50%, $P < 0.05$). Mold was greater in 10 cm than 15 cm silage (4.05 vs. 3.28 $\log_{10}$ cfu/g, $P < 0.05$). Ether extract and NDF digestibility of Hanwoo steer fed the diet formulated with 15 cm silage were greater ($P < 0.05$) than those fed the diets formulated with 10 cm silage ($P < 0.05$). In contrary, ADF digestibility was greater in the diet formulated with 5 cm silage than 10 cm silage ($P < 0.05$). Therefore, shoot height can improve the fermentation quality and digestibility of barley silage.

Key Words: barley silage, shoot height, digestibility

W275 Effects of the additives on fermentation quality of barley silage. H. J. Lee[1], D. H. Kim[1], H. Yoon[1], S. M. Amanullah[2], S. C. Kim*[2], and I. H. Choi[3], *[1]Division of Applied Life Science (BK21 program), Jinju, South Korea, [2]Department of Animal Science (Inst. Agric. Life Sci.), Gyeongsang National University, Jinju, South Korea, [3]Department of Companion Animal & Animal Resource Sciences, Joongbu University, Geumsan, South Korea.*

This study was carried out to determine the effect of the additives on fermentation quality of barley silage. Youngyang barley forage was grown at Animal Research Unit, Gyeongsang National University, Jinju, South Korea, and harvest at 29% DM. Approximately 300kg of barley forage were chopped and assigned into 1 of 4 treatments with 4 replications, which were CON (no additive), T1 (1.2×10^3 cfu/g of *L. plantarum*), T2 (0.1% of propionate) and T3 (combo). Barley forage was ensiled into 10-L bucket silo for 2-, 7-, 48-, and 100-d periods. After 100 d of fermentation, DM, NDF and hemicellulose content of silage remained unchanged ($P > 0.005$) among the treatments. Crude protein content was lower in T1 ($P = 0.004$), which further expressed by higher ($P < 0.001$) ammonia-N (% of total N) in this group than in the control and other treatments. Crude ash and ADF contents were higher in the control than in other treatments. The in vitro DMD and NDFD were lowest ($P < 0.05$) in the control than other treatments. The control silage has the higher ($P < 0.05$) pH value; however, pH did not differ with the difference in additives. Lactate was higher in T2 and T3 than that in the control and T1, but acetate was highest ($P < 0.001$) in control silage (6.05%), followed by T3 (5.19%), T2 (5.06%) and T1 (4.18%). These results gave the highest lactate/acetate ration in T2 (2.59), followed by T3 (2.39), T1 (1.97) and the control (1.10). LAB (7.15 vs. 6.82 vs. 6.39 vs. 6.51 log10 cfu/g, $P = 0.055$) tended to decrease with additives. No difference was observed in yeast or mold count among the treatments. Therefore, applying additives can improve the fermentation quality of barley silage.

Key Words: barley silage, inoculant, propionate

W276 Effects of microbial inoculants on alfalfa, ryegrass, and grass clover mixture silages on silage pH, dry matter loss, and aerobic stability. A. Lanckriet*[1], J. Jatkauskas[2], V. Vrotniakiene[2], E. French[3], and T. Hemling[4], *[1]DeLaval N.V., Drongen, Belgium, [2]Lithuanian University of Health Sciences, Baisogala, Lithuania, [3]DeLaval Inc., Waunakee, WI, [4]DeLaval Inc., Kansas City, MO.*

An in vitro study using 3L glass mini silos was conducted to observe the effects of silage inoculants on nutrient composition, pH, VFA concentration, DM loss, and aerobic stability. Three silages were studied: alfalfa (AS), perennial ryegrass (RS), and a mixture of red clover:ryegrass:timothy (MIX). Nine treatments (control, DeLaval Feedtech (F10, F18, F22, F3000), Sil-All 4 × 4 (SA), Lalsil Dry, Bonsilage (BO), Bio-sil Stabil, were organized as a randomized complete bock design, with 5 replicates per treatment. Silos were filled to a target density of 0.2 kg DM/L and ensiled for 90 d at 20°C. After 90 d, silages were analyzed for DM loss and chemical composition (DM, CP, NDF, and pH). Silage VFA (g/100 g of DM) were analyzed by GLC. Aerobic stability was measured on d 90 by exposing the silages to air and measuring temperature until silages were 3°C above ambient temperature. Mean nutrient composition (%) was 33.8, 32.2, and 32.8 for DM, 20.6, 14.7, and 19.0 for CP, and 38.0, 44.1, and 42.2 for NDF for AS, RS, and MIX. Lactate increased in RS for F18 and F22 compared with other inoculants (9.1 v. 6.6; overall mean ± SEM, 6.8 ± 0.57; $P < 0.01$) and MIX for F10, F22, F3000, and ISA versus other inoculants (5.8 v. 4.3; 4.9 ± 0.2; $P < 0.01$). After 90 d, pH was lower in AS treated with F18, F22, F3000, and SA versus other inoculants (4.88 v. 5.02; 5.1 ± 0.01; $P < 0.01$), in RS for F10, F22, F3000, and SA versus other inoculants (4.02 v. 4.21; 4.13 ± 0.02; $P < 0.01$), and in MIX treated with F10, F22, and F3000 compared with other inoculants (4.02 v. 4.18; 4.15 ± 0.03; $P < 0.01$). Loss of DM was reduced in RS for F10, F18, F22, F3000, and BO compared with other inoculants (2.9 v. 3.8%; 3.5 ± 0.7; $P < 0.01$), and reduced in MIX for F10, F22, and F3000 compared with other inoculants (4.02 v. 4.18; 4.6 ± 0.4; $P < 0.01$). Adding inoculants improved ($P < 0.05$) aerobic stability compared with the control (AS, 229.8 v. 98.4; RS, 197.7 v. 96.0; MIX, 167.1 v. 80.4). Results demonstrate improved silage quality by adding inoculants. In particular, DeLaval Feedtech and Sil-All 4 × 4 inoculants consistently improved silage quality compared with other treatments.

Key Words: inoculant