W107 Use of *Pleurotus oestreatus* to change the nutritional quality of maize stover. O. D. Montañez-Valdez*[1], J. M., Tapía-Gonzalez[1], G. Rocha-Chavez[1], J. A. Martínez-Ibarra[1], C. E. Guerra-Medina[2], E. O. Flores-García[2], and J. H. Avellaneda-Cevallos[3], [1]*Centro Universitario del Sur de la Universidad de Guadalajara*, *Ciudad Guzmán, Jalisco, México*, [2]*Universitario de la Costa Sur de la Universidad de Guadalajara*, *Autlán, Jalisco, México*, [3]*Universidad Técnica Estatal de Quevedo*, *Santo Domingo. Quevedo, Los Ríos, Ecuador*.

A study was conducted to evaluate the effect of *Pleurotus oestreatus* on chemical composition of maize stover. Maize stover treated and untreated with *Pleurotus oestreatus*, were obtained from a commercial facility. Ten samples of maize stover used previously as substrate to culture edible fungus were collected randomly. The negative control group consisted of the pasteurized maize stover untreated with *Pleurotus oestreatus*. All samples were analyzed to determinate dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose (C), hemicellulose (HC) and lignin (L). Data were analyzed by mean comparison using a Student's *t*-test. No differences ($P \geq 0.05$) between treatments were found for DM, CP, C and HC; however, treated maize stover ($P \leq 0.02$) showed higher percentages of OM (89.07 vs. 84.83), NDF (69.65 vs. 63.74), and ADF (48.18 vs. 43.68) as well as a lower L value (9.20 vs. 12.22). The growth of *Pleurotus oestreatus* on maize stover changes its chemical composition by increasing organic matter content and modifying cell wall components, this may improve the nutritional quality of agricultural byproducts. This process may allow using *Pleurotus oestreatus*-treated maize stover for ruminant feeding

Key Words: agricultural byproducts, white rot fungi, chemical composition

W108 Effect of the fermented apple pomace (manzarina) on the rumen epithelia growth with lamb feedlot diets. C. Rodríguez-Muela*[1], H. E. Rodríguez-Ramírez[1], A. Grado[1], A. Corral[1], O. Ruiz-Barrera[1], A. Arzola[1], and R. Bocourt[2], [1]*Universidad Autónoma de Chihuahua*, *Chihuahua, México*, [2]*Instituto de Ciencia Animal*, *La Habana, Cuba*.

The objective of this research was to evaluate the effect of manzarina (mzn) in the development of the ruminal epithelia, antioxidant activity and blood chemistry profiles of sheep plasma. Four treatments (Tr) were designed (n = 24, 12 males and 12 females): Tr1, males with 10.9% mzn diet (DM basis); Tr2, females with mzn diet; Tr3, males with basal diet; Tr4, females with basal diet. Basal diet contained (DM basis) 38.5% alfalfa hay, 12.4% soybean meal, 42.5% steam rolling corn, 2.0% animal fat, 3.1% molasses, 0.7% salt and 0.8% vitamin and mineral premix. Lambs remained in individual cages (0.5 × 1.0m), with water and food ad libitum by 58d. Two samples of blood were taken every 30 d (beginning, intermediate and at the end of the experiment), to determinate antioxidant activity (AA by Ferric Reductive Ability of Plasma) and the blood chemistry profiles (BC). Animals were slaughtered and 4 samples were taken of rumen wall to measure the long and wide of papillae on ruminal epithelia. Data of AA and BC was analyzed with a mixed model (fixed effects: Tr, sampling, sex and their interactions). An experimental unit nested in Tr as random effect was used. A hierarchical model was used to analyze long and wide of papillae. Effects of Tr, sex and their interaction were nested in the sampling rumen area. Results showed that AA of Tr1 was greater ($P < 0.06$) than AA of Tr2 animals on sampling 3 (24.34 vs. 21.79 mM Fe_2). There was an increment over time ($P < 0.05$) of leucocytes in all animals (7.52×10^3 uL^{-1} to 9.14×10^3 uL^{-1}). Leucocytes began to increase at 30th day of feeding period, with values inside the normal rank of these animal species without treatment effect ($P > 0.05$) for the remaining BC indicators. Animals of Tr1 had greater ($P < 0.05$) long of papillae (3.04 ± 0.07 mm) than Tr3 animals (2.43 ± 0.05 mm). Wide of papillae was greater ($P < 0.05$) in the animals consuming mzn diet (1.99 ± 0.02 mm) versus animals consuming diet without mzn (1.90 ± 0.02 mm). We conclude that the use of the manzarina in lamb feedlot diets improved the AA in plasma and stimulated the growth of the Rumen Epithelia.

Key Words: antioxidant, leucocytes, papillae

W109 Effects of ensiling king grass with *Albizia lebbeck* on fermentation and nitrogenous compounds of silage mixtures. T. Clavero* and R. Razz, *Centro de Transferencia de Tecnologia en Pastos y Forrajes, Universidad del Zulia*, *Maracaibo, Estado Zulia, Venezuela*.

King grass (*Pennisetum purpureum* × *Pennisetum typhoides*) silage is low quality with low nitrogen concentration. This study determined whether addition of albizia (*Albizia lebbeck*) would improve the quality or nitrogen status of the silage in a tropical dry forest in northwest Venezuela. The treatments for silage making were: 100% king grass (KG), 30% albizia (A):70% KG, 50% A:50% KG, 70% A:30% KG, 100% A. Chopped fresh plant materials of at least 1 cm length were ensiled into a laboratory silos and stored at 25°C for 45 d. After opening silos, dry matter (DM), pH, total nitrogen content (TN), protein nitrogen (PN), soluble nitrogen (SN), PN/TN, ammonia nitrogen (AN), neutral detergent fiber nitrogen of total nitrogen (NNDF/TN), and acid detergent fiber nitrogen of total nitrogen (NADF/TN) were determined. The experiment was a completely randomized design with 3 replications. Significant means were separated with Tukey test. Silage DM increased ($P \leq 0.01$) with increasing proportion of albizia in the mixtures, and was greatest (25.21%) with 70%. All levels of albizia showed decreases in pH values ($P \leq 0.01$), showing the lowest value (3.41) with 100% albizia. Values of NADF/TN and NNDF/TN were not affected by treatments ($P \geq 0.05$). The TN, PN, SN and PN/TN contents increased linearly ($P \leq 0.01$) as the percentage of albizia increased in the mixtures. A small amount of AN was detected in silage, however, throughout there were not significant differences ($P \geq 0.05$) between 50 and 100% mixing levels of albizia. These results indicated that mixing albizia with king grass in the silage making was shown to be successful in the improvement of fermentation quality and nitrogen levels in silages.

Key Words: silage mixtures, *Albizia lebbeck*, nitrogenous compounds

W110 Detection of mycophenolic acid and roquefortine C mycotoxins in Canadian corn silage. H. V. L. N. Swamy*[1] and N. A. Karrow[2], [1]*Alltech Canada*, *Guelph, ON, Canada*, [2]*University of Guelph*, *Guelph, ON, Canada*.

Academic research to date has been focused on 5 silage *Penicllium* mycotoxins that are implicated in animal disorders—mycophenolic acid (MPA), patulin (PAT), penicillic acid (PA), PR toxin (PR), and Roquefortine C (RFC). It is critical that this academic research is complemented by the analysis of these mycotoxins in silage collected from commercial dairy farms. Nine corn silage samples (year 2008 crop) were collected

from Ontario dairy farms and each sample was divided into 2 equal parts. One part was submitted to TLR International Laboratories (the Netherlands) for MPA, PAT and RFC analyses while the other part to Trilogy Analytical Laboratories Inc. (USA) for PR analysis. Among these 9 samples, 3 each were collected from well, moderate and poorly managed silage bunks/silos. The bunks were classified as well, moderate or poor based on the silage density and face management. Following Penn State procedure, silage samples were collected from 12 different points of silage face and then were mixed thoroughly before taking one representative sample for analysis. The detection limits for MPA, PAT, PR and RFC were 25, 50, 500 and 10 ppb, respectively. MPA, PAT and RFC were analyzed by liquid chromatography with double in-line mass spectrometers (LC-MS/MS) and PR was analyzed by thin layer chromatography (TLC). None of the samples indicated any detectable levels of PR toxin. The detection limit for PR, however, was high (500 ppb) and future efforts should be made to analyze this mycotoxin with LC-MS/MS so that detection limit of at least 50 ppb is achieved. Two of the silages obtained from poorly managed bunks/silos indicated detectable levels of *Penicillium* mycotoxins. One sample was contaminated with 70.8 ppb MPA and the other with 27.1 ppb RFC. The levels of MPA, PAT and RFC were below the detection limits for the remaining silage samples. To the best of our knowledge, these are the first reported *Penicillium* mycotoxins in commercial corn silage produced in Canada. Silages, therefore, should be tested for *Penicillium* mycotoxins along with vomitoxin (DON) to assess the total animal toxicity.

Key Words: silage, *Penicillium*, mycotoxins

W111 Fermentation profile over nine months of storage of brown midrib and non-brown midrib hybrid corn silage. K. E. Nestor Jr.*, P. Krueger, J. Anderson, J. Brouillette, and K. Emery, *Mycogen Seeds, Inc.*, *Indianapolis, IN*.

The objective of this study was to examine the difference in fermentation patterns and changes in nutrient content in silages made from brown midrib hybrids (bmr) or non brown midrib hybrids over time of storage. A total of 19 bmr corn hybrids and 24 non bmr corn hybrids were collected from 15 plot locations in the Midwest and Northeast regions of the United States. At each plot location at least one bmr and one non-bmr were collected together. Ten samples of each hybrid were chopped and collected into vacuum sealed bags and then stored in an environmentally controlled room until analysis. Samples were sent to Cumberland Valley Analytical Services on a monthly basis for analysis. Each sample was analyzed for dry matter (DM), crude protein (CP), soluble protein (SolP), net energy of lactation (NEL), acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, starch, sugar, 7 h in vitro starch degradability (DegStarch), pH, titratable acid, lactic acid, acetic acid, total volatile fatty acids (TotVFA), ammonia, and 30 h NDF digestibility (DNDF). Data by month was analyzed by paired *t*-test and pooled hybrid data was analyzed by ANOVA. When the data was pooled across all time points the bmr hybrids were higher ($P < 0.001$) in CP, NEL, DNDF and higher ($P < 0.01$) in acetic acid and TotVFA and higher ($P < 0.05$) in lactic acid. The bmr hybrids were lower ($P < 0.001$) in ADF, NDF, lignin and lower ($P < 0.01$) in ammonia and lower ($P < 0.05$) in DegStarch. Within month of fermentation, there were several, but inconsistent differences between the hybrids in several of the parameters measured. The fermentation patterns of each hybrid class were similar. Other than the differences in nutrient content, the results of this study suggest that bmr hybrids are not different than non-bmr hybrids in fermentation patterns over time of storage.

Key Words: silage, bmr, fermentation

W112 Herbage mass, botanical and chemical composition of forage sorghum and annual legumes in monoculture and intercropped. R. W. Colbert, E. Valencia*, and J. Beaver, *University of Puerto Rico, Mayaguez*, *Mayaguez, Puerto Rico*.

Forge sorghums (*Sorghum bicolor* cv. Brown midrib) and the legumes lablab (*Lablab purpureus* cv. Rongai) and velvet bean (*Mucuna pruriens* cv. Vine 90d) are excellent forages for the dairy industry in Puerto Rico. Brown midrib (BMR) is low in crude protein (CP; 6%) at 90 d harvest, limiting its use in the industry. There is potential to increase CP by intercropping legumes with BMR, but this has not been documented. This study was conducted to assess the effect of monoculture or intercropping BMR, Rongai and Vine 90d on herbage mass (HM), botanical and chemical composition. Treatments were BMR, Rongai and Vine 90d, and BMR-Rongai and BMR-Vine 90d intercropped. Experimental plots (25 m^2) were planted in May and August, 2008 in a randomized complete block with 5 replicates. Herbage mass was estimated in a 2 m^2 area 90 d after planting. Dried sub-samples (500 g) were ground in a Willey mill and used for CP and neutral detergent fiber (NDF) and acid detergent fiber (ADF) analysis. Data were analyzed using PROC Mixed in SAS and mean separation when significant was conducted with Fisher LSD. There were no differences ($P > 0.05$) for HM between BMR intercropped with legumes and BMR in monoculture. Herbage mass was 8.9, 8.8, and 8.4 Mg ha^{-1}, for BMR-Rongai, BMR-Vine 90d, and BMR, respectively. Botanical composition for Rongai did not vary ($P > 0.05$) in HM between May and August, with means values of 2.7 and 3.9 Mg ha^{-1} in intercropping and monoculture, respectively. Vine 90d presented the lowest ($P < 0.05$) HM, 2.8 and 1.3 Mg ha^{-1} for May and August, respectively. Both NDF and ADF ($P > 0.05$) were not different with values of 60.1 and 63.9% and 40.1 and 46.5%, for BMR-Rongai and BMR-Vine 90d, respectively. However, there were differences ($P < 0.05$) in CP for monoculture and intercrops. The CP for Rongai, Vine 90 d, and BMR in monoculture were 14.1, 11.1, and 6.0%, respectively. When intercropped, CP for BMR-Rongai and BMR-Vine 90d were 9.8 and 9.1, 3 percentage units greater ($P < 0.05$) than BMR. In conclusion, BMR intercropped with Rongai and Vine 90d improved its nutritive value from a ruminant nutrition perspective.

Key Words: brown midrib, Rongai, Vine 90 d

W113 Comparisons among predictive equations and NIR for determination of in vitro indigestible NDF of hay crop silages. R. Ward*[1], S. Weaver[1], and R. A. Patton[2], [1]*Cumberland Valley Analytical Services*, *Maugansville, MD*, [2]*Nittany Dairy Nutrition*, *Mifflinburg, PA*.

There may be advantages to using indigestible NDF (INDF) values in ration balancing programs if they could be derived in a time efficient and economical fashion. NIR holds promise as a means of generating this information. To investigate the accuracy of NIR compared with predictive equations, a data set of 130 hay crop silages with indigestible NDF determined at 120 h of incubation by the Tilley and Terry method was developed. Types of silages were 19 grass, 27 legume, 20 mixed mainly grass (MMG), 26 mixed mainly legume (MML) and 38 small grain silages. Using this data, chemically determined INDF was compared against equations developed using analyzed nutrients from a smaller data set for all hay crop silages and for individual forage types, as well as calculation of INDF as lignin*2.4. The mean square predicted error statistic of Bibby and Toutenburg was used to compare predictions with observed values. The overall determined equation was INDF = 1.409 + (2.838 * lignin %DM), $R^2 = 0.82$. For grass silage, the equation was INDF = (1.720 * ADF %DM) - 40.101, $R^2 = 0.96$, while legume was INDF = 8.803 + (2.045 * lignin), $R^2 = 0.97$, for MMG INDF = 6.336 + (3.052 * starch %DM) + (0.337 * Ash %DM), $R^2 = 0.99$, for MML INDF

= (1.267 *ADF %DM)-23.971, R^2 = 0.97, and for small grain, INDF = 15.987 + (0.528 * NDICP %DM), R^2 = 0.99. Using an equation of lignin*2.4 (R^2 = 0.77) considerably under predicts the amount of INDF in hay crop silages whether determined at 120 or 240 h of incubation. We conclude that there is a strong relationship of lignin to INDF for hay crop silages. Further these results suggest that NIR is a better predictor of INDF than equations and that feed specific equations are better than general equations using only lignin as a predictor.

Table 1.

						Error Due To	
Model	Mean	Std Dev	RMSPE	% Mean	Bias	Regression	Random
Observed	18.11	4.87	-	-	-	-	-
NIR	17.96	4.32	2.01	11.2	0.5	0.3	99.2
Feed Specific	18.41	4.27	4.87	27.2	0.4	19.3	80.3
Overall	16.96	4.53	3.61	20.2	10.2	6.9	82.9
Lignin*2.4	13.15	3.83	5.96	33.3	69.3	0.2	30.5

Key Words: hay crop silage, NIR, INDF

W114 Relating dry matter density to dry matter loss within corn silage bunker silos. K. E. Griswold*[1], P. H. Craig[2], J. S. Graybill[1], and S. K. Dinh[1], [1]*Penn State Cooperative Extension*, *Lancaster,* [2]*Penn State Cooperative Extension*, *Dauphin*.

The objective was to refine the relationship between dry matter (DM) density and DM loss within corn silage bunker silos. Poly-weave nylon bags (36 per silo) containing chopped brown mid-rib (BMR) corn were buried in 3 bunker silos during filling on the same farm. Bags were blocked by depth from the end of the bunk, 10.6 m (front), 27.8 m (center), and 44.9 m (back), level from the silo floor, 0.6 m (bottom), 1.5 m (middle), and 2.15 m (top), and within level, location from the east wall, 0.9 m (I), 4.7 m (II), 8.4 m (III), and 12.2 m (IV). Upon feed-out, all bags at a specific depth were retrieved and silage cores for DM density were obtained at each bag position. Cores were collected using a 5.08 cm diameter stainless-steel coring tube driven by a gas-powered drill. Corn and silage DM was determined using a Koster moisture tester. Data were analyzed using PROC MIXED and RSREG within SAS. The model included the fixed effects of depth, level, location, all interactions, and the random effect of bunk. Significance was set at $P < 0.05$, and trends at $0.05 < P < 0.10$. There were no significant interactions. Density was affected ($P < 0.0001$) by depth, level, and location. Density was 201, 253, and 255 kg DM/m^3 for the front, center, and back, respectively. Density was 284, 268, and 224 kg DM/m^3 for the bottom, middle and top, respectively. Density was 219 and 211 kg DM/m^3 for I and IV compared with 260 and 254 kg DM/m^3 for II and III, respectively. DM loss % was affected ($P < 0.001$) by depth and level but not location. Loss was 9.2, 6.5, and 7.3% for the front, center, and back, and 6.5, 5.0 and 8.4% for the bottom, middle and top, respectively. There was a linear inverse relationship (R^2 = 0.18) between loss and density. Response surface regression of DM density and DM% versus DM loss also showed an inverse relationship (R^2 = 0.28). These results suggest a large degree of variation in DM loss is not associated with the DM density and DM% of the corn silage within a bunker silo.

Key Words: corn silage, density, loss

W115 Silo-King improves dry matter (DM) recovery and lowers the yeast, mold, and clostridia populations in high quality alfalfa balage. D. H. Kleinschmit*, D. P. Casper, D. J. Schauff, G. P. Gengelbach, K. E. Lanka, D. F. Jones, G. Ayangbile, and D. A. Spangler, *Agri-King, Inc.*, *Fulton, IL.*

High quality alfalfa balage is an excellent forage source for dairy cattle, however it may be susceptible to microbial deterioration and DM loss during ensiling. Silo-King is a silage fermentation aid designed to both improve the initial fermentation process via enhanced production of lactic acid and inhibit the growth of spoilage organisms so it may be an appropriate additive to aid in the production of high quality balage. On May 20, 2008 a total of 12 bales of alfalfa balage were made, with 6 bales (541 ± 9.43 kg) untreated (UNT) and 6 bales (524 ± 9.30 kg) treated with Silo-King via baler mounted applicator at a rate of 0.033% of fresh forage weight (SK) and wrapped with 8 mils of plastic. The nutrient content of both treatments before ensiling were similar. After 65 d of ensiling, final weights for determination of DM recovery and core samples for nutrient analysis and microbial counts were obtained from each bale. The experiment was analyzed as a completely randomized design with ANOVA being conducted with the MIXED procedure of SAS. The model was y = treatment + rep with rep being the random variable and least squares differences used for means separation. Even though nutrient content and 30-h in vitro DM digestibility were not altered by treatment in this study, UNT succumbed to more ($P < 0.01$) DM loss compared with SK (0.56 vs. 0.05% for UNT and SK, respectively). This was likely due to a tendency for SK to have a lower ($P < 0.10$) pH compared with UNT (5.35 vs. 5.25 for UNT and SK, respectively). Balage treated with SK had lower ($P < 0.02$) populations of clostridia (2067 vs. 97 colony forming units (cfu)/g of forage for UNT vs. SK, respectively) and yeasts (3317 vs. 25 cfu/g for UNT vs. SK, respectively) and a tendency for less ($P < 0.06$) molds (1203 vs. 7 cfu/g for UNT vs. SK, respectively). Based on the results in this study, the use of Silo-King as a forage enhancer is a viable tool to preserve the valuable DM in high quality balage and to enhance its feeding value by almost eliminating the presence of undesirable organisms, such as yeasts, molds, and clostridia.

Key Words: alfalfa, inoculants, yeasts

W116 Nutritional value of corn silage associated with additives. R. H. de Tonissi e Buschinelli Goes*[1], E. S. Myagi[2], K. A. de Souza[1], K. A. G. Nogueira[1], R. A. Patussi[1], M. G. de Menezes Gressler[1], C. E. Dambros[2], and E. R. de Oliveira[1], [1]*Universidade Federal da Grande Dourados*, *Dourados, MS, Brasil*, [2]*Universidade Federal de Goiás*, *Goiânia, GO, Brasil*.

Corn plant, cut at 90 d, was ensiled in 72 experimental silos in randomized design, in factorial 4 × 6 square (4 treatments and 6 d-opening) with 3 replicates, and the averages compared by Tukey's test at 5% probability, for evaluate the nutritional value of corn silage associated with additives. The corn silage was associated with additives at 5% in natural matter, and the treatments were: soybean hulls (CS+5%SH), rice meal (CS+5%RM) and crushed sunflower (CS+5%SC). The control was 100% of the corn plant (CS). The silos were opened at 0, 28, 56, 84, 112 and 140 d of fermentation. The pH reduced from 28 d of fermentation, with lowest value (3.39) at 112 d. All additives reach a pH favorable to preservation of forages. There was effect ($P < 0.05$) for additive and time of opening for dry matter (DM), crude protein (CP), ether extract (EE), NDF and total carbohydrates (TC). Crushed sunflower increased DM of silage on day zero, independent of the additive DM decreased to 140 d of fermentation. The CP increased with additive addiction. Crushed sunflower increased the CP, in 71% (average 13.3%), CS had a mean of 7.7% and CS+5%SH and CS+5%RM (9.1 and 9.6%). Crude protein was higher for the 112 and 140 d after ensiling. The addition of soybean hulls reduced the concentration of EE (1.5%) and crushed

sunflower and rice meal increased EE (24.8 and 10.9%); because chemical composition of the additive. The NDF decreased according ensilage time. The lower values of NDF occurred at 112 d (63.02, 65.46, 57.83 and 60.98% for CS, CS+5%SH, CS+5%RM and CS+5%SC, respectively). The levels of total carbohydrates remained stable over the days of fermentation for addition of soybean hulls, rice meal and CS (averages 85.5, 75.2 and 86.5%). CS+5%SC had the lowest values of TC for all opening days (mean 58.4%). Ash content was increased for addition of soybean hulls and rice meal (4.2 and 3.9%), while the CS+5%SC and corn silage presents average of 3.5 and 3.4%. Ash decreased after 56 d of fermentation. The addition of 5% soybean hulls, rice meal and crushed sunflower improve the nutritional value of corn silage

Key Words: crude protein, ether extract, chemical composition

W117 Nutritive value and fermentation parameters of warm-season grass silage. J. M. B. Vendramini*[1], A. T. Adesogan[2], M. L. A. Silveira[1], L. E. Sollenberger[2], O. C. M. Queiroz[2], and W. F. Anderson[3], [1]*University of Florida*, *Ona,* [2]*University of Florida*, *Gainesville,* [3]*USDA ARS*, *Tifton, GA*.

The objective of this study was to investigate the nutritive value and fermentation characteristics of different species of warm-season grass silages treated with or without inoculants in Florida. Nine forage species and cultivars, elephantgrass (*Pennisetum purpureum*), Mulato (*Brachiaria* sp.), bahiagrass (*Paspalum notatum*), stargrass (*Cynodon nlemfuensis*), Tifton 85 bermudagrass (*Cynodon* sp.), Jiggs bermudagrass (*Cynodon dactylon*), Coastcross 2 bermudagrass, Florakirk bermudagrass, and Floralta limpograss (*Hemarthria altissima*) were treated with or without (control) a microbial inoculant solution (Si-All) in a split-plot arrangement with 3 replicates. Plots were harvested on July 17 and October 9 2008. Forage was packed into mini-silos at a density of approximately 450 kg fresh forage/m^3 and ensiled for 84 d. The data were analyzed using PROC MIXED of SAS with forage species (main plot) and inoculant treatment (sub-plot) as fixed effects. Replicate and its interactions were considered random effects. The means were compared using the PDIFF statement of SAS. In the summer, NDF concentration was greater for the bermudagrasses than the average of other species (68 vs. 65%, $P < 0.01$, SE = 1). Mulato had the lowest NDF concentration (57%, $P < 0.03$, SE = 0.8) and the greatest IVTD concentration (63%, $P < 0.05$, SE = 1) compared with other treatments. Limpograss silage had the lowest pH (6.5, $P < 0.07$, SE = 0.3) and the greatest lactic acid concentrations (2.6%, $P < 0.01$, SE = 0.1). Elephantgrass silage had decreased lactic acid concentration (0.1%, $P < 0.001$, SE = 0.01) with greater pH (8.3, $P < 0.01$, SE = 0.3) than the other species. Inoculated silages had a lesser lactic acid concentration than control (0.62 vs. 1.84%, $P < 0.001$, SE = 0.2). In the fall, elephantgrass silage pH was less (7.2 vs. 8.8, $P < 0.06$, SE = 0.6) and the concentrations of total volatile fatty acids (4.6 vs. 0.4%, $P < 0.01$, SE = 0.2), lactic acid (1.5 vs. 0.2%, $P < 0.05$, SE = 0.5) and acetic acid (2.1 vs. 0.2%, $P < 0.001$, SE = 0.3) greater than in the bermudagrasses. There was no effect ($P > 0.10$) of the inoculant on the nutritive value and silage fermentation parameters in the fall.

Key Words: warm-season grass, silage, nutritive value

W118 Chemical composition and nutritive value of some cowpea (*Vigna unguiculata* L. Walp) haulm varieties. U. Y. Anele*, J. Hummel, O. M. Arigbede, C. Böttger, and K.-H. Südekum, *University of Bonn*, *Bonn, Germany*.

A study was carried out to evaluate the chemical composition, in vitro gas production, in vitro apparent and true substrate degradability, efficiency of microbial crude protein (CP) production, CP flow to the duodenum, methane production, protozoa population, and short chain fatty acids production of the haulms of 6 cowpea varieties. The study was arranged in a 2 × 2 × 2 factorial design, with 3 replicates. Three improved (ITA2, ITA6 and ITA8) and 3 commercial (Oloyin, Peu and Sokoto) cowpea varieties harvested in Nigeria during the wet and dry seasons were used for the study. After an initial gas test to evaluate 96 h gas production profiles of haulms with and without polyethylene glycol (PEG), the time to half maximal gas production was calculated and a second incubation conducted with fermentation stopped at substrate specific half time and 24 h for each substrate. True substrate degradability was measured from incubated residues and combined with gas volume to estimate the partitioning factor. Crude protein flow to the duodenum was estimated by combining gas volume with the measured ammonia nitrogen in the incubated fluid. Addition of PEG did not have any effect ($P > 0.05$) on all the variables determined. Interaction between group (improved vs commercial) and season was observed for the CP ($P = 0.002$), lignin ($P = 0.003$) and hemicellulose ($P = 0.030$) contents of the haulms. A group × season interaction was observed for some of the variables at both substrate specific half time and 24 h. On the average, the commercial cowpea haulms had greater microbial mass and produced less methane than the improved cowpea haulms. The improved cowpea haulms were less degraded in the rumen and as a result ensured greater amount of CP flow to the duodenum. The results validated that cowpea haulm is an important agro-based by-product that is adequate in protein and energy to sustain ruminant animal production in Nigeria and other Sub-Saharan African countries during the extended dry season.

Key Words: in vitro gas production, legume, protein value

W119 Silage characteristics, and nutritive value of sugar beet tops and crown harvested by two different methods. M. Raisianzadeh*[1], M. Danesh[2], H. Fazaeli[3], and M. Nourozi[1], [1]*Khorasan Agriculture and Natural Resources Research Center*, *Iran*, [2]*Ferdosi University of Mashhad*, *Iran*, [3]*Animal Science Research Institute*, *Karaj, Iran*.

Two areas of 500 m^2 in each of 3 sugar beet farms, that were different according to plant covers were selected. In one area, sugar beet tops and crowns (SBTC) before harvesting (method 1) but in another one SBTC were cut after harvesting of tuber (method 2).Costs and quality of obtained SBTC compared. The SBTC collected in method 1, had better quality than that of the method 2 but because of more labor used for method 1, it was more costly when compared with method 2. In a completely randomized block experiment, with 2 treatments (2 methods of SBTC collectives) and 4 replications the SBTC was ensiled with addition of 10%molasses and 2% urea to study its silage characteristics. In the last stage, digestibilities of silages obtained from each harvesting methods were compared. Result showed that SBTC silage collected by method 1 had better quality with higher organic matter and crud protein but lower pH ($P < 0.05$).The protein fractions including true protein and non protein nitrogen were significantly ($P < 0.05$) different between the treatments. Silages from method one, had higher quality compared with silages from method 2 and hence they had different pH and organic matter ($P < 0.05$). Silage made from TC cut before harvesting had higher ($P < 0.05$) crude protein, true protein and NPN contents, may be due to the lower percentage of SB crowns produced in the first method. Also highest levels of DM, OM, d.value digestibility percentage were observed in the first method.

Key Words: sugar beet tops and crowns, harvesting methods, silage characteristics

W120 Dry matter of corn at harvest alters whole plant chemical composition and predicted milk yields. P. M. Walker[1], J. M. Carmack*[1], L. H. Brown[2], and F. N. Owens[2], [1]*Department of Agriculture, Illinois State University*, *Normal,* [2]*Pioneer Hi-Bred International, A DuPont Business*, *Johnston, IA*.

Objectives of this trial were to determine effects of plant maturity (DM) on nutrient composition, projected milk per acre and milk per ton. Six commercial Pioneer corn hybrids (105 to 116 d CRM) with 24 rows per hybrid to minimize cross pollination effects were planted on May 12, 2009 near Normal, IL. Plants (replicate sets of 5 plants per harvest date) from each hybrid were randomly harvested in the 4 middle rows and cut 7 inches above ground level twice each week starting August 10 until DM content reached 50% (October 12). Sets of harvested plants were chopped, sampled, dried, and assayed via calibrated NIR analysis. By regression analysis from 25 to 45% DM, effect of plant DM on nutrient composition averaged across hybrids was examined. Using linear, quadratic, and cubic regression analysis, effects of harvest DM on milk yield per ton and per acre were calculated (based on Milk 2006 equations) for each hybrid and date. Finally, stepwise regression was used to determine the relative importance of specific nutrients and measurements on milk per ton and milk per acre. For each 1% increase in harvest DM, the percentage of starch in DM increased by 2% ($P < 0.01$) while decreases ($P < 0.01$) were detected for NDF (1.1%), sugars (0.7%), and ash (0.1%). Because hybrids differed in nutrient composition on various harvest dates, milk per acre and milk per ton were altered by harvest DM, and ranking of hybrids changed with harvest date. Compared with harvest at 30% DM, harvest at the optimum DM content (between 33 and 36% for these hybrids) increased projected milk yield by 5 to 13% per ton. Harvest between 33 and 40% DM increased milk yield per acre by 7 to 25% above harvest at 30% DM. Hybrid ranking at 35% DM differed from that at 30% DM ($R^2 = 0.62$; NS). Across hybrids and harvest dates, milk per ton depended primarily (($P < 0.01$) on starch content and NDFD (partial $R^2 = 0.82$ and 0.06) while milk per ton varied with starch and protein yields (partial $R^2 = 0.86$ and 0.07). Results from this trial suggest that milk per ton and acre will vary with harvest dry matter, and starch content and yield will affect projected milk yields.

Key Words: NDF, corn silage, maturity

W121 Effect of bunker silo sidewall plastic on fermentation, nutrient content and digestibility of corn silage. K. E. Griswold*[1], E. E. McDonell[2], L. Kung Jr.[2], and P. H. Craig[3], [1]*Penn State Cooperative Extension*, *Lancaster,* [2]*University of Delaware*, *Newark,* [3]*Penn State Cooperative Extension*, *Dauphin*.

The effect of sidewall plastic (SP) on fermentation, nutrient content and digestibility of corn silage was investigated in 20 dairy farm bunker silos, 10 without and 10 with SP. Samples were collected at 5 sites in each silo. Approximately 0.65 m from an outside wall at 3 levels, bottom ≈0.65 m from floor, top ≈0.65 m from top, and middle ≈equidistant to bottom and top. The fourth site was ≈1.3 m from the outside wall and ≈0.65 m from the floor. The fifth site, serving as an internal control, was collected equidistant to the walls and 2.0 m from the floor. At each site, 3 samples were collected in a triangular pattern using a stainless-steel coring tube. Samples were stored on ice until analysis. Data were analyzed using PROC MIXED within SAS. The model included fixed effects of plastic, location, interaction of plastic by location, and random effect of farm. Significance was set at $P < 0.05$, and trends at $0.05 < P < 0.15$. There were no interactions. Silage was wetter ($P < 0.0001$) at the wall bottom compared with all other sites, and was drier ($P < 0.0001$) in the center compared with all other sites. Silage tended ($P = 0.10$) to be drier in SP silos (31.8% DM) compared with silos without SP (29.5% DM). Data were then sorted by presence or absence of SP and analyzed with a model including fixed effect of location, random effect of farm, and single DF contrast of center versus wall samples. Silos without SP tended to have less acetic acid ($P = 0.08$) and less ethanol ($P = 0.01$) in wall samples versus the center while there were no differences between wall and center samples in SP silos. Silos with SP had less lactic acid ($P < 0.02$) in wall samples versus the center while silos without SP showed no difference between wall and center samples. The 30-h NDF digestibility was not different between wall and center samples in SP silos, but was less ($P < 0.04$) in wall samples versus the center for silos without SP. These results suggest that use of sidewall plastic in bunker silos alters fermentation, and may produce drier corn silage with greater digestibility.

Key Words: corn silage, sidewall plastic, digestibility

W122 Quality traits of the stem from corn hybrids for silage production according to the maturity stage. M. Zopollatto*[1], L. G. Nussio[1], J. O. Sarturi[2], C. M. M. Bittar[1], P. Schmidt[3], and G. B. Mourao[1], [1]*University of Sao Paulo*, *Piracicaba, Brazil*, [2]*University of Nebraska*, *Lincoln*, [3]*Federal University of Parana*, *Curitiba, Brazil*.

The objective of this study was to evaluate the stem quality traits from corn hybrids for silage production harvested across maturity stages. A randomized block design, with an 8x6x2 factorial scheme based on 8 harvesting times, 6 corn hybrids and 2 harvesting years (2001/02 and 2002/03) was performed. The hybrids CO 32, semi-hard endosperm; AG 5011, soft endosperm; P 3041, hard endosperm; DKB 333B, semi-hard endosperm; AG 1051, soft endosperm and Z 8550, semi-soft endosperm were harvested when they reached 50% tasseling, 15 d later and weekly, totaling 8 harvesting times. Plant was fractionated in leaf, stem, cob, grain and husk. Stem portion was analyzed for CP, NDF, digestible NDF (dNDF) and IVTDDM using the NIRSystems 5000 spectrophotometer. Variables were analyzed using the PROC MIXED procedure (SAS), and the averages compared by the Student *t*-test, with 5% level of significance. Maturity advance resulted in decreases ($P < 0.05$) in stem dNDF (55.2 to 39.6%), CP (7.0 to 4.23%) and in IVTDDM (66 to 53.7%). For the NDF content and digestible DM production (DDMP), the hybrids showed different responses along the maturity stage. At the ensiling stage (30–35% DM – between 5th and 6th harvesting time, from 94 to 112 d after seeding), stem NDF, dNDF, CP, IVTDDM and DDMP were 71.1 to 78.5% DM, 40.9 to 48.5% DM, 3.81 to 4.97% DM, 55.8 to 64.1% and 2.333 to 4.529 kg/ha, respectively. At the ensiling stage, Z8550 showed the most desirable stem quality characteristics for silage production, the lowest ($P < 0.05$) NDF (71.1% DM, SEM = 0.86) content and the highest ($P < 0.05$) stem dNDF (48.5% DM, SEM = 0.74), IVTDDM (64.1% DM, SEM = 0.96) and DDMP (3.651 kg/ha, SEM = 237). Hybrids P 3041, DKB 333B and AG 1051 also presented the highest ($P < 0.05$) stem DDMP at the ensiling stage, 4.107 (SEM = 285), 4.257 (SEM = 237) and 4.529 (SEM = 237), respectively. Monitoring the stem quality traits of corn hybrids for silage is an important tool for selecting corn hybrids based on the influence on the nutritive value of the whole plant.

Key Words: digestibility, fiber, harvesting time

W123 Butyric acid in commercially analyzed legume silage samples. L. R. Jones*[1] and R. T. Ward[2], [1]*American Farm Products, Inc.*, *Ypsilanti, MI,* [2]*Cumberland Valley Analytical Services, Inc.*, *Maugansville, MD*.

Butyric acid production by clostridia bacteria in hay crop silages has been associated with fermentation failure, significant dry matter losses, and reduced dry matter intake. A data set of 563 forage samples submitted for commercial analysis was evaluated for fermentation and descriptive statistics. Samples coded as either legume or legume grass mixes and having a dry matter level of 25–45% were included in the data set. Forage samples were analyzed for dry matter (DM), crude protein (CP), ammonia as a percent of CP (ammCP), lignin as a percent of NDF (ligninNDF) Ash, pH, lactic acid (LA), and butyric acid(BA) content. In the data set, 26% of samples had BA levels > 0.1% DM (BA1), 14% had BA levels > 0.5% DM (BA5) and 10% had BA levels > 1.0% DM (BA10). The incidence of BA was evaluated for 3 DM contents: < 32.5% (L), 32.5% 37.5% (M), and >37.5% (H), as well as pH levels of < 4.25 (LL), 4.25–4.75 (L), 4.75–5.25 (M) and >5.25 (H). For the L DM level, incidence of each butyric acid level (BA1, BA5, and BA10) increased as pH increased (17%, 0%, 0% for LL; 37%, 16%, 6% for L; 68%, 45%, 35% for M and 71%, 71%, 65% for H, respectively). For the M DM level, incidence of each BA level increased as pH increased (9%, 0%, 0% for LL; 13%, 3%, 1% for L; 42%, 22%, 17% for M and 56%, 44%, 38% for H). BA levels are highly correlated ($P < 0.0001$) with pH (r = 0.43), LA (r = −0.39), ammCP (r = 0.76), ADF (r = 0.38), NFC (r = −0.33). Samples with higher BA levels have higher pH, ammCP, and ADF levels and lower LA and NFC levels. Terminal pH was highly correlated ($P < 0.0001$) with LA (r = −0.62), ammCP (r = 0.50), ligninNDF (r = 0.40), ash (r = 0.35). LA accounts for 38% of the variation of pH. LA levels were highly correlated ($P < 0.0001$) with ammCP (r = −0.37), ADF (r = 0.38) and NFC (r = 0.34). Ammonia (ammCP) is correlated with all factors associated with BA possibly due to the proteolytic activity of clostridia organisms responsible for BA production. Across all DM levels, BA is prevalent when pH is not reduced; however, there is an interaction of DM level and pH level necessary to inhibit BA production.

Key Words: silage, butyric acid

W124 Environmental factors affecting changes in dry matter content of corn planted for summer or fall silage harvest in a subtropical climate. J. K. Bernard*[1], B. T. Scully[2], and J. S. Barlow[1], [1]*University of Georgia*, *Tifton,* [2]*USDA-ARS*, *Tifton, GA*.

A 3-yr trial was conducted to determine the environmental factors related to changes in the dry matter (DM) content of temperate corn (*Zea mays*) planted for summer or fall harvest as silage in a subtropical climate. Corn was planted in late March or early April (Pioneer 31Y42 and Masters Choice 590) for July harvest followed by a second crop planted in July (AgraTech 760 and Pioneer 33M52) for harvest in late October. When corn reached half-milk line stage of maturity, 3 replicate plots of corn plants were hand harvested every hour from 0600 through 1800 h. The corn plants were chopped using a field chopper to 1.9 cm theoretical chop length. A subsample of the chopped material was dried in a forced air oven for 60 h at 55°C to determine the DM content. Environmental temperature and relative humidity (RH) were continuously measured inside (IN) and outside (OUT) of the corn canopy. During the summer, the DM content increased 1.7% after 0900 and increased linearly throughout the remainder of the day. In the fall, the DM content increased 1.5% after 1000 and 1.7% after 1200 before peaking at 1500 and then declining. Temperature-humidity index (THI), THI^2, and RH^2 were computed for use in the statistical analysis. The RH ($P = 0.02$) and RH^2 ($P < 0.01$) measured IN were negatively correlated with DM content across both seasons. During the summer, the DM content was negatively correlated ($P < 0.02$) with RH and RH^2 measured IN and OUT and positively correlated ($P < 0.01$) with temperature, THI, and THI^2 IN and OUT. However, only RH and RH^2 measured IN were negatively correlated ($P < 0.05$) with DM content in the fall. Stepwise regression analysis of data was conducted across seasons as well as within season. Across seasons, the final equation was $\%DM = 32.49 - 0.001RH^2(IN) + 4.884THI(IN) - 0.026THI^2(IN) + 0.107RH(OUT) - 4.859THI(OUT) + 0.026THI^2(OUT)$ ($R^2 = 0.50$, $P < 0.0001$). Results of this trial indicate that the DM content of the whole corn plant changes differently in the summer compared with fall, primarily in response to changes in the RH inside the canopy.

Key Words: corn silage, DM content, drying rate

W125 Relationship of vomitoxin levels in corn silage to in vitro dry matter digestibility. R. Ward[1] and R. A. Patton*[2], [1]*Cumberland Valley Analytical*, *Maugansville, MD*, [2]*Nittany Dairy Nutrition*, *Mifflinburg, PA*.

There is increasing awareness of the damage that can be caused by Fusarium mycotoxin ingestion by dairy cattle. One reason for detected mycotoxins may be greater usage of BMR corn silage varieties. It is hypothesized higher digestibility may result in greater susceptibility to corn plant molds. Vomitoxin (DON) has often been used as a marker for contamination by Fusarium mold species. To investigate this, a data set composed of all corn silages submitted to Cumberland Valley Analytical Services for DON analyses was prepared. There were 1948 silages in the data set with 185 being identified as BMR varieties; 1068 were confirmed positive to DON. DON was measured using HPLC at 220 nm UV detection. Limit of detection was 0.5 ppm. Assessment of differences for levels of DON between silage types was by Proc Mixed of SAS. Incidence of infection was investigated using logistic regression. Samples identified as BMR had 1.135 ppm of DON and normal contained 1.295 ppm ($P = 0.24$). When non-positive samples were excluded, BMR contained 2.386 ppm (n = 155) and normal silage 2.303 ppm DON (n = 913;$P = 0.72$). Of BMR samples submitted, 83.8% were positive, but only 51.8% for normal silage. Logistic regression found that BMR was 1.419 times more likely to be infected than normal corn silage ($P < 0.004$). Caution should be applied to these statistics as these samples were screened as having problems and are not random. To further investigate the influence of NDF digestibility (NDFd) on DON levels, groups were constructed based on the following scheme: (1) >65% NDFd; (2) 60–64.99%; (3) 55–59.99%; (4) 50–54.99%; (5) 45–49.99; (6) <45%. Mean DON levels for the groups are (1) 1.177 ppm, (2) 1.140 ppm, (3) 1.215 ppm, (4) 1.470 ppm, (5) 2.022 ppm, and (6) 0.982 ppm. Only group 5 was significantly different from the others ($P < 0.05$), although group 2 tended to be lower than groups 3 and 4 also ($P < 0.10$). We conclude that although BMR corn silage may have a higher incidence of DON than normal corn silage, levels of infection are not different, and it would not be due to differences in NDFd. Further work will be needed on a random basis to verify the infective rate of BMR corn.

Key Words: DON, mycotoxins, corn silage

W126 Fermentation and ruminal degradability of corn silage inoculated with *Lactobacillus buchneri*. F. C. Basso[1], R. A. Reis*[1], D. M. Figueiredo[1], D. A. Mota[2], K. A. Magalhães[1], T. F. Bernardes[3], and J. F. H. Rodrigues[1], [1]*UNESP/FCAV*, *Jaboticabal, São Paulo, Brazil*, [2]*UFAM*, *Parintins, Amazonas, Brazil*, [3]*UFRA*, *Pará, Belém, Brazil*.

The aim of this trial was to evaluate the effect of *L. buchneri* doses on fermentation and ruminal degradability of corn silage. *L. buchneri* (NCIMB 40788) was applied to corn hybrid Maximus at: SLB - control (not inoculated); LB1 – 5×10^4, LB2 - 1×10^5, LB3 - 5×10^5, LB4 - $1 \times$

10^6 CFU/g of forage. Four plastic buckets (7 L) per treatment were filled with 4 kg of treated corn, sealed and stored at room temperature. After 130 d of fermentation, buckets were opened, spoiled forage discarded and the remainder was homogenized and placed in plastic buckets, and maintained in a closed room at room temperature. For determination of aerobic stability (AS) the silage temperature was measured every half hour by a data logger during the aerobic exposition (288 h) and room temperature was measured by data logger distributed near the buckets. Samples were collected to evaluate dry matter content (DM), pH values, acetic acid concentration (%DM), lactic acid (%DM), counting of yeasts and molds (Log CFU/g) in potato dextrose agar and ruminal degradability (measured by in situ procedure by 48 h). Nylon bags (9 x14 cm) with a pore size of 40μm were filled with 5 g of DM of silage samples. The statistical analysis included one-way ANOVA and Tukey's test ($P < 0.05$). The DM content was higher in the SLB and LB1 treatments ($P < 0.05$). The pH value, lactic acid (%DM) and molds did not differ significantly among silages. Acetic acid concentrations were higher in treated silages ($P < 0.05$). The number of yeast was lower in the silages with *L. buchneri* ($P < 0.05$). Aerobic stability of corn silage increased with *L. buchneri* ($P < 0.05$). The inoculant did not affect the ruminal degradability (%DM) of corn silages ($P < 0.05$). All doses reduced yeasts and improved aerobic stability.

Table 1. Fermentation, microbial dynamic and ruminal degradability of corn silage with *L. buchneri*

Treatments	DM	pH	Acetic Acid	Lactic Acid	Yeasts	Molds	AS	Degradability
SLB	32.04a	3.9a	0.80b	6.62a	4.71a	3.71a	46.3b	59.23a
LB1	32.03a	4.0a	1.06ab	6.7a	1.71b	2.97a	154.9a	58.45a
LB2	29.03b	3.95a	1.24a	6.5a	1.7b	2.45a	151.7a	55.83a
LB3	29.08b	4.0a	1.18a	6.88a	1.25b	2.97a	223.9a	55.92a
LB4	29.62b	4.0a	1.34a	6.47a	2.31b	2.69a	165.2a	57.5a
CV (%)	2.67	1.45	16.73	20.33	32.78	32.43	8.81	4.91

Means followed by equal letters are not different by Tukey test ($P>0.05$).

Key Words: heterofermentative bacteria, microbial dynamics, yeasts

W127 Dispersion of an inert marker in water on freshly chopped whole plant corn by two methods to simulate addition of an inoculant. J. M. Lim*, M. C. Santos, J. P. Rigueira, M. C. Der Bedrosian, and L. Kung Jr., *University of Delaware*, *Newark*.

Silage inoculants are often added in a liquid form to the forage mass at harvest. A common method of application is to add the inoculant with a sprayer system at the chopper in the field. Applying the inoculant via a "shower" method to the top of a forage mass in a forage truck or wagon is also practiced. Even distribution of an inoculant using the shower method has been questioned. Thus, the objective of this study was study the distribution of an inert marker applied to harvested whole plant corn using 2 methods. Forage was either 1) untreated (C) or treated with water containing dysprosium chloride (DY) via a 2) shower method (SHO), or 3) a spray (SPR) method. Dysprosium was applied to achieve a target of 2 ppm/kg of forage DM for treatments 2 and 3. Treatment via SHO was by manually pouring water with DY on the top surface of a forage in truck (7.25 t of wet forage) with a surface dimension of 5 × 2.7 m (length × width). For SPR, water was applied via a conventional sprayer system at the chopper. Application of water in both methods was set to achieve 2.2 L of water/t of wet forage. For all treatments forage was unloaded at the silo and spread and packed over a surface of about 13 × 6 m (length × width) in the bunker silo. Treatments were replicated twice with 9 samples randomly collected after packing. Control samples were collected from forage loads that were untreated. The concentration of DY in forage samples was determined using inductively coupled plasma spectrometry. Recovery of elemental DY in a spiked forage sample was 97 ± 2%. The concentrations of DY differed among treatments and were 0.09 ± 0.21, 0.47 ± 0.50 and 2.1 ± 0.66 ppm/kg of forage DM for C, SHO, and SPR respectively ($P < 0.0001$). The average concentration of DY for SPR was closer to the theoretical target (2 ppm/kg) and was less variable (CV of 31 vs. 106%) than for SHO. The results of this study suggest that distribution of an inoculant in water has the potential for better distribution if it is applied at the chopper compared with a shower method on the forage truck.

Key Words: silage, inoculant

W128 Treating first-cutting alfalfa in Michigan with Silo-King reduces heating during the ensiling process. D. P. Casper, G. P. Gengelbach*, M. E. Donaldson, D. F. Jones, D. H. Kleinschmit, K. E. Lanka, and D. J. Schauff, *Agri-King, Inc.*, *Fulton, IL*.

The generation of heat through the oxidation of carbohydrates during the ensiling process can dramatically affect forage quality. A field survey evaluated the post-ensiling temperature rise of 1st cutting alfalfa ensiled in bunker silos during 4 crop years (2005, 2006, 2008, and 2009) in Michigan. Bunker temperatures were measured once weekly for 4 weeks following ensiling using a 51-cm compost thermometer. Treatments were untreated Control (CON), competitor inoculant currently used by producer (COMP) or Silo-King (SK). The number of bunkers sampled, by treatment, for each year was: 2005 (9, 0, 11), 2006 (7, 7, 16), 2008 (21, 11, 11), and 2009 (27, 29, 18) for CON, COMP, and SK, respectively. The highest temperature recorded in the weeks post-ensiling was considered the peak temperature (PT). Data on PT were analyzed using a completely randomized design having a factorial arrangement of treatments using the PROC MIXED procedure of SAS. The interaction of Treatment by Year was non-significant ($P > 0.10$), so data were pooled and analyzed for the main effects of Treatment and Year. The lowest PT ($P < 0.01$) were for alfalfa bunkers treated with SK (42.4, 40.6, and 32.5°C, for CON, COMP, and SK, respectively) compared with CON and COMP treated bunkers, which were similar. The PT for bunkers varied across Year with 2005 and 2009 being similar ($P > 0.10$) and the highest, 2006 intermediate and 2008 being the lowest ($P < 0.06$) (40.4, 37.6, 36.8, and 39.2°C for 2005, 2006, 2008, and 2009, respectively). The rise in PT that normally occurs during the ensiling of 1st cutting alfalfa in bunkers can be prevented by treating the forage with Silo-King. Over the years, Silo-King performance was consistent and repeatable in reducing the PT of bunkers through inhibiting heat generation by preventing the oxidation of carbohydrates by plant respiration and spoilage organisms during the ensiling process.

Key Words: alfalfa silage, silage inoculant, silo heating

W129 Effect of harvest moisture, bale wrapping, and an organic acid on forage quality in grass. E. Allen*, K. Martinson, and C. Sheaffer, *University of Minnesota-Twin Cities*, *St. Paul*.

The relationship between forage moisture at baling and chemical composition has not been evaluated in grass hay intended for equine feed. Mold in hay is a serious risk and is known to cause respiratory problems in horses. The objective was to determine the relationship between moisture at time of baling, wrapping, and the application of an organic acid preservative on forage quality and mold growth in grass hay. Thirty-six 1.2 × 1.5 m first cutting orchardgrass round bales were randomized in a complete block design using 4 replicates of 3 target moistures: < 150

g/kg (LM), 200–250 g/kg (MM), and 300–350 g/kg (HM) (wet basis). In field bale moisture was estimated with a bale moisture probe. At baling, a commercially available organic acid hay preservative (Fresh CUT Plus) was applied at 4.5 kg/ton to bales containing MM and HM. After baling, bales were cored and samples were analyzed for chemical composition. Four LM (without preservative), 8 MM (4 with and 4 without preservative) and 4 HM (without preservative) moisture bales were individually wrapped with 6 mils of plastic. After 10 weeks, cores were taken on each bale to determine forage quality and mold counts. Data was analyzed using Proc Mix in SAS and mold counts were log-transformed. Actual moistures for hay baled at the targets of LM, MM, and HM averaged 120, 200, and 260 g/kg respectively. After 10 weeks, moisture content of MM and HM wrapped bales were maintained, while moisture of unwrapped bales decreased to 130 and 180 g/kg, respectively ($P = 0.01$). For all treatments, no changes over time were observed for CP (90 g/kg), ADF (390 g/kg), NDF (590 g/kg), and DE (2.04 Mcal/kg). For MM and HM, wrapping reduced ($P < 0.001$) mold growth (1,700 and 5,700 cfu/g, respectively) compared with no wrapping (4 million and 3 million cfu/g, respectively). The preservative did not reduce or inhibit mold growth at any moisture. Reducing mold growth and maintaining forage quality was achieved by baling dry hay (<150 g/kg moisture) and wrapping wet hay (200–350 g/kg moisture).

Key Words: harvest moisture, bale wrapping, organic acid

W130 Effects of sulfite-based preservatives on preservation and aerobic stability of alfalfa haylage and corn silage. C. J. Fu*, T. W. Clark, and D. V. Dhuyvetter, *Ridley Nutrition Solutions, Ridley Inc.*, *Mankato, MN*.

Experiments were conducted to determine the effects of forage preservatives on alfalfa (*Medicago* L.) haylage and corn (*Zea mays* L.) silage preservation and aerobic stability. Preservatives included sulfite-based commercialized and experimental products in liquid and dry forms. Experiments included laboratory and field trials of varying size that included 18-L pail and 20-ton bag testing. All experiments were completely randomized experimental design with 2 to 4 replications. Products were applied according to the label instruction and the same rates were applied for experimental products. For laboratory trials, whole plant corn at 40% DM with about 19 mm cut and first cutting alfalfa at 50%DM with 13 mm cut were harvested with a convention pull-type harvester. The packing density was 0.2 Kg DM per liter. For the field trial, first cutting alfalfa at 30% DM with 13 mm cut was harvested with the same type harvester and packed in 2.74 m wide Ag-Bag(Ag-Bag International Ltd.). Treatments included control (CONT) carrier only, liquid preservative (LIQP), bunk stabilizer dry form (STAD), experimental liquid preservative (EXPL), and experimental bunk stabilizer dry form (EXSTA). The mini-silo haylage test showed that EXPL significantly increased the lactic acid percentage of total VFA compared with CONT and LIQP, and showed a 5 to 10 times reduction in yeast and mold count ($P < 0.05$). The 82 d bag haylage test indicated that EXPL increased DM recovery from 93% to 98% ($P < 0.05$) compared with CONT. Laboratory aerobic stability tests of corn silage showed EXSTA held temperature lower by 11 to 16°C compared with CONT and STAD ($P < 0.05$) either at ambient (21°C) or warmer (27 to 35°C) temperatures. Furthermore, EXSTA reduced yeast and mold counts by 100 to 1000 times compared with those of STAD and CONT, respectively ($P < 0.01$). From these experiments, it can be concluded that EXPL and EXSTA have potential to improve alfalfa haylage and corn silage preservation in addition to bunk stability.

Key Words: alfalfa haylage, corn silage, preservatives

W131 Effect of alfalfa entries selected to tolerate agricultural machinery traffic on forage yield and regrowth. J. Santillano-Cázares*[1] and J. L. Caddel[2], [1]*Universidad Autónoma de Baja California*, *Mexicali, Baja California, México*, [2]*Oklahoma State University*, *Stillwater*.

It has been suggested that wheel traffic reduces alfalfa (*Medicago sativa* L.) yields and stand persistence. Thus, efforts have been made to select alfalfa cultivars to tolerate wheel traffic. The objective of this research was to determine if selected alfalfa entries out produced forage yields and regrowth rate non traffic-selected entries. The experiment was conducted on one of Oklahoma State University's experimental stations, in Stillwater, OK. Soil textures in the station were sandy-loam and loam. Twenty alfalfa entries were planted at 20 kg ha-1 on March 2002. The alfalfa entries tested included commercial varieties and experimental lines. Alfalfa entries included alfalfas selected for wheel traffic tolerance and not selected for wheel traffic tolerance. Entries were subjected to either traffic or no traffic. Traffic treatment was applied by driving the front and rear tires with a 100 horse power tractor over the plots during 3 years, 5 d after each harvest. The treatment structure was a 2 × 20 factorial and treatments were assigned by using a RCBD in a split-plot design structure, with 6 replications. Main plots were the traffic treatments and subplots were the alfalfa varieties. Plot size was 1 × 5 m (5 m^2) and the size of the sampling area was 0.6 × 5 m (3 m^2). Forage yields were measured in 2002, 2003, and 2004 from 1 × 5 m (5 m^2) plots. Regrowth was estimated only in the first harvest year of the study (2002) by measuring stem height from soil level to the tips of the stems, 5 d after harvest. The alfalfa entry × wheel traffic interaction was not significant ($P > 0.05$) for forage yields or regrowth rate. No interaction indicates that the selected entries were injured about the same as the normal entries (without selection) when driven on 5 d after harvests. It was concluded that under the actual environmental and management conditions of this study, alfalfa selection for traffic tolerance was ineffective. However, it clearly demonstrated that wheel traffic reduced alfalfa yields and should be avoided when possible.

Key Words: wheel traffic, alfalfa selection, yield

W132 Influence of maturity on leaf fiber and protein fractions of different alfalfa varieties. A. Palmonari*, M. Fustini, G. Canestrari, G. Biagi, and A. Formigoni, *Università di Bologna*, *Bologna, Italy*.

Impact of leaves on the hole plant fibrous and protein fractions in alfalfa is usually affected by harvesting systems and the preference for forage quantitative production.
Leaves are very rich in nitrogen and protein, being active in photosynthesis. On the other hand, leaves are more subject to the co-association between lignification and decreased amount of protein and soluble carbohydrates. Aim of this study was to determine how plant maturity influences fibrous and protein fraction in alfalfa leaves. Four alfalfa varieties (P, M, L, BC) were collected at three different stages of maturity (10, 20, and 30 d of age). All samples were collected using scissors, trying to preserve the integrity of the hole plant. After drying at 65°C, leaves were separated from stalks, ground, and analyzed chemically for NDF, ADF, ADL, CP, SolP, NPN, and NDIP. Data were analyzed using two-way ANOVA with alfalfa variety and time as the main effects. From Day 10 to Day 30, NDF decreased from 24.1 to 23.1%, while ADF and ADL increased from 16.2 to 18.0% and from 5.7 to 7.8%, respectively ($P < 0.01$). Among tested varieties, P contained ($P < 0.01$) less ADL (5.2 vs. 6.8, 6.9, and 7.7% for M, L, and BC, respectively) and ADF (15.7 vs. 17.6, 17.1, and 18.1% for M, L, and BC, respectively) and more NDF (24.4 vs. 23.5, 22.8, and 23.3% for M, L, and BC, respectively).

Average values of CP, SolP, NPN, and NDIP in alfalfa leaves were 28.8, 10.4, 9.7, and 28.3%, respectively. As expected, from Day 10 to Day 30, CP (−29%), SolP (−38%), NPN (−42%), and NDIP (−21%) decreased ($P < 0.01$). Variety of alfalfa had no significant effect on leaf protein content. These data suggest that maturity strongly influences the composition of alfalfa leaves. In conclusion, this study produces evidence that maturity increases ADL and reduces protein in leaves, thus reducing their nutritional value. Interestingly, maturity had no effect on ADF content of P leaves, suggesting a higher nutritional value of this variety.

Key Words: alfalfa leaves, maturity, chemical composition

W133 Effect of a bacterial inoculant on the quality of and nutrient losses from corn silage produced in farm-scale silos. O. C. M. Queiroz*[1], A. T. Adesogan[1], K. G. Arriola[1], and M. F. Queiroz[2], [1]*Department of Animal Sciences, University of Florida*, *Gainesville,* [2]*Department of Animal Sciences, UNESP*, *Jaboticabal, SP, Brazil*.

This project aimed to determine effects of applying an inoculant containing homofermentative and heterofermentative bacteria on the fermentation and aerobic stability of and nutrient losses from corn silage produced in farm-scale silos. Corn forage was harvested at 34% DM, treated without (Control) or with 1 × 106 cfu/g of *Lactobacillus buchneri* and *Pediococcus pentosaceus*, packed (45 tons) in quadruplicate into 3.7-m-wide Ag bags, and ensiled for 166 d. Silage removed from the bags (500 kg/d) was separated into spoiled (visibly darker, heating or moldy) and good portions and weighed for 35 d. Weekly composites were analyzed for chemical composition, aerobic stability (time to 2°C above ambient temperature) and fungal counts. The experiment had a completely randomized design. Data were analyzed with a model including treatment, time, and the interaction. Inoculation did not affect the chemical composition of the spoiled or good silage but decreased the quantity (5.7 vs. 12.9 kg/d; $P = 0.002$) and percentage (3.4 vs. 7.8; $P = 0.004$) of spoiled silage by over 50%. Losses of CP (0.23 vs. 0.92 kg/d; $P = 0.03$), gross energy (433 vs. 1842 kcal/d; $P = 0.02$), and NDF (1.34 vs. 4.12 kg/d; $P = 0.04$) in spoiled silage were less in inoculated versus Control silages. Inoculated silages had a lower pH (3.91 vs. 3.99; $P = 0.01$), lactate concentration (0.69 vs. 0.86%; $P = 0.04$), lactate: acetate ratio (0.61 vs. 1.41%; $P = 0.04$) and a greater acetate (1.15 vs. 0.73%; $P = 0.04$) concentration than the Control silage. Inoculated silages tended to have fewer yeasts (2.59 vs. 4.62, log cfu/g; $P = 0.07$) than Control silages, but aerobic stability did not differ (14.7 vs. 9.5 h; $P = 0.71$). The inoculant inhibited the growth of yeasts and substantially reduced the amount of spoilage and the associated energy and nutrient losses.

Key Words: *Lactobacillus buchneri*, *Pediococcus pentosaceus*, inoculant

W134 Changes in cell wall fractions and in vitro dry matter digestibility, of corn silage associated with additives. R. H. de Tonissi e Buschinelli Goes*, K. A. de Souza, K. A. G. Nogueira, D. de Faria Pereira, T. da Cunha Cornélio, M. G. de Menezes Gressler, E. R. de Oliveira, and K. C. da Silva Brabes, *Universidade Federal da Grande Dourados*, *Dourados, MS, Brasil*.

Corn plant, cut at 90 d after planting, was ensiled in 72 experimental silos in a completely randomized design, in a factorial square 4 × 6 (4 treatments and 6 d opening) with 3 replicates; and the averages compared by Tukey test at 5% probability, for evaluate the changes in cell wall fractions and in vitro dry matter digestibility (DMD) of corn silage associated with additives. The corn silage was associated with additive at 5% in natural matter, and the treatments were: soybean hulls (CS+5%SH), rice meal (CP+5%RM) and sunflower crushed (CS+5%SC). The control was composed of 100% of the corn plant (CS). The silos were opened 0, 28, 56, 84, 112 and 140 d. The pH showed ($P < 0.05$) reduction from 28 d of fermentation, with 112 d to the lowest value (3.39). All additives were able to reach a pH favorable to preservation of forages. There was a significant effect ($P < 0.05$) for inclusion of additives and time of opening, where the NDF decreased in their levels. The lower values of NDF occurred at 112 d (63.02, 65.46, 57.83 and 60.98% for CS, CS+5%SH, CS+5%RM and CS+5%SC, respectively). Reduction of NDF indicates the solubilization of the wall cell. There was effect ($P < 0.05$) of time of ensiling for hemicellulose (HCEL), and ADF. The HCEL reduced when increases the time of silage, no difference between the opening d 0 to 112; with average of 29.36%. ADF reduced to the extent until at 140 d, with value of 34.9%. Lignin and cellulose had effect for addition of additive ($P < 0.05$), where the addition of soybean hulls, rice meal and sunflower crushed reduced the lignin content of corn silage, averaging 10.6, 8.7 and 11.0%, respectively. The lignin content of corn silage was 12.2%. The addition of soybean hulls increased the cellulose content of silage, while the levels for CS, CS+5%RM and CS+5%SC, were 26.4, 24.3, 24.8%. DMD ($P < 0.05$), improved after 84 d of ensiling, with values of 69.3%. The DMD for day zero was 62.9%. The addition of 5% of additives changes the composition of the cell wall of corn silage. The in vitro digestibility of dry matter increased according to the time of ensiling.

Key Words: sunflower crushed, rice meal, soybean hulls

W135 Effect of oxygen barrier film on the storage temperature and top losses of corn silage in stack silo. F. C. Basso[1], R. A. Reis*[1], T. F. Bernardes[2], E. C. Lara[1], F. B. Assis[1], M. Nogueira[1], and A. P. T. P. Roth[1], [1]*UNESP/FCAV*, *Jaboticabal, São Paulo, Brazil*, [2]*UFRA*, *Bélem, Pára, Brazil*.

The aim this trial was to study the effect of the oxygen barrier film on the storage temperature and top losses of corn silage in stack silo. One trial was carried out on 1 commercial farm in Jaboticabal, Brazil, in 2009. Whole-corn crops were harvested at around the 50% milk-line stage and ensiled in stack silo. The covering treatments were: a sheet of 200-µm-thick black-on-white polyethylene film (ST) and a sheet of 45-µm-thick transparent oxygen barrier film (OB) plus a sheet of ST over the OB film. The stack silo was divided in 2 parts along the length: half was covered with ST film and half with OB plus ST film. Both films were secured with soil around the silo. During silo filling, 20 bags (10 for each treatment) containing 3.5 kg of herbage and one data logger were buried at the peripheral zone (15 cm of depth) of the silo to determine storage temperature and top losses of silage during the conservation period. After 45 d of fermentation, the bags were removed during feedout. The bags were weighed to determine dry matter (DM) losses. The DM content, number of yeasts and molds and pH value were measured. The storage temperature of corn silage under OB film always was lower than under ST film after 13 d of fermentation. The storage temperature was lower in corn silage under OB film until 5.1°C. The DM content was 25.86% in corn silage covered with ST film and 27.31% in corn silage under OB film ($P < 0.05$). The corn silage under the OB film had fewer molds compared with the silage under the ST film (3.93 vs. 4.61 Log_{10} CFU/g, respectively - $P < 0.05$). The number of yeasts (5.27 Log_{10} CFU/g under OB film vs. 5.93 Log_{10} CFU/g under ST film) and pH value (4.09 under OB film vs. 4.07 under ST film) did not differ ($P > 0.05$) between silages. The DM losses were 7.39% in silage covered with OB film, while in corn silage under ST film the DM losses were 10.18%, but this difference was not significant ($P >$

0.05). Oxygen barrier film plus polyethylene film reduced the storage temperature and the number of molds.

Key Words: polyethylene film, polyamide film, aerobic stability

W136 Effects of microbial inoculant on fermentation, microbial dynamics and aerobic stability of corn silage. F. C. Basso[1], R. A. Reis*[1], E. C. Lara[1], F. B. Assis[1], M. Nogueira[1], A. P. T. P. Roth[1], and T. F. Bernardes[2], [1]*UNESP/FCAV*, *Jaboticabal, São Paulo, Brazil*, [2]*UFRA*, *Bélem, Pára, Brazil*.

The aim of this trial was to evaluate the effects of microbial inoculant on fermentation, microbial dynamics and aerobic stability of corn silage. Whole-plant corn (350 g/kg) was ensiled in quadruplicate laboratory silos (7L) after the following treatments: untreated (control), *Lactobacillus buchneri* NCIMB 40788 (LB - 1×10^5 CFU/g of fresh forage), *Bacillus subtilis* (BS - 1×10^5 CFU/g of fresh forage), *Propionibacterium acidicipropionici* MA26/4U (PA - 1×10^5 CFU/g of fresh forage), *Lactobacillus plantarum* MA18/5U (LP - 1×10^5 CFU/g of fresh forage), *L. buchneri* plus *L. plantarum* (LBLP), *B. subtilis* plus *L. plantarum* (BSLP) and *P. acidicipropionici* plus *L. plantarum* (PALP). After 96 d of ensilage, silos were opened, spolied forage discarded and the remainder was homogenized and placed in plastic buckets and maintained in a closed place at room temperature. To determine aerobic stability (AS), silage temperature was measured every half hour by a data logger inserted in the center of mass during the aerobic exposure and room temperature (average 24°C) was measured by data logger placed near the experimental silos. Dry matter content (DM), pH value, ammonia nitrogen (NH3/TN) content and yeasts and molds counts (Log CFU/g) in potato dextrose agar were measured. The statistical analysis included one-way ANOVA and Tukey's test ($P < 0.05$). The DM, NH3/TN and molds counts were not different among treatments. The pH value was lower in silages without inoculant and with *P. acidicipropionici* ($P < 0.05$). The corn silage with *L. buchneri*, *L. buchneri* plus *L. plantarum*, *B. subtilis* and *P. acidicipropionici* had lower number yeasts and improved aerobic stability ($P < 0.05$). The microbial inoculant with heterofermentative bacteria and the association between *L. buchneri* plus *L. plantarum* is effective in decreasing the numbers of yeasts and improves the aerobic stability of corn silage.

Table 1. Fermentation, microbial dynamic and aerobic stability of corn silage with microbial inoculant.

Treatments	DM	pH	NH3/NT	Yeasts	Molds	AS
Control	34.92	3.81b	5.17	3.99a	3.80	23.33d
LB	34.11	3.87ab	5.02	1.25b	3.85	100.42a
BS	34.32	3.86ab	4.85	1.0b	4.0	78.42abc
PA	33.91	3.81b	4.9	2.39ab	3.55	70.25bc
LP	34.05	3.87ab	5.56	3.86a	3.8	54.75c
LBLP	34.46	3.89a	5.52	2.58ab	3.65	87.08ab
BSLP	35.06	3.83ab	5.03	3.34a	4.37	52.67c
PALP	35.58	3.85ab	4.64	3.89a	3.57	58.75c

Means followed by equal letters do not differ by Tukey test ($P>0.05$).

Key Words: heterofermentative bacteria, homofermentative bacteria, *Lactobacillus buchneri*

W137 In vitro gas production and microbial protein synthesis in alfalfa-timothy mixtures. F. Hassanat*[1], G. Tremblay[2], G. Allard[3], G. Bélanger[2], A. Bertrand[2], Y. Castonguay[2], R. Michaud[2], and R. Berthiaume[1], [1]*Agriculture and Agri-Food Canada*, *Sherbrooke, Qc, Canada*, [2]*Agriculture and Agri-Food Canada*, *Quebec, Qc, Canada*, [3]*Faculté des sciences de l'agriculture et de l'alimentation, Université Laval*, *Quebec, Qc, Canada*.

Forage diets containing an optimal balance between crude protein (CP) and nonstructural carbohydrates (NSC) sources maximize microbial protein (MP) yield and minimize NH_3 output, which would improve metabolizable protein availability to animals. Impact of increasing the ratio of NSC:CP on in vitro gas production (IVGP) and MP yield was investigated by increasing the proportion of grass in legume:grass mixtures. In a completely randomized block design, triplicates of alfalfa:timothy mixtures of 100:0, 75:25, 50:50, and 25:75 (DM basis) were incubated for 24h using ANKOM^{RF} gas production monitoring system in separate days. Gas production data were fitted to a Michaelis-Menten model to estimate gas production parameters. Incubation residues were refluxed with neutral detergent fiber (NDF) solution to isolate MP from undegradable residues. Linear ($P_{lin.}$) and quadratic ($P_{quad.}$) components of the effects of treatments were determined. Increasing timothy proportion linearly increased NSC and NDF but reduced CP concentration; maximum changes with highest timothy proportion compared with alfalfa alone were +44% for NSC, +49% for NDF, and −48% for CP. These changes increased IVGP from 308 to 352 mL gas g^{-1} OM ($P_{lin.} < 0.01$), increased time to ferment 50, 75 and 90% of the substrate ($P_{quad.} < 0.05$) and reduced maximal degradation rate from 0.18 to 0.16% h^{-1} ($P_{lin.} < 0.01$). In vitro true dry matter degradability was highest for alfalfa alone and decreased ($P_{lin.} < 0.01$) as timothy proportion increased. The amount of substrate available to rumen microbes was therefore reduced when the proportion of timothy increased which in turn reduced MP yield ($P_{lin.} < 0.05$). However, when expressed on a CP basis, MP yield increased ($P_{quad.} < 0.05$) with increasing timothy proportion. The reduction of NH_3 concentration ($P_{lin.} < 0.01$) with increasing timothy proportion suggests that the dietary protein was utilized more efficiently for MP synthesis. Although MP yield per g dry matter was highest for alfalfa alone, the 25:75 alfalfa:timothy mixture supplied the best NSC:CP ratio for efficient in vitro MP synthesis.

Key Words: in vitro gas production, forage mixture, microbial protein

W138 Prediction of Tanzânia grass dry mass production using agrometereological parameters. L. C. Araujo*[1], P. M. Santos[2], J. R. Pezzopane[2], and P. G. da Cruz[1], [1]*"Luiz de Queiroz" College of Agriculture/USP*, *Piracicaba, São Paulo, Brazil*, [2]*Embrapa Southeast Cattle*, *São Carlos, São Paulo, Brazil*.

Mathematical models that predict the effect of climatic variables over forage production may be used as a decision support toll on farms. The objective of this study was to determine the effect of climatic events on *Panicum maximum* cv. Tanzânia (Tanzânia grass) production and parameterize models to predict forage accumulation rate. Tanzânia grass was cultivated in São Carlos, SP, Brazil (21°57′42″ S, 47°50′28″ W, altitude 860 m). Pastures were fertilized during the raining season and rotationally grazed all around the year. Data from 53 periods of pasture growth, between 1999 and 2005, were used to verify its relation with climatic variables. Daily temperature (maximum, minimum and mean), rain and solar radiation were monitored. Growing degrees days was calculated considering 17°C as lower basal temperature. Potential evapotranspiration (Eto) and actual evapotranspiration (Eta) were calculated based on water balance for every 5 d. Growth index (GI) was calculated using minimum temperature, solar radiation and the relationship between Eta/Eto. To estimate the effect of water availability on forage production, the relationship between Eta and Eto was used as a factor to penalize the accumulation of energy, measured as growing degree days or solar radia-

tion. Linear and exponential regression analysis was done to determine the relationship between forage accumulation rate (dependent variable) and climatic parameters (independent variable). Results confirm that herbage accumulation rate depends on climatic variables. The coefficient of determination was higher when both energy and water availability was considered on the model: Eta (R^2 = 0.85), growing degree days corrected by Eta/Eto (R^2 = 0.83) and GI (R^2 = 0.81). It was concluded that Eta, growing degree days corrected by Eta/Eto and GI may be used to predict Tanzânia grass herbage accumulation rate when climate is the major limitation factor for forage production.
Supported by FAPESP.

Key Words: mathematical models, tropical grass, weather

W139 Effects of chemical additives on the ensilage of sugarcane. A. F. Pedroso*, W. Barioni Jr., G. B. Souza, and V. R. Del Santo, *Brazilian Agricultural Research Corporation - Embrapa*, *São Carlos, SP, Brazil*.

The objective was to evaluate efficacy of chemical additives at controlling alcoholic fermentation and DM losses and increasing aerobic stability (AE) of sugarcane silages. Mechanically harvested sugarcane (12 mo old; 22° Brix; DM: 330 g/kg) was ensiled in 15 × 30 cm PVC tubes (4 replicates/treatment). Nine treatments were applied to the forage at ensiling (fresh basis): untreated - Control; urea (5 g/kg) + sodium benzoate (0.5 g/kg) - UB1; urea (7.5 g/kg) + benzoate (0.5 g/kg) - UB2; urea (5 g/kg) + benzoate (0.75 g/kg) - UB3; urea (7.5 g/kg) + benzoate (0.75 g/kg) - UB4; sodium propionate at rates of 1, 2 and 4 g/kg - PROP1, PROP2 and PROP3, respectively; calcium hydroxide (10 g/kg) - CA. Additives were applied in aqueous solutions. Minisilos were weighed and sampled on d 0 and 78 d after ensiling. Dry matter loss (DML) was calculated and aerobic stability was defined as the time (h) that elapsed before the temperature of aerated silages exceeded room temperature by 2°C. Data were analyzed as a completely randomized design and differences among means were tested using *t*-test. Control silage presented characteristic high ethanol content, high DML and poor AE (Table 1). Silage treated with CA had 90% less ethanol and 69% lower DML relative to control ($P < 0.05$). Ethanol content and DML did not differ ($P > 0.05$) between the lowest doses of urea + benzoate (UB1) and CA and higher doses of urea and benzoate (UB2, UB3, UB4) were not more effective than UB1. Among propionate treatments, only PROP3 reduced ($P < 0.05$) simultaneously ethanol content and DML in the silage compared with control (64% and 76% less, respectively). Only CA improved ($P < 0.05$) silage AE compared with control. pH values differed among treatments but all values indicated adequate conservation.

Table 1. Fermentation parameters and aerobic stability of experimental silages

Treatment[1]	pH	Ethanol (g/kg DM)	DM loss (g/kg DM)	Aerobic stability (h)
Control	3.50^{e}	76.2^{ab}	188^{a}	40^{bc}
UB1	3.64^{cd}	26.5^{cd}	88^{cd}	41^{bc}
UB2	3.73^{b}	34.7^{c}	77de	34^{c}
UB3	3.69^{bc}	29.6^{c}	115^{bc}	48^{ab}
UB4	3.70^{b}	28.7^{c}	65de	42^{bc}
PROP1	3.54^{e}	58.2^{b}	129^{b}	45^{bc}
PROP2	3.63^{d}	79.1^{a}	164^{a}	46^{bc}
PROP3	3.67^{bcd}	27.2^{c}	46^{e}	52^{ab}
CA	3.94^{a}	7.4^{d}	58de	60^{a}
SE	0.04	11.5	19	7

[1]Refer to the text; [abc] Means in columns with unlike superscript differ ($P < 0.05$) by the *t*-test.

Key Words: aerobic stability, alcoholic fermentation, silage

W140 Effect of cutting management (PM vs. AM) and maceration on forage total nonstructural carbohydrates concentration and cattle preference. G. Raggio*[1], A. L. Tucker[1], M. Mongeon[2], R. Bergeron[1], and R. Berthiaume[3], [1]*Campus Alfred Université de Guelph*, *Alfred, Ontario, Canada*, [2]*Ministry of Agriculture, Food and Rural Affairs*, *Alfred, Ontario, Canada*, [3]*Dairy and Swine Research & Development Centre, Agriculture and Agri-Food Canada*, *Lennoxville, Canada*.

The aim of this study was to assess the effect of hay made from forage cut at sundown (PM) or sunup (AM) and macerated or not (control) on forage nonstructural carbohydrates (NSC) and cattle preference. Half of a timothy-alfalfa field at the late bud stage was cut at 18:00 whereas the second half was cut at 0600 h the next morning. Half of both the PM and AM cut were then macerated at 0900 h on d 2 with the remaining quarters being left to wilt without maceration (control). Hay was field dried, baled, and chopped before usage. A preference trial was conducted over 6 consecutive days with 6 Holstein heifers. During adaptation, hay from each treatment was offered alone as meals. Four treatments were used: AM control, AM macerated, PM control and PM macerated. Each possible pair of the 4 treatments (n = 6) was randomly assigned to the animals (one pair d-1), over 6 consecutive days. Two heifers at a time were moved to an adjacent pen separated in 2, offered 2 kg of each type of hay in adjacent tubs, and allowed 30 min to eat. Intake was calculated as the difference between hay offered and leftover. Hay samples were collected during the 6 experimental days and pooled by treatment. Heifer positions in the pen, treatments and treatment positions (left or right) were randomized daily. Data were analyzed as a multidimensional scaling and also by ANOVA with a model including animal effects and hay. Orthogonal contrasts were used to test for cutting time, maceration and cutting time × maceration effects. Feed composition (DM basis) was not affected by treatments (DM 88 ± 0.7%, CP 10 ± 0.7%, ADF 39 ± 1.0%, NDF 64 ± 1.8%). However, cutting time (AM vs. PM) tended to affect NSC concentration (24 vs. 25 ± 0.4%, $P = 0.09$). Overall, cutting in PM vs. AM (1359 vs. 754 ± 112 g DMI, $P = 0.01$) and macerating vs. control (1521 vs. 592 ± 112 g DMI, $P < 0.01$) increased hay consumption. There was no interaction between cutting time and maceration. These results suggest that both mowing in the PM and maceration were effective at increasing short-term dry matter intake.

Key Words: preference, cattle, conditioning