

improved herd management. To date, five of the 20 farms have received Level Two Certification. In conclusion, the TU MGPC program provided producers with valuable information necessary for meat goat producers to become competitive in this global economy.

**Key Words:** goats, extension, producer education

**W112 Influence of citronella and geranium essence treatment on milk aroma.** S. Carpino<sup>1</sup>, G. Belvedere<sup>1</sup>, T. Rapisarda\*<sup>1</sup>, G. Azzaro<sup>1</sup>, and G. Licitra<sup>1,2</sup>, <sup>1</sup>CoRFiLaC, Regione Siciliana, Ragusa, Italy, <sup>2</sup>D.A.C.P.A. University of Catania, Italy.

A commercial mix containing geranium and citronella essence was used in a farm against flies. Several authors report volatile compounds can be transferred by breath and skin to blood and consequently to milk. This study was performed in a dairy cow farm located in the South of Sicily. The aim of this study was to detect the influence of geranium and citronella essence treatment on milk aroma profile at different times. Geranium and citronella mix was spread on lactating cows through the farm cooling system. Milk samples were collected at 0 (M0), 12 (M12), 24 (M24) and 36 (M36) hours from mix spreading and then analyzed.

SMart Nose system (LDZ, Switzerland) allowed the direct analysis by MS of volatile organic compounds (VOCs). Dynamic headspace extraction (Purge&Trap) (Tekmar 8900) in combination with a gas chromatograph olfactometry/mass selective detector (GC/MSD/O) were also used to analyze the odour active compounds of milk samples. Sensory analysis, using triangle test technique, was also performed on M0 and M12 milk samples, by CoRFiLaC staff in Ragusa, Italy. Principal Component Analysis (PCA) applied to SMart Nose results had a good separation (PC1 55.96%; PC2 12.04%) among the four groups of milk samples. This result clearly indicated that, at different times of treatment, samples showed different volatile compounds. Moreover, GCO results demonstrated that M0 milk samples had the richest profile among the M12, M24 and M36 respectively. Triangle test confirmed ( $p < 0.001$ ) all the instrumental results and clearly indicated a difference between treated and no treated milk. The different aroma profiles in milk samples are strongly correlated to the volatile components of the mix treatment. Further, studies are needed to better understand if different concentrations of these mixes might be used without interfering with milk and eventually cheese flavour. This would be a good practical application for farmers in order to improve cow comfort, health and safety in their farm.

**Key Words:** milk, volatile compounds, geranium citronella essence

## Forages and Pastures: Silages

**W113 Relationship of corn silage dry matter content to density in bunker silos.** K. E. Griswold\*<sup>1</sup>, P. H. Craig<sup>2</sup>, and S. K. Dinh<sup>1</sup>, <sup>1</sup>Penn State Cooperative Extension, Lancaster, <sup>2</sup>Penn State Cooperative Extension, Dauphin.

Dry matter (DM) content and density of corn silage (CS) was investigated in 103 bunker silos and piles over a 5-year period. For each silo/pile, 12 samples were collected using a 5.08 cm diameter stainless-steel coring tube driven by a gas-powered drill. Core depth was recorded to the nearest 0.64 cm, and wet weight was determined on a digital scale. Sample DM was determined with a Koster Crop Tester. Density was calculated by dividing core dry weight by core volume. Cores were collected at three vertical levels, bottom  $\approx$  1 m from silo floor, top  $\approx$  1 m from top edge, and middle  $\approx$  equidistant between bottom and top. At each level, cores were collected horizontally at four locations, I and IV within 2.4 m of the outside edges, and II and III equidistant between I and IV. Data were analyzed using PROC REG and RSREG within SAS. When individual core density and DM content were regressed, there was a significant quadratic relationship ( $P < 0.0001$ ,  $R^2 = 0.13$ ). However, when level and location were included in the model as covariates, the strength of the relationship increased ( $R^2 = 0.43$ ). Location was not significant in the model. These results suggest that DM content of corn silage is weakly related to density within bunker silos/piles and that level at which density is measured has a greater impact on density than DM content. Regression of the silo/pile average density and DM content showed a significant quadratic relationship ( $P < 0.0001$ ,  $R^2 = 0.28$ ), which suggested that DM content of corn silage may have greater impact on overall density of corn silage in silo/pile than density at specific positions within a silo/pile.

**Key Words:** corn silage, dry matter, density

**W114 Biomass yield and nutritive value of three forages for silage.** R. L. Holness\*, N. C. Whitley, and K. Baldwin, North Carolina A&T State University, Greensboro.

A two yr study was conducted to measure the biomass yield and nutrient content of three forages for potential silage use. Forages used were conventional (Round-Up Ready®; CC) and organic (OC) corn (*Zea mays*) and pearl millet (*Pennisetum americanum*; PM). Plots measuring 18x18 m were used in a completely randomized design with four replications. Fertilization considered organic status as well as soil test recommendations. Forages were seeded at recommended rates and harvested at the same time both years. Four weeks after planting, CC was treated with glyphosate. Areas of 3.05 x 3.05 m were manually sampled to a 10-cm stubble height. Samples were weighed to determine fresh biomass accumulation, fed into a silage flail-type mower conditioner and sub-sampled for nutritional content analysis by near infrared reflectance spectroscopy (Dairy One, Ithaca, NY). Biomass yield was influenced by a forage x yr interaction ( $P < 0.01$ ). Corn forages had greater ( $P < 0.05$ ) yields than PM for both years, however, CC and OC yield were similar in yr 1 but CC was greater than OC for yr 2 (a year with less rainfall). Both forage type and year influenced CP, TDN and NSC ( $P < 0.05$ ) with values higher for yr 1 than yr 2 and higher for CC and OC (which were similar) than for PM. Values for ADF, NDF and Ca were influenced by treatment ( $P < 0.001$ ) with CC and OC values being similar but lower than that for PM. Variety and year both influenced levels of P, K, and Mg ( $P < 0.05$ ). Corn forages had similar levels for both years but P was higher than PM in yr 1, lower in yr 2; K was lower in PM for yr 1 than yr 2 and PM Mg was similar to CC but lower than OC in yr 1 and lower than both CC and OC in yr 2. Overall, corn produced silage with greater biomass and better nutritional values than PM with organic and conventional corn silage forages having similar nutrient profiles.

**Key Words:** organic corn, pearl millet, silage



### W118 Using molecular techniques to identify and differentiate bacterial species and strains used in commercial silage inoculants.

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One of the problems encountered when analyzing the bacterial profiles found in silage inoculants is that they may contain a mixture of closely related species and strains which exhibit similar biochemical properties. However the advancement in molecular techniques has led to the development of a number of methods which enable this problem to be overcome. In this study, a DNA fingerprint method was used to identify species of bacteria present in commercially available silage inoculants; specific primers were used to identify isolates of *Lactobacillus buchneri* from these samples, and RAPD-PCR was used to differentiate closely related isolates of this organism and compare them to *L. buchneri* 40788. Commercial preparations (5) which contained *L. buchneri* were plated out. DNA was extracted from each plate and amplified. The resulting amplicons were separated by TTGE and the band positions compared with known standards (*L. buchneri*, *L. casei*, *E. faecium*, *L. plantarum*). In most instances, the package label corresponded to what was found in the packet except one sample which was supposed to contain *L. buchneri* did not appear to contain any viable cells of this organism as seen by the absence of a *L. buchneri* band. Further attempts to use *L. buchneri* specific primers on this preparation also did not produce a reaction, confirming this. To differentiate between strains of *L. buchneri*, single colonies were isolated from each commercial sample. Each isolate was Gram stained and those which resembled *L. buchneri* in morphology were selected, their DNA extracted and amplified using specific primers. Those which gave a positive reaction were then subjected to RAPD-PCR using 5 different primers and compared with the corresponding fingerprint of *L. buchneri* 40788. All were different to 40788 however, some of these new isolates only exhibited minor differences to each other, indicating that they were very closely related. A rapid method has been developed which can enable the identification and differentiation of different species of lactic acid bacteria and strains of *L. buchneri* commonly used in commercial silage inoculants.

**Key Words:** *L. buchneri*, silage, fingerprint

### W119 Sorghum forage as an alternative to corn silage in dairy cows feeding.

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Aim of the study was to study the possibility of substituting corn silage with low lignin (brown midrib, BMR)-sorghum silage in the diet of lactating cows. Two TMRs containing BMR333 single harvest sorghum forage silage (SF) or corn silage (CS) were fed to 60 Holstein dairy cows in a change-over design. Diets included (dry basis) 26.3% CS or 17.3% SF, 6.0% alfalfa hay, 11.0% Italian ryegrass hay and 56.6% or 65.7% concentrate for CS or SF diet, respectively. Diets had 15.5% CP, 31.5% aNDFom and 24.2% starch, on DM. Due to the low SF starch content (2.8% on DM), a higher amount of corn meal was included in the SF diet (5.7 vs 8.0 kg/d). Forages were also incubated *in situ* to determine rumen degradability and degradation rate ( $k_d$ ) of NDF. All data were statistically analyzed by SAS-GLM procedure. DMI was not affected by diet (24.4 vs 25.4 kg/d for CS and SF fed cows). Milk yield (32.6 and 33.1 kg/d for CS and SF diets), milk fat (4.16% for both diets) and milk protein (3.42 and 3.40% for CS and SF diets) were not affected by dietary treatment (NS). MUN was lower in the diet CS (9.2 vs 9.9 mg/dl;

$P < 0.001$ ); this was probably due to the higher starch fermentability of corn silage as compared to corn meal, included at a higher proportion in the SF diet, resulting in a better N utilization for CS diet. The rate of aNDFom degradability ( $k_d$ ) was higher for SF, although only a trend was detected. On the other hand potentially degradable aNDFom (a+b) was higher for CS; thus, effective degradability was not different between the two forages (table 1), confirming the results obtained *in vivo*. BMR sorghum silage can be effectively used in dairy cow feeding, provided starch content of the diet is balanced.

**Table 1. *In situ* rumen DM and aNDFom degradability**

	DM				aNDFom			
	CS	SF	SE	P	CS	SF	SE	P
a <sup>1</sup> (%)	33.1	23.7	0.44	***	3.63	3.27	1.08	NS
b <sup>2</sup> (%)	46.3	48.7	0.23	**	67.3	63.3	1.55	NS
k <sub>d</sub> (%/h)	3.3	3.3	0.19	NS	2.5	3.10	0.17	0.07
a+b <sup>3</sup> (%)	79.4	72.4	0.39	***	70.9	66.6	0.71	*
Effective deg <sup>4</sup>	49.5	40.8	0.73	**	21.5	21.8	1.11	NS

\* $P < 0.05$ ; \*\*  $P < 0.01$ ; \*\*\*  $P < 0.001$ . <sup>1</sup>soluble fraction; <sup>2</sup>degradable fraction; <sup>3</sup>potentially degradable fraction; <sup>4</sup>effective degradability with a passage rate of 6%/h

**Key Words:** sorghum forage BMR, dairy cow, NDF degradability

### W120 Nutritive value and fermentation profile of sorghum silages with urea and two storage periods.

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The objective of the study was to determine the effects of doses of urea (0.0, 2.5, 5.0, and 7.5%, DM base) and storage periods (30 and 60 days) on the chemical composition, IVDMD, NH<sub>3</sub>-N, pH values and WSC of the silages. The addition of urea doses showed a quadratic effect upon DM content. The smallest estimated DM content of silage (21,87%) was observed at 5,69% of urea dose added. The urea addition in the ensiling process of sorghum increased the CP, NDIP, and IVDMD and reduced the NDF, ADF, cellulose and lignin contents. To the fermentative characteristics of the silages, the urea doses had a quadratic effect in the NH<sub>3</sub>-N contents. The pH values of the silages increased linearly. There was effect of the silage periods on the NH<sub>3</sub>-N content and pH value. However, the urea addition in the ensiling process of sorghum did not cause any significant change in reducing the fermentative characteristics of the silages. The nitrogen fractions of the silage were influenced by the urea addition, being verified positive linear effect for the A fraction, negative linear effect for B1+B2, B3 and C fractions. It was detected a linear reduction of CT contents in function of the urea addition. The fractions of CT were influenced by urea addition, being verified negative linear effect on the content of A+B1 fractions; positive linear effect on the B2 and C fractions for the storage period of 60 days. The addition of urea in the ensiling process of sorghum can reduce losses by fermentation and increasing the nutritive value of the silage.

**Key Words:** ensilage, digestibility, ammoniation



**W121 Elephantgrass with and without wilting, added of cassava meal in silage production.** R. Garcia\*<sup>1</sup>, A. C. Oliveira<sup>1</sup>, A. J. V. Pires<sup>2</sup>, O. G. Pereira<sup>1</sup>, and F. E. P. Fernandes<sup>1</sup>, <sup>1</sup>Federal University of Viçosa, Viçosa, MG, Brazil, <sup>2</sup>State University of Bahia, Itapetinga, Ba, Brazil.

Two experiments were conducted, using a completely randomized design, to evaluate the nutritive value, fermentative characteristics and losses in elephantgrass with and without wilting and added cassava meal (0; 7.5; 15 and 22.5% natural base), in the ensiling process and to determine protein and carbohydrate fractions of silage. In experiment I, wilting associated with cassava meal was efficient to increase dry matter (DM) content, to minimize DM losses and to reduce crude protein (CP), acid detergent insoluble nitrogen, neutral detergent fiber, neutral detergent fiber ash and protein free, acid detergent fiber, and celluloses contents. Cassava meal addition in elephantgrass silage production caused reduction in ether extract, hemicellulose and lignin contents and increased organic matter content, in vitro DM digestibility, and total digestible nutrients. The wilting treatment had effect only in neutral detergent insoluble nitrogen content. It was observed quadratic effect of without wilting on pH and butyric acid, with pH showing minimum value of 3.7% in 15.9% cassava meal level. It was observed quadratic effect of without wilting on ammonia nitrogen and acetic acid but linear effect of wilting on ammonia nitrogen and acetic acid. In experiment II the regression analysis detected a linear increase of total carbohydrates (TC) content as a function of cassava meal addition. The association of wilting with different levels of cassava meal influenced the TC fractions (A+B1 and B2), but did not have effect on nitrogen fractions (A and B1+B2). The wilting of elephantgrass associated to cassava meal was efficient to reduce the moisture and the losses in the silage. The cassava meal improved the in vitro DM digestibility. The level of 22.5% of cassava meal (natural base) in the ensiling process of elephantgrass (19.5% DM) can be recommended to improve the nutritive value and fermentative characteristics of silage.

**Key Words:** digestibility, *Pennisetum purpureum*, by-product

**W122 Effects of ensiling corn and sorghum silages under normal or adverse conditions on proportions of long chain fatty acids.** B. C. do Amaral<sup>1</sup>, S. C. Kim<sup>2</sup>, O. F. Zacaroni<sup>1</sup>, A. T. Adesogan<sup>1</sup>, and C. R. Staples\*<sup>1</sup>, <sup>1</sup>University of Florida, Gainesville, <sup>2</sup>Gyeongsang National University, Jinju, South Korea.

The objective was to determine the effect of ensiling regime and storage duration on long chain fatty acid (LCFA) profiles of corn (CS) and sorghum silages (SS). Corn (Pioneer 30F34) and sorghum (NK300) forages, grown at the University of Florida, were ensiled at 31 and 36% dry matter, respectively. Chopped forages were packed into 20-L silos in triplicate and ensiled for 0, 7, 21 and 156 d. Half of the silos were sealed immediately and stored at 24°C (normal ensiling) and half were placed in a 30°C room for 48 h before sealing and storage at 30°C (adverse ensiling). Silages were subsampled, freeze-dried, ground, and analyzed for FA using gas chromatography. Sorghum silage had greater ( $P < 0.05$ ) concentrations of total FA (1.90 vs. 1.80% of DM), 18:1n-9 (20.9 vs. 19.5% of FA), and C18:3n-3 (17.9 vs. 15.6% of FA) than CS whereas CS had greater concentrations of C16:0 (23.8 vs. 20.0% of FA) than SS. Adverse ensiling tended to increase ( $P=0.06$ ) total FA concentration over time (18.9 vs. 18.2% of DM), increased proportions of C16:0 (22.3 vs. 21.5% of FA) and C18:0 (3.1 vs. 2.7% of FA) but decreased proportions of C18:2n-6 (36.6 vs. 38.5% of FA) across both silage types. The effect of storage duration on the proportions of individual FA differed between CS and SS. The proportions of C18:3n-3 decreased linearly with storage duration but the decrease was greater for SS (20.2, 19.7,

and 13.8% of FA) than for CS (16.2, 16.5, and 14.1% of FA for 0, 7, and 156 d of ensiling, respectively). In contrast, proportion of the other unsaturated FA, C18:1n-9 and C18:2n-6, increased with storage duration. In silages prepared under adverse conditions, the proportion of C18:3n-3 in silage did not decrease dramatically until 156 d whereas proportions of C18:3n-3 decreased at both 7 and 156 d of ensiling in silos ensiled under normal conditions. Approximately 13 to 31% of linolenic acid was degraded in corn and sorghum silage during ensiling but proportions of linoleic acid remained relatively unchanged.

**Key Words:** silage, ensiling time, fatty acid

**W123 Nutritive value of corn hybrids for silage production according to the maturity stage.** M. Zopollatto\*<sup>1</sup>, L. G. Nussio<sup>1</sup>, J. O. Sarturi<sup>2</sup>, G. B. Mourão<sup>1</sup>, A. P. Duarte<sup>3</sup>, C. M. M. Bittar<sup>1</sup>, and V. P. Santos<sup>1</sup>, <sup>1</sup>University of Sao Paulo/ESALQ, Piracicaba, SP, Brazil, <sup>2</sup>University of Nebraska, Lincoln, <sup>3</sup>Apta Regional, Assis, SP, Brazil.

The objective of this study was to evaluate the nutritive value of corn hybrids for silage production harvested across maturity stages A randomized block design, with an 8×6×2 factorial scheme based on eight harvesting ages, six corn silage hybrids and two 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 days later and weekly, totalizing eight harvesting times. Maturity advance resulted in increases ( $P < 0.05$ ) in the mean starch content (1.8 to 26.1%) and digestible dry matter production (5.9 to 16.3 t/ha –DDMP). However, decreases ( $P < 0.05$ ) in forage neutral detergent fiber – NDF (71.9 to 52.8%); digestible NDF (64.7 to 54.4%) and crude protein (12.5 to 7.0%) were observed across the time. The in vitro true dry matter digestibility (IVTDMD) did not ( $P > 0.05$ ) changed along maturity stage (71.8 to 72%) At the ensiling stage (30–35% DM – at the 5th harvesting age, from 94 to 105 days after seeding) P3041, AG 1051 and Z 8550 hybrids showed the most desirable quality characteristics for silage production: the lowest ( $P < 0.05$ ) NDF content (54.9; 55.2 and 55.1%, respectively) and the highest ( $P < 0.05$ ) digestible NDF content (60.0; 62.4 and 61.0%, respectively), IVTDMD (75.4; 74.3 and 75.6%, respectively) and DDMP (14.4; 14.3 and 13.9 t/ha, respectively). Furthermore, AG 1051 and CO 32 hybrids showed the highest ( $P < 0.05$ ) starch content (23.5 and 20.9%, respectively) at the ensiling stage. The forage nutritive value is a result of the interactions between fiber and starch kernel contents and differences observed across the maturity indicated that the maximum forage nutritive value for setting a harvesting window may differ among cultivars.

**Key Words:** digestibility, fiber, starch

**W124 Nutritional quality of sunflower silage associated with additives.** R. H. de Tonissi e Buschinelli de Goes\*<sup>1</sup>, K. A. de Souza<sup>1</sup>, E. S. Myagi<sup>3</sup>, R. A. Patussi<sup>1</sup>, K. C. da Silva Brabes<sup>1</sup>, A. C. Martinez<sup>2</sup>, C. O. de Abreu<sup>2</sup>, E. R. de Oliveira<sup>1</sup>, and D. D. Alves<sup>4</sup>, <sup>1</sup>Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brazil, <sup>2</sup>Universidade Estadual de Maringá, Umuarama, Paraná, Brazil, <sup>3</sup>Universidade Federal de Goiás, Goiânia, Goiás, Brazil, <sup>4</sup>Universidade Estadual de Montes Claros, Janaúba, Minas Gerais, Brazil.

Sunflower (20.0% DM and 10.0% CP) was ensiled in 36 experimental silos in a randomized design, in a factorial square 4x3 (four treatments,

three days of opening) with three replicates; to evaluate the effect of the addition of soybean hulls, sunflower crushed seeds and urea on the nutritional quality of sunflower silage. The averages were analyzed by the Tukey test to 5% of probability. The treatments were: Control (100% of Sunflower plants - SS), SS + 5% of soybean hulls, SS + 5% of crushed sunflower seeds and SS + 5% of urea. The silos were opened at 14, 21 and 28 days after ensilage. There was no effect ( $P > 0.05$ ) for day of opening, or addition on organic matter (OM), neutral detergent insoluble protein (NDIP), mineral matter (MM), neutral detergent fiber (NDF) or acid detergent fiber (ADF), (mean = 91.12, 8.66, 9.29, 62.54, 46.02%, respectively). Dry matter (DM) and ether extract (EE) presented interaction for addition and days of opening ( $P < 0.05$ ). 5% of soybean hulls increased the DM after 28 days of ensilage (34.9%), for the crushed sunflower seeds the MS were higher after 21 days (31.7%). The DM of SS at 28 days was 26.4%. The addition of 5% crushed sunflower seeds presented higher EE to the 28 days of ensilage (6.96%). The control presents at 28 silage day of 4.8% EE and 26.4% DM. There was an effect on crude protein (CP), acid detergent insoluble protein (ADIP) and total carbohydrates (TC), for additions ( $P < 0.05$ ), but not for opening dates. Urea provided increment of nitrogen's fractions, and consequently larger crude protein and acid detergent insoluble protein (23.5 and 1.3% DM), while others treatments presents a media of 11.8% and 0.8% of AIPD. The addition of 5% of soybean meal and crushed sunflower seeds increased the total carbohydrates in sunflower silage (76.9 and 71.5%), this didn't happen with the urea addition (63.1%). The SS presents total carbohydrates of 73%. The addition of urea provides a higher CP and ADIP and 5% of sunflower crushed seeds and soybean hulls increases DM and EE after 21 days of silage and the total carbohydrates of sunflower silage.

**Key Words:** crushed sunflower seeds, soybean hulls, urea

**W125 In situ dry degradation coefficients of whole crop barley silage treated with *Lactobacillus plantarum* or mixed with *Pediococcus pentosaceus* plus *Propionibacter freudenreichii*.** M. Vatandoost, M. Danesh Mesgaran\*, A. Heravi Mousavi, and A. R. Vakili, *Ferdowsi University of Mashhad, Mashhad, Iran*.

The aim of the present study was to determine the chemical composition and in situ dry matter (DM) degradation of whole crop barley silage (WCB, 35% DM) as untreated or treated with *Lactobacillus plantarum* ( $8 \times 10^{10}$  CFU (LP8) or  $16 \times 10^{10}$  CFU (LP16) per g of DM) or mixed with *Pediococcus pentosaceus*+*Propionibacter freudenreichii* ( $5.5 \times 10^{10}$  CFU (PP5.5) or  $11 \times 10^{10}$  CFU (PP11) per g of DM) for 30 days ( $n = 4$ ). Standard procedures were used to determine the chemical composition of the samples. The pH of the silage extract was determined using a pH meter (Metrohm 691, Swiss). NH<sub>3</sub>-N concentration was determined in acidified silage extract (5 ml of the extract + 5 ml of 0.2 M HCl) using a distillation method (Kjeltec 2300 Autoanalyzer, Foss Tecator, Sweden). The rumen degradable parameters of DM of the silages were determined using in situ procedure. Four sheep (44±5 kg liveweight) fitted with rumen cannula were used in the present study. About 5 g DM of each sample was placed in each polyester bag (10×12 cm, 52 µm pore size), then incubated ( $n = 4$ ) for 2, 4, 8, 16, 24, 48, 72 and 96 h. For zero time, bags were washed using cold tap water. The equation of  $P = a + b(1 - e^{-ct})$  was applied to determine the coefficients ( $a =$  quickly degradable fraction,  $b =$  slowly degradable fraction,  $c =$  fractional degradation rate constant). The inoculants caused to decrease the pH and NH<sub>3</sub>-N concentration (mg/dl) (WCB = 4.07 and 9.10, LP8 = 3.69 and 8.47, respectively). Neutral detergent fiber content of the treated silages was significantly increased ( $P < 0.05$ ) than WCB (WCB = 554, LP8 = 581, LP16 = 627, PP5.5 = 542

and PP11 = 617 g/kg DM; SEM = 6.22). Treated silages had a greater slowly degraded fraction of DM compared with WCB samples (WCB =  $0.44 \pm 0.03$ , LP8 =  $0.48 \pm 0.02$ , LP16 =  $0.49 \pm 0.01$ , PP5.5 =  $0.47 \pm 0.02$  and PP11 =  $0.49 \pm 0.02$  g/kg DM; SEM = 6.22).

**Key Words:** silage, *Lactobacillus plantarum*, degradation

**W126 The effect of propionic acid or propionate ammonium on chemical composition and in situ dry matter degradation of whole crop barley silage.** M. Vatandoost, M. Danesh Mesgaran\*, A. Heravi Mousavi, and A. R. Vakili, *Ferdowsi University of Mashhad, Mashhad, Iran*.

The aim of this study was to evaluate the effect of propionic acid or ammonium propionate on chemical composition and in situ dry matter (DM) degradation of whole crop barley silage. It was harvested (about 35% DM), chopped, and then ensiled as untreated (UT) or treated with propionic acid (3 or 6 g per Kg of DM; P3 or P6, respectively) or ammonium propionate (1 or 1.5 g per Kg of DM; AP1 or AP1.5, respectively) for 30 days ( $n = 4$ ). Standard procedures were used to determine the chemical composition of the samples. Silage extract pH was determined using pH meter (Metrohm 691, Swiss). NH<sub>3</sub>-N concentration was determined in acidified silage extract (5 ml of the extract + 5 ml of 0.2 N HCl) using distillation method. The ruminal degradable parameters of DM of the silages were determined using in situ procedure. Four sheep (44±5 Kg Body Weight) fitted with the rumen fistulae were used in the present study. Bags (10 × 12 cm) were made of polyester cloth with a pore size of 52 µm. About 5 g DM of each sample was placed in each bag, and four bags for each treatment were incubated for each time (2, 4, 8, 16, 24, 48, 72, 96 h). For zero time, bags were washed using cold tap water. The equation of  $P = a + b(1 - e^{-ct})$  was applied to determine dry matter degradation coefficients ( $a =$  quickly degradable fraction,  $b =$  slowly degradable fraction,  $c =$  fractional degradation rate constant). Both additives did not have any significant effect on pH (UT = 4.07, P3 = 4.05, P6 = 4.03, AP1 = 3.95 and AP1.5 = 3.93; SEM = 0.15) or crude protein concentration (UT = 7.98, P3 = 8.03, P6 = 8.11, AP1 = 8.06 and AP1.5 = 8.08 g/kg DM; SEM = 0.09). However, these additives caused a significant ( $P < 0.05$ ) increase in neutral detergent fibre content (UT = 554, P3 = 661, P6 = 664, AP1 = 577 and AP1.5 = 595 g/kg DM; SEM = 7.7). NH<sub>3</sub>-N concentration (mg/dl) was significantly increased when ammonium propionate was applied (UT = 9.10, AP1 = 11.69; SEM = 0.53). The additives caused an increase in slowly degradation fraction of DM (UT =  $0.46 \pm 0.03$ , P3 =  $0.56 \pm 0.03$ , P6 =  $0.57 \pm 0.04$ , AP1 =  $0.49 \pm 0.02$  and AP1.5 =  $0.52 \pm 0.03$ ).

**Key Words:** silage, propionic acid, propionate ammonium

**W127 Antioxidant activity and white blood cells on plasma of lambs fed with Manzanarina.** H. E. Rodríguez-Ramírez\*<sup>1,2</sup>, C. Rodríguez-Muela<sup>1</sup>, R. Bocourt-Salabarría<sup>3</sup>, C. Chávez-Hernández<sup>2</sup>, O. Ruiz-Barraera<sup>1</sup>, C. Hernández-Gómez<sup>1</sup>, R. Jasso-Ibarra<sup>2</sup>, and C. Holguín-Licón<sup>1</sup>, <sup>1</sup>Universidad Autónoma de Chihuahua, Chihuahua, México, <sup>2</sup>INIFAP, Campo Experimental Delicias, Delicias, Chihuahua, México, <sup>3</sup>Instituto de Ciencia Animal, Habana, Cuba.

Apples have positive effects as a natural antioxidant. Manzanarina (Mzn) is a solid state fermentation product of apple byproducts. Mzn could preserve some of the apple properties; in addition, it has high yeasts content. The objective was to evaluate Mzn influence over plasma antioxidant activity (AA) and white blood cells concentration on lambs

(n=24 lambs), during a feedlot trial. Six males (M) and six females (F) were fed with a ≈10% of Mzn in diet (n=12; t1), six M and six F were fed with a common diet (t2). Animals remained on individual stalls with water and feed *ad libitum* during 56 d. Samples of blood were taken on July 31 (1), August 30 (2) and September 26 (3) of 2007 to determinate AA (FRAP technique) and white blood cells count (Beckman Coulter® A°C-T 5diff AL device). Data analysis was done with a multivariate procedure for repeated measures (SAS 9.0 GLM, REPEATED statement); the effects were treatment, sex and their interaction. Blood sampling moment (1, 2 or 3) was used as repeated measure. On sampling 3, plasma AA (mM Fe<sub>2</sub> eq.) of t1 lambs (7.40±0.25) was higher (P≤0.08) than t2 lambs (6.61±0.23) plasma AA. There was not difference (P≥0.05) between t1 and t2 Leukocyte counts (L\*10<sup>3</sup>\*μL<sup>-1</sup> of blood). t1 lambs had 8.0±0.6\*10<sup>3</sup>, 7.1±0.4\*10<sup>3</sup> and 8.7±0.4\*10<sup>3</sup> L\*μL<sup>-1</sup> on samplings 1, 2 and 3; t2 lambs had 8.7±0.6\*10<sup>3</sup>, 7.6±0.4\*10<sup>3</sup> L\*μL<sup>-1</sup> and 8.0±0.4\*10<sup>3</sup> L\*μL<sup>-1</sup> on the same moments. On sampling 3, Neutrophils proportion (Ne%) was higher (P≤0.025) on t1 F (53.8±5.0%), compared with t1 M (34.8±5.0%) and t2 F (32.3±5.0%) Ne%, t2 M had 45.3±5.0%. On sampling 3, Lymphocytes proportion (Ly%) was lower (P≤0.05) on t1 F (41.3±5.6%) compared with t1 M (62.0±5.6%) and t2 F (61.2±5.6%) Ly%, t2 M had 49.5±5.6%. On sampling 2, Eosinophils proportion (Eo%) was higher (P≤0.05) on t1 lambs (2.3±0.2%) compared with t2 lambs (1.4±0.2%). Monocytes and Basophils proportions were similar (P≥0.05) between treatments. We conclude that there is a positive influence of the diet with Mzn (t1) over the AA of lambs' plasma and there is an influence of the diet over the leukocyte profile.

**Key Words:** antioxidant, leukocyte, lambs

**W128 Inoculant-treated corn silage quality and performance of lactating cows.** A. Ghaempour<sup>1</sup>, G. R. Ghorbani<sup>1</sup>, M. Khorvash<sup>1</sup>, and A. Nikkhah<sup>2</sup>, <sup>1</sup>Isfahan University of Technology, Isfahan, Iran, <sup>2</sup>Zanjan University, Zanjan, Iran.

It has been a question for large dairy holders if applying inoculants to low-DM corn crop can improve preservation quality. The objective was to determine the effect of microbial inoculant application to high moisture corn crop on silage quality and performance of lactating cows. Crop corn was harvested at milk stage of maturity with 21% DM, cut at a theoretical particle length of 2 cm, filled in four 60-tone bunker silos, and treated with 1) no inoculants, 2) inoculant A (Ecosyl) containing *Lactobacillus plantarum*, 3) inoculant B (Biotal) containing *Pediococcus pentosanus*, *Lactobacillus plantarum* and *Propionibacter freudenreichii* or 4) the combination of inoculants A and B. Eight multiparous lactating Holstein cows at 100 ± 20 days in milk with an average body weight of 650 kg were used in a 4 × 4 Latin square design with four 20 d periods, 14 d of adaptation and 6 d of sampling. Treatments were total mixed rations (TMR) with inoculant-treated corn silages as above. Diets contained 32.9% corn silage, 14.3% alfalfa hay, 15% ground barley, 13.1% ground corn, 17.4% soybean meal, 3.4% cottonseeds, 1.8% fat powder, 0.8% sodium bicarbonate, 0.45% calcium carbonate, and 0.8% vitamin and mineral supplement. Orts were adjusted to not exceed 10% of the daily TMR. Cows were milked in a milking parlor three times daily at 0500, 1300 and 2100 h. Rumen fluid was sampled by rumenocentesis at 4-h post-feeding. Inoculants did not affect silage pH, and concentrations of ammonia, lactate, acetate, CP, NDF, ADF, ash and water soluble carbohydrates. Dry matter intake (21.5, 22.8, 21.7 and 21.7 ± 0.6 kg/d) and milk yield (33.7, 32.8, 32.3 and 33.6 ± 1.4 kg/d), and milk percentages of fat (3.32, 3.14, 3.32, and 3.15 ± 0.16), protein (3.05, 3.08, 3.06 and 3.08 ± 0.06) and lactose (5.44, 5.45, 5.47 and 5.44 ± 0.08) were unaffected by corn silage inoculant treatment. Applying inoculants to

corn crop before ensilage did not significantly affect rumen pH VFA concentrations, and total tract nutrient digestibility. Results suggest little effect of inoculants on corn silage quality and performance of mid lactation dairy cows on diets with 32.9% corn silage.

**Key Words:** corn silage, inoculant, dairy cow

**W129 Fitted models for description of cumulative gas production profiles from silages of sunflower and corn.** R. Mello\*<sup>1</sup>, A. L. R. Magalhães<sup>2</sup>, F. C. Breda<sup>1</sup>, A. J. Regazzi<sup>3</sup>, A. C. de Queiroz<sup>3</sup>, and J. L. Nörnberg<sup>4</sup>, <sup>1</sup>Universidade Federal de Roraima, Boa Vista, Roraima, Brazil, <sup>2</sup>Universidade Federal Rural de Pernambuco - Unidade Acadêmica de Garanhuns, Garanhuns, Pernambuco, Brazil, <sup>3</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, <sup>4</sup>Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil.

The aim of this work was to identify among the Brody, Von Bertalanffy, Gompertz, France, Logistic, Modified logistic and Dual-pool logistic models, the one that presents the highest quality of fit for description of cumulative gas production curves from silages of sunflower and corn. Twelve different sunflower silages and two different corn silages samples were obtained from different ensiling experiments using laboratory silos. Substrates were incubated with ruminal fluid buffered in triplicate, resulting in 42 individual curves. Gas production was followed over time in a semi-automated in vitro system with pressure transducer. Parameters of the models in question were estimated through the Marquadt algorithm implemented in the NLIN procedure of SAS® software. The quality of fit was evaluated by coefficient of determination, residual mean square, graphic analysis of the observed and estimated curves, graphic analysis of dispersion of the studentized residual, average percentage error, relative efficiency and number of iterations to converge. Brody, France and Dual-pool logistic models showed the largest values of coefficient of determination in both substrates, and the difference among them was considered worthless. They also showed the smallest values of residual mean square in sunflower silages, being the difference among them was considered worthless. Brody and France models presented smaller residual mean square in corn silages, but these models estimated negative gas production on initial times of incubation in both substrates, being biologically impossible. All the models showed positive dispersion of the residual in both substrates after 144 hours of incubation. The Brody model showed smaller average percentage error and number of iterations in both substrates. The Dual-pool logistic and France models showed higher relative efficiency, respectively, in sunflower and corn silages. Thus, the Dual-pool logistic model showed higher quality of fit to the cumulative gas production curves in sunflower and corn silages.

**Key Words:** fermentation kinetics, mathematical models, nonlinear models

**W130 Nitrogenous compounds and fermentation characteristics of king grass - leucaena silages.** T. Clavero\* and R. Razz, *Universidad del Zulia, Maracaibo, Estado Zulia, Venezuela.*

In order to increase nitrogenous compounds and improve fermentation quality of king grass (*Pennisetum purpureum* × *Pennisetum typhoides*) silage, ensiling with *Leucaena leucocephala* was tested. King grass and leucaena were cultivated in a very dry tropical forest in north west of Venezuela. The treatments for silage making were: 100% king grass (KG), 30% leucaena (L)-70% KG, 70%L-30% KG and 100% L. Fresh plant materials were chopped to 1 cm length, mixed according to treat-



ments, ensiled in laboratory silos and stored a 25 °C for 45 d. After opening the silos, dry matter (DM), pH, temperature (T), total nitrogen content (TN), protein nitrogen (PN), soluble nitrogen (SN), ammonia nitrogen (AN), PT/TN and N-NDF/TN were determined. The data were analyzed according to a completely randomized design with three replications, significance among mixing levels was determined by Tukey test. DM content of the resultant silages significantly increased ( $p \leq 0.001$ ) with the inclusion of leucaena in the mixtures, reached the highest values (26.49%) with 70%, which is considered as optimal for a good conservation. The introduction of leucaena produced a trend towards a significantly ( $p \leq 0.05$ ) decreased of pH levels of the silages, showing the lowest values (3.48) with 100% leucaena. T was not affected by treatments. TN, PN, SN, PN/TN and N-FND/TN contents increased with increasing proportion of leucaena in the mixtures. However, there were not significant differences ( $p \geq 0.05$ ) among 70-100% levels of leucaena. AN was not detected or only in small amount during ensiling period. Those results indicated that mixing leucaena with king grass would inhibit proteolysis and reduced the loss of nitrogen compounds during fermentation of the silage also leucaena material might inhibit clostridia growth during storage and stimulate lactic acid fermentation, resulting in a decreased pH value of the silage. In this study, the inclusion of leucaena at the rate of 30% or more, increased nitrogenous compounds and improved silage fermentation.

**Key Words:** silage, *Leucaena leucocephala*, nitrogenous compounds

**W131 The effect of sewage irrigation on mineral composition and in-vitro digestibility of two corn forage varieties.** E. Yosef<sup>1</sup>, E. Zukermann<sup>2</sup>, J. Miron<sup>1</sup>, M. Nikbahat<sup>1</sup>, and D. Ben-Ghedalia<sup>1</sup>, <sup>1</sup>*The Volcani Center, ARO, Bet Dagan, Israel*, <sup>2</sup>*Extension Service-Ministry of Agriculture and Rural Development, Bet Dagan, Israel*.

Summers in Israel are dry and forage crops must be irrigated. The usage of sewage irrigation of summer forages, increased in Israel due to regional droughts and the necessity to eliminate the excess of urban waste waters. The purpose of this study was to evaluate the effect of secondary-treated sewage water irrigation on the composition and in vitro digestibility of two corn forage varieties: Oropesa (Europe origin) and 32P75 (USA Pioneer). The irrigation treatments were sewage vs. flood water at a level of  $3380 \text{ m}^3/\text{ha}$ . In each treatment, both corn varieties were grown as five replicated plots and sampled by manual harvesting at the soft dough stage of maturity. The conductivity of the sewage and flood water used was 1.41 and 0.81 ds/m, respectively. Within each variety, plant morphology, plant yields and cell wall content and composition were not affected by type of irrigation. Despite of the several folds higher mineral concentrations in sewage water as compared with flood water: Na ( $\times 5.4$ ), S ( $\times 2.6$ ), K ( $\times 14$ ), P ( $\times 473$ ), Al ( $\times 5.6$ ), B ( $\times 2.4$ ), Mn ( $\times 24.3$ ), Cu ( $\times 31.9$ ) etc., the mineral composition in both

irrigation treatment of corn plants was similar. The sewage treatment improved dry matter and NDF in vitro digestibility of corn Oropesa as compared with flood water treatment (71.2% vs. 68.8% and 53.8% vs. 45.7%, respectively). However, sewage treatment decreased in vitro digestibility of 32P75 as compared with flood treatment (66.5% vs. 71.6% and 51.3% vs. 57.6%, respectively). In both treatment of each variety the nitrate contents were similar, but Oropesa contained 2-3 folds higher nitrate content than 32P75. In this study the mineral concentrations of secondary-treated sewage water were below the critical level which may damage the corn plants quality.

**W132 Biomin® BioStabil Mays enhanced the fermentation and the aerobic stability of corn silage under tropical laboratory conditions.**

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An experiment was conducted to determine the effects of the silage additive Biomin® BioStabil Mays (BSM, blend of homo- and heterofermentative bacteria) on the fermentation characteristics and aerobic stability of corn whole plant (QPM variety) growth and ensiled in Puerto Rico. Corn was harvested 75 d after planting and chopped finely. Prior to ensiling, the vegetative material was treated or not with BSM (1 x 105 cfu/ g silage). Treatments were applied to weighted portions of corn forage, manually mixed, and packed into PVC laboratory silos. Samples of fresh forage and triplicates silos of each treatment were taken at 0, 3, 45 and 90 d of fermentation, analyzed for pH, chemical composition, and fermentation products. Statistical analysis was performed as a completely randomized design with a 2 by 4 factorial arrangement of treatments. Tukey t-test was used for mean separation. For aerobic stability determination, triplicate silos from each treatment were emptied after 45 and 90 d of ensiling, placed into styrofoam containers lined with a plastic bag and exposed to air for 5 d. Temperature was monitored every 6 hours during the 5 d with a thermometer embedded in the surface of the exposed silage. pH was measured after 0, 1, 3 and 5 d. Statistical analysis of pH data was performed as a completely randomized design with a 2 by 5 factorial arrangement of treatments. The same model was utilized for temperature data except that 19 times of aerobic exposure (hours) were utilized instead of 5 d. Tukey t-test was also used for mean comparison. BSM enhanced the fermentation characteristics of corn ensiled during 45 d as evidenced by lower pH ( $P < 0.05$ ) and higher lactic acid content ( $P < 0.05$ ). After 90 d of fermentation BSM lowered the ratio of  $\text{NH}_3\text{-N}/\text{total-N}$  ( $P < 0.05$ ) as compared with corn ensiled without additive. After the opening of the silos at the d 45 and 90 the temperature of silages treated with BSM was lower than that of the control silage ( $P < 0.05$ ). In summary, BSM improved the fermentation characteristics and the aerobic stability of corn ensiled under tropical laboratory conditions.

**Key Words:** corn silage, additive, tropical environment

## International Animal Agriculture

**W133 Dairy farm milk quantity, quality, and revenue within a private organization in Central Thailand.** S. Yeamkong<sup>1</sup>, S. Koonawootrittriron<sup>1</sup>, M. A. Elzo<sup>2</sup>, and T. Suwanasopee<sup>1</sup>, <sup>1</sup>*Kasetsart University, Bangkok, Thailand*, <sup>2</sup>*University of Florida, Gainesville*.

Survival of dairy farming in Thailand depends on the ability of dairy farmers to increase profitability and efficiency of their dairy operations. Revenues are primarily related to amount of milk produced, and

secondarily to milk quality. The objective here was to determine factors affecting milk quantity, quality, and revenue in dairy farms from a private organization in Central Thailand. The dataset had 34,133 farm monthly records for milk yield per cow (MC), fat percentage (FP), protein percentage (PP), lactose percentage (LP), solids-not-fat percentage (SP), total solids percentage (TP), somatic cell count (SC), and milk revenue per cow (RC) collected from September 2003 to December 2007 in 1,101 dairy farms. Seasons were winter (November to February),