

blood samples were collected. Blood was analyzed for NEFA concentrations. Energy balance was determined by the cows  $NE_L$  intake minus the sum of  $NE_L$  for maintenance and the  $NE_L$  for milk output (NRC, 2001). The model ( $EB = -3.14 - 0.009 \cdot NEFA + 0.341 \cdot DIM - 0.002 \cdot DIM^2$ ) was developed previously in multiparous cows and subsequently used to predict EB in both cows and heifers. Cows and heifers reached nadir EB 5 to 10 DIM and reached positive EB by 18 to 23 DIM while increasing in DMI and milk yield. Cows reached peak milk production of 56 kg at 44 DIM, where heifers peaked at 57 DIM yielding 45 kg. For both cows and heifers, the model validation followed observed EB trends well. However, for cows the model did under predict EB over DIM and NEFA values. Clearly there is a demand for energy in early lactation where the cow is mobilizing body reserves. Understanding the significance of EB on animal health requires large animal numbers such that an indirect estimation of EB is needed. The prediction equation for EB after more extensive validation may provide the tool.

**Key Words:** transition, energy balance

**M212 Incidence of *Escherichia coli* O157:H7 contamination in fecal, wool, and carcass samples from feedlot lambs.** M. Long<sup>\*1</sup>, T. T. Ross<sup>1</sup>, T. Edrington<sup>2</sup>, J. D. Thomas<sup>1</sup>, and K. Christensen<sup>1</sup>, <sup>1</sup>New Mexico State University, <sup>2</sup>USDA ARS.

The present study examined the incidence of *E. coli* O157:H7 in feedlot lambs on the farm and at slaughter. We hypothesize that *E. coli* O157:H7 is prevalent in feces and on the pelt of feedlot lambs and the feces and pelt pose a potential source of carcass contamination. Fecal,

wool, and carcass samples were examined for *E. coli* O157:H7 to evaluate potential carcass contamination sources. All fecal samples were enriched in a gram-negative broth prior to immunomagnetic separation and enrichment using anti-*E. coli* O157 antibody-labeled paramagnetic beads (Dynabead anti-*E. coli* O157, Dynal Inc., Lake Success, N.Y.). Wool and carcass swab specimens were enriched with sterile brilliant green bile 2% broth. Enrichments were plated onto a sorbitol MacConkey plate containing cefixime and potassium tellurite. Three sorbitol-negative colonies exhibiting typical *E. coli* colony phenotype were selected and cultured in MacConkey broth and trypticase soy broth. Broth cultures were heat killed at 100 C and tested with an enzyme immunoassay for reactivity with anti-*E. coli* O157 monoclonal antibody. A greater number of wool samples tested positive for *E. coli* O157:H7 than fecal samples. Of the eighteen wool samples, ten samples (56%) tested positive for *E. coli* O157:H7, of the thirty fecal samples, twelve (40%) were positive for *E. coli* O157:H7. However, all carcass samples were negative for *E. coli* O157:H7 contamination. In conclusion, wool and fecal samples tested positive for *E. coli* O157:H7 and may be a potential source of carcass contamination. Furthermore, a positive wool sample did not always correlate with a positive fecal sample. This indicates that one animal shedding *E. coli* O157:H7 in its feces could contaminate the wool of multiple animals in the same pen and thereby increase the chance for carcass contamination. Additional research is needed to determine if *E. coli* O157:H7 was not transferred to the carcasses or if current techniques are unable to recover *E. coli* O157:H7 from the carcass.

**Key Words:** *E. coli* O157:H7, Feedlot lambs, Carcass

## Forages & Pastures: Silages, forage supplementation

**M213 In vitro dry matter digestibility and fermentation characteristics of sawdust-wheat bran mixtures fermented by *Aspergillus oryzae*, *Formitella fraxinea*, and *Sarcodon aspratus*.** Y. K. Kim<sup>1</sup> and D. J. Schingoethe<sup>2</sup>, <sup>1</sup>Chungnam National University, Chungnam, Republic of Korea, <sup>2</sup>South Dakota State University, Brookings.

The objective of this research was to determine the effect of fermentation by the mycelia of fungal species *Aspergillus oryzae*, *Formitella fraxinea* and *Sarcodon aspratus* on the in vitro dry matter digestibility and fermentation characteristics of mixtures containing sawdust plus 20% wheat bran w/w, on a dry matter basis, as a means to recycle sawdust including fungal mycelium into a feedstuff. The mixtures were unfermented (UFM) and fermented by *Aspergillus oryzae* (AOM) for 3 d and by *Formitella fraxinea* (FFM) and *Sarcodon aspratus* (SAM) for 2 wk at 29 C in an incubator. Neutral detergent fiber (NDF) contents in mixtures were lower for SAM and UFM (80.4 and 82.2%) than for FFM and AOM (88.3 and 86.9%) ( $P < 0.05$ ). In vitro DM digestibility after 48 h was higher for SAM (21.2%) than for UFM, AOM and FFM (17.9, 14.9, and 12.2%) ( $P < 0.05$ ). The average pH was lower for SAM (6.44) than for UFM, AOM and FFM (6.87, 7.01, and 7.34) after 48 h of fermentation ( $P < 0.01$ ). Concentrations of sugar in fermented fluid after 48 h were higher for SAM (0.71%) than for AOM, FFM and UFM (0.34, 0.31 and 0.27%) ( $P < 0.01$ ). Concentrations of acetate and propionate (mole/100 mole) were higher for SAM (54.21 and 19.04) than for AOM (34.06 and 11.08), UFM (17.94 and 7.96) and FFM (10.31 and 4.96) ( $P < 0.05$ ). Concentrations of butyrate were not different between SAM and UFM. It was concluded that the sawdust-wheat bran mixture fermented by *Sarcodon aspratus* (SAM) increased the DM digestibility of the mixture and improved the production of VFA in fermented fluid of the mixture compared with unfermented and fermented mixtures by other fungal species.

**Key Words:** Fungal fermentation, In vitro DM digestibility, In vitro fermentation characteristics

**M214 Nutrient content and protein quality in grass silages.** W. Heimbeck<sup>\*1</sup>, M. Coenen<sup>2</sup>, K. Suedekum<sup>3</sup>, L. Hogeback<sup>2</sup>, S. Hoepken<sup>2</sup>, and K. Eicken<sup>4</sup>, <sup>1</sup>Degussa AG, Feed Additives, Hanau, Germany, <sup>2</sup>School of Veterinary Medicine, Hannover, Germany, <sup>3</sup>Christian-Albrechts University, Kiel, Germany, <sup>4</sup>Veterinarian Practice, Ovelgoenne, Germany.

The quality of grass silage varies depending on botanical composition, harvesting conditions and the ensiling process. The protein fraction of

grass silages may be subject to deterioration during storage. The goal of the present investigation was to study changes in the protein quality of grass silages during a complete winter season (October through March). Samples of grass silages, produced according to common practice, were obtained from 11 farms in Northern Germany in four week intervals and analyzed for major nutrients. Furthermore, the N-fraction was differentiated into true protein, amino acids, and soluble and insoluble nitrogen. On average, pH of silages was 5.2, lactic acid varied between 1.2 and 133 mmol/kg, while acetic acid averaged 95 mmol/kg. The range for dry matter (DM) contents of the silages was between 232 and 788 g/kg, while crude fiber varied between 227 and 330 g/kg DM. Mean crude protein was 203 (130-282) g/kg DM. True protein was on average only 50% of CP (39-163 g/kg DM). In some samples, the percentage of crude protein that was true protein was less than 30%. This corresponds to the analyzed total amount of protein-bound amino acids in the silages. The low proportion of true protein in crude protein, and the corresponding lower amino acid content, mean that the real protein supply arriving at the intestine can be quite low for cows eating high quantities of such grass silages. Because of the variation in true protein and amino acids in grass silages, the non-differentiated data for rumen degradability (UDP) in feeding tables, as well as assumptions about degradability for dynamic models, seems to be questionable and may not reflect the real quantity of protein which is available at the small intestinal level.

**Key Words:** Grass silage, Protein quality, True protein

**M215 The effect of *Lactobacillus buchmeri* 40788 on the fermentation of alfalfa silage ensiled for an extended period of time.** M. P. Lynch, D. H. Kleinschmit<sup>\*</sup>, J. M. Neylon, T. E. Ebling, M. Reddish, J. M. Ladd, J. E. Lynch, M. Steifel, T. Gassert, and L. Kung, Jr., University of Delaware, Newark, DE.

Treating silages with *Lactobacillus buchmeri* are more stable when exposed to air because lactic acid is converted to acetic via a novel pathway. However, excessive production of acetic acid in silage could be detrimental and thus the objective of this study was to determine the effect of time of ensiling and effect of *L. buchmeri* on fermentation profile of alfalfa silage. Wilted alfalfa (40% DM) was either untreated (U) or treated with *L. buchmeri* 40788 (Lallemand Animal Nutrition, Milwaukee, WI, 400,000 cfu/g of fresh forage) (T) and ensiled in triplicate 0.4-L laboratory silos for 4 mo, 1 y, and 1.5 y. Changes in silage fermentation caused by T, were similar at all times of ensiling. On average, the pH of U (4.29) was less than T (4.63) ( $P < 0.05$ ), due to the greater

concentration of lactic acid in U (4.55 vs. 3.77%). The concentration of acetic acid was dramatically greater in T (6.85%) vs. U (3.29%) and the ratio of lactate:acetate was also greater in U (1.39) vs. T (0.56). The concentration of NH<sub>3</sub>-N in T (0.275%) was greater than in U (0.165%), whereas the concentration of water-soluble carbohydrates was greater in U (1.4%) than for T (0.43%). In conclusion, treating alfalfa silage with *L. buchneri* 40788 increased the concentration of acetic acid by degrading lactic acid and the time of ensiling did not impact the quality of alfalfa silage treated with *L. buchneri* 40788.

**Key Words:** *Lactobacillus buchneri*, Silage, Fermentation

**M216** The effect of *Lactobacillus buchneri* 40788 and *Pediococcus pentosaceus* on the fermentation and aerobic stability of corn silage. D. H. Kleinschmit\*, R. J. Schmidt, J. E. Lynch, J. M. Ladd, K. E. Stratton, J. G. Carr, M. Reddish, and L. Kung, Jr., *University of Delaware, Newark, DE*.

Some studies have shown that the increase in acetic acid in silage from *Lactobacillus buchneri* does not occur until after 4 to 6 wk of ensiling. In addition, the aerobic stability of silages treated with *L. buchneri* in the field has been perceived, by some, as being worse when compared to untreated silages. Therefore, the objective of this study was to determine the effect of a microbial inoculant, containing *L. buchneri*, on the fermentation and aerobic stability of corn silage during the early stages of ensiling. Whole plant corn (37% DM) was ensiled in triplicate 20-L laboratory silos for 14, 28, 42, and 56 d. Fresh forage was either untreated (U) or treated with *L. buchneri* 40788 (400,000 cfu/g of fresh forage) and *Pediococcus pentosaceus* (100,000 cfu/g) (Lallemand Animal Nutrition, Milwaukee, WI) (T). After 14 d of ensiling, T had greater concentrations of lactic acid (5.07 vs. 4.79%), acetic acid (2.14 vs. 1.82%), and ethanol (0.66 vs. 0.34%) and aerobic stability was improved (117 vs. 79 h) compared to U ( $P < 0.05$ ) although yeast counts were similar between treatments. The chemical composition and aerobic stability of both silages were similar after 28 and 42 d, however, the population of yeasts were lower in T compared to U at both time points (4.60 vs. 5.62 and 2.88 vs. 5.01 log<sub>10</sub> cfu/g, 28 and 42 d, respectively). After 56 d of ensiling, T had a lower concentration of lactic acid (4.36 vs. 4.86%) and greater concentrations of acetic acid (2.73 vs. 2.05%), and ethanol (0.70 vs. 0.48%). The aerobic stability of T was greater than U (136 vs. 102 h), due to the lower yeast counts in T ( $< 2.00$ ) compared to U (4.80). In conclusion, inoculating corn silage with *L. buchneri* 40788 in combination with *P. pentosaceus* improved aerobic stability consistently after 42 d of ensiling and provided a more efficient fermentation in the early stages of ensiling without compromising aerobic stability.

**Key Words:** Silage, Fermentation, *Lactobacillus buchneri*

**M217** A summary of the effect of *Lactobacillus buchneri* on the fermentation and aerobic stability of silage. D. H. Kleinschmit\* and L. Kung, Jr., *University of Delaware, Newark, DE*.

*Lactobacillus buchneri* has been shown to improve the aerobic stability of a variety of silages. We have summarized the effects of *L. buchneri* on silage fermentation and aerobic stability from 25 published studies with 49 comparisons versus untreated silages. In descending order of numbers of comparisons, corn, grass, small grain, and alfalfa silages comprised the database. The effects of inoculation were summarized by separating the study treatments into the following categories: 1) untreated silage, nothing applied (U), 2) silage treated with *L. buchneri* at  $\leq 100,000$  cfu/g of fresh forage (LB1), and 3) silage treated with *L. buchneri* at  $> 100,000$  cfu/g (LB2). The pH and DM recoveries of LB1 and LB2 were unaffected compared to U. When compared by treatment, the lactic acid concentration was 5.49% for U and was lower ( $P < 0.05$ ) for LB1 (4.27%) and LB2 (3.95%). Treatment with LB2 (4.53%) resulted in silage with greater amounts of acetic acid than for U (2.10%) and LB1 (3.30%). The lactate:acetate ratios reflected the concentrations of these acids and was lower ( $P < 0.08$ ) in LB2 (1.01) and LB1 (2.29) than for U (3.76). Inoculation also increased ( $P < 0.06$ ) the concentration of propionic acid in silage treated with LB1 (0.33%) and LB2 (0.44%) when compared to U (0.11%). Untreated silages averaged 3.52 log<sub>10</sub> cfu of yeasts per g of silage whereas yeasts were lower ( $P < 0.05$ ) in LB1 (2.50), however, LB2 had less yeasts than U and LB1 ( $< 2.00$ ). When compared to U (113 h), inoculation with *L. buchneri* improved the aerobic stability of silages in a dose dependent manner (259 and 355 h for LB1 and LB2, respectively). There was a negative correlation between the concentration of acetic acid and population of yeasts in silage ( $r^2 =$

0.34) and a positive correlation between the concentration of this acid and aerobic stability ( $r^2 = 0.28$ ). The application rate of *L. buchneri* was positively correlated with the concentrations of acetic acid in silages ( $r^2 = 0.06$ ) and aerobic stability ( $r^2 = 0.23$ ). In conclusion, inoculating silages with *L. buchneri* results in greater concentrations of acetic and propionic acid, which inhibits the growth of yeasts and improves the aerobic stability in a wide variety of silages. Furthermore, the degree of effectiveness is dose dependent.

**Key Words:** *Lactobacillus buchneri*, Silage, Inoculant

**M218** Effects of amino acid fermentation liquor byproducts upon corn silage fermentation and stability. P. G. Summer\*<sup>1</sup>, <sup>1</sup>Ajinomoto U.S.A., Inc., Eddyville, Iowa.

The objectives of this study were to determine the effects of amino acid fermentation liquor byproducts upon ensilage of corn plant and its aerobic stability. Fermentation liquors from production of glutamic acid (EFS) or lysine (KFS) or Urea were added to fresh chopped corn plant to equal added N at 0.5 or 1.0% of fresh forage in laboratory silos (4.5kg) and compared with a non-treated control. Byproducts EFS and KFS contain about 16% N on a dry basis, primarily as ammonium chloride or ammonium sulfate, respectively. Silages were sampled after 80 days of ensiling and exposed aerobically for 7 days. Results are shown in the table. Within each level of added N, lactic acid was higher in Urea compared with EFS, KFS or Control ( $P < 0.05$ ). Acetic acid was greater in high EFS ( $P < 0.05$ ) and lower in Urea ( $P < 0.05$ ) compared with Control. Total true protein N was greater in high EFS or KFS ( $P < 0.05$ ) compared with Control and high KFS increased true protein N ( $P = 0.05$ ) compared with high Urea. The pH of silage on day 80 was higher in high Urea ( $P < 0.05$ ) compared with Control and either level of EFS or KFS. After aerobic exposure (d 87), pH in both levels of EFS were similar and tended to be lower compared with Control ( $P = .16$ ). On day 82 temperatures of all treated silages were numerically lower than Control. On day 87 only temperature of high EFS silage was significantly lower than Control. These results indicate that addition of fermentation byproducts to whole plant corn silage might reduce loss of true protein and prolong stability of silage when exposed to air.

Treatment 0.5% added N 1.0% added N Item Control EFS KFS Urea  
EFS KFS Urea SEM Lactic d80 (% of DM) 6.48<sup>a</sup> 5.75<sup>a</sup> 5.82<sup>a</sup> 8.16<sup>b</sup> 6.00<sup>a</sup>  
5.82<sup>a</sup> 8.22<sup>b</sup> 0.23 Acetic d80 (% of DM) 3.85<sup>ab</sup> 4.20<sup>ab</sup> 4.17<sup>ab</sup> 3.42<sup>bd</sup> 5.33<sup>c</sup>  
4.66<sup>ac</sup> 2.69<sup>d</sup> 0.20 True Protein N d80 (% of DM) 0.54<sup>a</sup> 0.65<sup>abc</sup> 0.63<sup>abc</sup>  
0.57<sup>a</sup> 0.70<sup>bc</sup> 0.75<sup>c</sup> 0.63<sup>abc</sup> 0.03 pH d80 3.9<sup>a</sup> 3.9<sup>a</sup> 3.9<sup>a</sup> 4.1<sup>ab</sup> 4.0<sup>a</sup> 3.9<sup>a</sup>  
4.3<sup>b</sup> 0.05 pH d87 5.1<sup>ab</sup> 4.0<sup>a</sup> 4.6<sup>ab</sup> 5.9<sup>b</sup> 4.0<sup>a</sup> 4.8<sup>ab</sup> 5.0<sup>ab</sup> 0.29 Temp. Co  
d82 26.4 21.8 22.7 22.2 21.7 23.5 22.3 1.16 Temp. Co d87 32.6<sup>a</sup> 28.3<sup>ab</sup>  
31.7<sup>a</sup> 32.0<sup>a</sup> 25.5<sup>b</sup> 28.9<sup>ab</sup> 29.5<sup>ab</sup> 1.27

**Key Words:** Silage, Silage additive

**M219** Feeding brown midrib-3 corn silage or conventional corn silage cut at either 20 or 66 cm of height to early lactation cows. D. D. Dominguez\*<sup>2</sup> and L. D. Satter<sup>1,2</sup>, <sup>1</sup>U.S. Dairy Forage Research Center, USDA-ARS, <sup>2</sup>Dairy Science Department, University of Wisconsin, Madison.

The objective was to determine the impact on milk yield when brown midrib-3 corn silage (bm3, Cargill F-697) cut at 20 cm or conventional corn silage (Golden Harvest H-8250) cut at 20 (normal cut-NC) or 66 cm (high cut-HC) was fed to dairy cows during the transition period and early lactation. Sixty two Holstein cows (20 primiparous and 42 multiparous) averaging 24.8 days ( $\pm 6.9$ ) before calving were randomly assigned to trts. The silages were chopped at 0.95 cm theoretical length of cut, and stored in bunker silos. NDF content (% DM) of bm3, NC and HC silages was 40.6, 38.2 and 35.8. The precalving diets had 64.5, 64.5 and 69 % of forage for bm3, NC and HC trts, and postcalving diets had 61.5, 58.5 and 61.5 %. Corn silage accounted for 67 % of forage DM. The length of the experimental period after calving was 112 days. Statistical analysis was done by repeated measures analysis of unbalanced data. DMI prepartum and postpartum was not affected by trts. Means for DMI postpartum for primiparous and multiparous cows for bm3, NC and HC trts were 18.5, 22.6; 18.1, 22.6; 16.6 and 21.8 kg/d. Milk yield was not affected by trts in multiparous cows, but it was decreased ( $P \leq 0.001$ ) for HC in primiparous cows. Means for milk yield for primiparous and multiparous cows for bm3, NC and HC trts were 31.2, 39.3; 32.5, 40.8; 28.2 and 41.4 kg/d. FCM (3.5%) was not affected by trts in multiparous cows, but it was decreased ( $P \leq 0.001$ ) in primiparous cows with HC. Means for FCM for primiparous and multiparous

cows for bm3, NC and HC were 32.9, 44.3; 33.2, 45.0; 29.8 and 45.0 kg/d. Milk composition and body condition score were not affected by trts. Feed efficiency (kg milk/kg DMI) was not affected by trts in primiparous cows, but it was improved in multiparous cows with HC. Means for feed efficiency for primiparous and multiparous cows for bm3, NC and HC were 1.65, 1.78; 1.73, 1.84; 1.64 and 1.93.

**Key Words:** Corn silage, Brown midrib-3, Milk production

**M220 Forage intake and digestibility of tropical grass and rhizome perennial peanut hay (*Arachis glabrata*) supplemented with fish silage.** H. Diaz\*, A. Rodriguez, T. Ruiz, and R. Fuentes, *University of Puerto Rico*.

Two experiments were conducted to determine the effect of fish silage (FS) supplementation on forage intake and digestibility of tropical grass hay (80 % *Digitaria decumbens*; 20% *Panicum maximum*; TGH) and rhizome perennial peanut hay (*Arachis glabrata*; RPP). Discarded fish were mixed with 20% cane molasses (w/w), a lactic acid producing bacterial-inoculant applied at 106 cfu/g fresh material and allows to ferment for 21 days. In experiment 1, TGH was offered as basal diet (Control) or was supplemented with FS at .45 % (T2) and .90 % (T3) of the animal LW daily. In experiment 2, RPP was offered as basal diet (Control) or was supplemented with FS at 0.225 % (T2) and .45 % (T3) of the animal LW. In both experiments, 9 rams were used as experimental units and submitted to 8 days of adaptation period and a 6-day data collection period. Data from both trials were analyzed according to a latin square design with three periods. In experiment 1, grass hay intake and digestibility increased ( $P < 0.05$ ) with supplementation at both levels of FS, but the positive response was greater in animals supplemented with 0.45% of LW. In Experiment 2, forage intake was similar in all treatments. However, dry matter digestibility was higher ( $P < 0.05$ ) for T2 than control animals, but was similar to that of rams of T3. In conclusion, animal response to FS supplementation differs between tropical grass and RPP hay. Fish silage increased tropical grass hay intake and digestibility regardless of level of supplementation, however, no effect on forage intake was observed when RPP was offered as basal diet but FS supplementation at the higher level increased dry matter digestibility.

**Key Words:** Fish silage, Supplementation, Tropical hay

**M221 Fermentation characteristics of corn hybrids ensiled in mini-silos.** D.J.R. Cherney\*, J. H. Cherney, and W. J. Cox, *Cornell University, Ithaca, NY*.

A variety of traits and corn silage processing techniques are being promoted for high milk production through improved forage quality. In order to evaluate numerous experimental variables and their interactions involving different corn silage hybrids, scaled down mini-silos are necessary. Objectives of this study were to evaluate the influence of sample size on pH,  $\text{NH}_3$ , and volatile fatty acid profile of eight corn silage hybrids, selected to vary in fiber digestibility, ensiled in vacuum-sealed polyethylene bags for 60 d and to assess the suitability of these mini-silos for detecting differences among hybrids. Hybrids were grown at the Teaching and Research Center located near Harford, NY, and harvested at a DM of about 32% in fall 2002. Three field replications of each hybrid were chopped and vacuum ensiled in bags with sample sizes of 50, 100, 200, 400, and 600 g. Increasing sample size resulted in decreased lactic acid, acetic acid, total acids, and  $\text{NH}_3$  ( $P < 0.05$ ). Most of the difference among sample sized occurred between the 50 and 100 g sample size. Lactic acid:acetic acid ratio ( $3.1 \pm 0.13$ ) and pH ( $3.9 \pm 0.08$ ) did not vary ( $P > 0.05$ ) among sample sizes. There was no detectable butyric acid in the samples. Fermentation characteristics suggested that all samples were well ensiled, but that the fermentation profile of the 50 g samples differed the most from other sample sizes. There were no differences ( $P > 0.05$ ) among hybrids in DM ( $32.6 \pm 0.73\%$ ) or  $\text{NH}_3$  ( $0.64 \pm 0.16\%$ ). Hybrids did vary in lactic acid, acetic acid, lactic acid:acetic acid, total acids, and pH, however ( $P < 0.05$ ). Differences among hybrids were also noted for CP ( $P < 0.05$ ). It is possible to use vacuum-sealed plastic bags to ensile corn, with samples as small as 100 g, and to use these mini-silos to assess differences among hybrids.

**Key Words:** Corn silage, Fermentation, Laboratory silo

**M222 Intake and milk yield of cows fed diets containing *L. buchneri*-inoculated corn silage and high moisture corn or acetic acid supplement .** D. K. Combs\* and P. C. Hoffman, *University of Wisconsin, Madison, USA*.

*Lactobacillus buchneri* is a hetero- fermentative inoculant that increases aerobic stability of ensiled forages and grains. Silages inoculated with *L. buchneri* have higher concentrations of acetic acid relative to untreated silages. Acetate can depress intake when infused into the rumens of cattle, but has also been used as a preservative for grain and corn silage. Small improvements or losses in animal performance could influence the economic incentives for using *L. buchneri*. This study assessed how feed intake and milk production are affected by feeding diets that contain corn silage and high moisture corn that have been inoculated with *L. buchneri* or that have been supplemented with acetic acid. Three total mixed rations (TMR) were fed to lactating dairy cows. TMRC was a diet of untreated corn silage and untreated high moisture shelled corn fed ad libitum. TMRB was formulated identical to TMRC, except that corn silage and high moisture corn were inoculated with *L. buchneri* at the time of ensiling. TMRA was a diet formulated to be isocaloric to TMRC and TMRB, but with untreated corn silage and high moisture grain and supplemented with 700 ml glacial acetic acid/cow/d. Corn silage was ensiled in two - 2.5 m diameter horizontal plastic bags. One bag was filled with corn forage inoculated with  $5 \times 10^5$  CFU/g of *L. buchneri*. High moisture shelled corn was ensiled in two concrete silos and *L. buchneri* was applied to one silo at  $5 \times 10^5$  CFU/g fresh material. Eighteen multiparous Holstein cows were used in the experiment. The design was as a replicated 3x3 Latin square. Cows were randomly assigned to squares and treatment sequences randomly were allocated within squares. Milk yield was not different ( $P > 0.05$ ) between TMRC, TMRB and TMRA (41.3, 42.2 and 41.9 kg/d, respectively). Milk fat percentage was higher ( $P < 0.05$ ) when cows were fed TMRA (3.12%) than when fed TMRC (2.92%) or TMRB (2.83%). Fat corrected milk ( $35.0 \pm 0.5$ kg) and dry matter intake ( $21.2 \pm 0.4$  kg) were similar ( $P > 0.05$ ) between treatments. Neither inoculation of corn silage and high moisture corn with *L. buchneri* or feeding acetate depressed feed intake or milk production in dairy cattle.

**Key Words:** Dairy, Silage inoculant, *L. buchneri*

**M223 Characterization of corn endosperm properties in 33 germplasm sources for potential improvements in ruminal starch degradability.** D. Majee\*, R. D. Shaver, and J. G Coors, *University of Wisconsin-Madison*.

Starch degradation in corn is influenced by several interrelated endosperm characteristics. The objective of this study was to characterize corn endosperm properties of 33 germplasm sources for future development of corn hybrids with high ruminal starch degradability. These included 17 lines from the Germplasm Enhancement of Maize (GEM) project at Iowa State University; six flint lines from North Carolina State University (NCSU) and CIMMYT; six near-isogenic inbreds of Oh43 carrying *o2*, *fl2*, *su2*, *ae1*, *h1* and *wz1su2* alleles that affect endosperm composition; an experimental breeding population developed for improved silage quality (WQS C2) and three check inbreds; B73, Oh43, and W64A. Harvesting was done at milkline (ML) and black-layer (BL) stages. The BL samples had higher ( $P < 0.05$ ) weight of 1000 dried seeds (252.5 vs. 209.7g LSD=3.8). Dried kernels from middle portions of ears were used to determine % vitreousness (V) using a light box. Hardness was determined from a 20g sample using a Stenvert micro hammer-cutter mill that measured time to collect ground sample to a set receptacle height (T); total column height (TH); and height ratio of course to fine (C/F) particles. The ML samples had lower %V compared to BL samples (66.9 vs 72.4% LSD=0.8). Inbreds with softer endosperm ( $P < 0.05$ ) from BL samples were; *o2*(Oh43) (0% V; 11.2s T; 82mm TH; 0.02 C/F ratio); *fl2*(Oh43) (0% ; 9.8s; 86mm; 0.01 C/F ratio); and *h1*(Oh43) (20%; 15.3s; 81mm; 0.04 C/F ratio), compared to inbred check B73 (50%; 23.7s; 71mm; 0.37 C/F ratio). The remaining germplasm ranged from medium to hard (60-95% V and 0.47-0.90 C/F ratio). Correlations between %V and hardness factors were higher for BL samples compared to ML; TH ( $R^2 = 0.79$  vs. 0.39); C/F ratio ( $R^2 = 0.67$  vs. 0.67); and T ( $R^2 = 0.66$  vs. 0.42). These data show that a wide range of corn genetic material has potential for improving ruminal

starch degradability and that visual rating of vitreousness on corn harvested at BL stage can determine corn hardness properties with relative accuracy.

**Key Words:** Corn starch, Vitreousness

**M224 Nitrate leaching in silage maize production on sandy soils.** M. Wachendorf\*, M. Buechter, K. Volkers, and F. Taube, *University of Kiel, Kiel, Germany.*

As part of an integrated research project, dealing with nitrogen (N) recovery in specialized dairy farms, a field experiment with maize for silage (cultivar Naxos) was conducted to assess the effects of mineral nitrogen fertilization (0, 50, 100, 150 kg N ha<sup>-1</sup> yr<sup>-1</sup>), slurry application rate (0, 20, 40 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup>) and the use of an understorey with perennial ryegrass (cultivar Fennema) on the nitrate (NO<sub>3</sub>) leaching losses. Samples of leachate were taken by ceramic suction cups. Water fluxes were derived from water balance calculations. An increasing N supply with mineral fertilizer or slurry resulted in increased leaching losses, with fertilizer N showing greater effects than slurry N. A grass understorey sown at the end of May significantly reduced the losses. Only with excessive amounts of N supply (>200 kg N ha<sup>-1</sup>), NO<sub>3</sub> concentration in the leachate exceeded the European Union (EU) limit for drinking water (50 mg NO<sub>3</sub> l<sup>-1</sup>). Regression analysis showed, that NO<sub>3</sub> leaching losses were positively related to the mineral N content in the soil at the end of the growing season, with leaching losses representing 50% of the mineral N in the soil on an average. At high levels of soil N content leaching losses were strongly reduced with a grass understorey, whereas no differences occurred at low levels. Leaching losses were positively related to the N balance at the field scale, which was calculated from the difference between N input (N from fertilizer and slurry) and N output (N removed with herbage mass). At a constant level of N surplus losses were smaller when maize was grown with an understorey. From the results obtained, it is suggested that, under the predominant soil conditions N leaching losses under maize can be estimated satisfactory by means of mineral nitrogen content in the soil at the end of the growing season as well as by the calculated N budget. At fertilizer rates of 40 m<sup>3</sup> slurry ha<sup>-1</sup> plus 50 kg mineral N ha<sup>-1</sup> as commonly applied in agricultural practice in northern Germany, no increased NO<sub>3</sub> leaching losses occur.

**Key Words:** Silage maize, Nitrogen losses, Environment

**M225 Effects of forage quality and type of protein supplement on intake and digestibility in beef steers and performance of postpartum beef cows.** J. J. White\*, G. D. Pulsipher, and T. DelCurto, *Eastern Oregon Agriculture Research Center, Union, OR.*

Two experiments were conducted to evaluate the effects of forage quality and supplemental UIP level on intake, digestibility, and performance of beef cattle. In Exp. 1, five ruminally cannulated steers (BW = 456 ± 6 kg) were used in a 6 × 5 incomplete Latin square with treatments in a 2 × 2 factorial plus two controls. Factors were hay quality, moderate (M, 8.0% CP, 62.1% NDF) and low (L, 4.0% CP, 81.5% NDF), and supplement type, high UIP (HUIP, 60% UIP, 48% CP) and low UIP (LUIP, 40% UIP, 49% CP). Supplement was provided daily to meet 100% of CP requirements. Intake and total fecal output were measured on d 15 to 19, and total rumen evacuations on d 21. Supplementation increased (*P* < 0.01) DM intake and digestibility and NDF intake in steers fed L forage. An interaction (*P* = 0.10) occurred for NDF intake. In steers fed L forage NDF intake was greater with HUIP supplement (2.6 kg/d) than with LUIP supplement (2.4 kg/d), but in steers fed M forage NDF intake was greater with LUIP supplement (3.1 kg/d) than with HUIP supplement (3.0 kg/d). Ruminant NDF fill and liquid volume were greater (*P* < 0.07) in steers fed L forage compared to M forage. In Exp. 2, 96 postpartum multiparous cows (BW 555 ± 8 kg) were blocked by calving date and assigned to treatments in a 2 × 2 × 2 factorial arrangement within a split plot design. The additional treatment factor in Exp. 2 was supplement intake level, low or high 90 or 110% of CP requirements. Hay quality was L (6.3% CP 75% NDF) and M (8.6% CP and 74% NDF). Supplements were fed three times weekly to groups of four from calving to breeding. Cow BW and BCS were taken at calving and breeding. Cyclicity was determined prior to breeding and pregnancy was determined at weaning. Cows receiving the high intake level of supplement lost less (*P* = 0.06, -29 kg) BW than cows on the

low level (-33 kg). These results indicate that quality of forage and protein supplement type interact to affect intake, but not postpartum cow performance.

**Key Words:** Forage quality, Protein supplementation, Beef cows

**M226 Protein supplementation of Brangus stocker calves grazing winter Tallgrass Prairie.** L. A. Appeddu\*<sup>1</sup> and M. A. Brown<sup>2</sup>, <sup>1</sup>Southwestern Oklahoma State University, Weatherford, OK, <sup>2</sup>USDA-ARS Grazinglands Research Laboratory, El Reno, OK.

In years when growing conditions are not favorable for establishment of fall wheat pasture in the Southern Great Plains, producers need cost-effective grazing alternatives for home grown calves until spring wheat pasture is available. The objective of this research was to evaluate the potential of wintering Brangus calves on perennial Tallgrass Prairie and offering limited amounts of a cottonseed meal (CSM) or feather meal (FM) based supplement. Two weeks after weaning in October 2000, calves were sorted by sex and placed on one of four pastures (Big Bluestem, Little Bluestem, Dropseed, Cheat; avg 49.5% ADF and 5.5% CP). Calves were supplemented by pasture with CSM (20 steers and 25 heifers) or FM (20 steers and 25 heifers) for 90 d. Measures included calf weights, hip height, serum metabolites and ADF digestibility using acid detergent insoluble ash as an internal marker. Supplements had 42% CP and similar *in situ* digestibilities. Calves lost weight during the first 40 d on pasture (-0.21 kg d<sup>-1</sup>); therefore, daily supplement amounts were increased from 908 to 1362 g hd<sup>-1</sup>. No differences in gain were detected between steer groups over the last 50 d (0.44 ± 0.038 kg d<sup>-1</sup>), but heifers fed FM gained more (*P* < 0.001) than those fed CSM (0.42 vs 0.26 ± 0.034 kg d<sup>-1</sup>). Calves fed FM vs CSM had a greater increase (*P* < 0.05) in hip height (3.3 vs 2.8 ± 0.23 cm). Steers had lower (*P* < 0.001) serum urea nitrogen levels than heifers (15 vs 21 ± 0.9 mg dl<sup>-1</sup>). Serum glucose levels tended to be lower for steers fed CSM than FM (62 vs 73 ± 2.2 mg dl<sup>-1</sup>), but similar between heifer groups (82 ± 2.0 mg dl<sup>-1</sup>). By d 90, a higher ADF digestibility was found for heifers fed FM as compared to heifers fed CSM and steers fed CSM or FM (66 vs 56, 55, 51 ± 2.5%). Although supplying FM improve heifer utilization of winter Tallgrass Prairie, no differences were detected for subsequent 60 d gains (1.2 ± 0.06 kg d<sup>-1</sup>) or pregnancy rates (66%) when heifers were placed on spring wheat pasture. Results suggest Brangus calves can be wintered on lower quality pasture with minimal inputs when annual cool season forages are not available.

**Key Words:** Forages, Protein Supplementation, Digestibility

**M227 Interseeding triticale with windrowed millet as a winter feeding program for developing heifers.** W. S. Mackay\*, J. C. Whittier, D. Couch, and D. N. Schutz, *Colorado State University, Fort Collins, CO USA.*

Sixteen weaned crossbred beef heifers were used to compare two winter feeding programs. Heifers were randomly assigned to one of the following treatments: 1) Millet Only (MO), heifers grazing windrowed millet only, and 2) Triticale and Millet (TM), heifers grazing windrowed millet and triticale seeded between the windrows. In May of 2001, dry fertilizer was applied to a field, and foxtail millet was seeded July 5-6 and then windrowed in the late dough stage September 5-7. The field was divided into three plots and triticale drill seeded between the windrows of one of two subplots within each block. Both heifer groups grazed the windrowed millet for 89 days. Grazing access to windrows was restricted by an electric fence perpendicular to the windrows. The fence was moved weekly to provide access to ungrazed windrow and triticale forage. Clipped samples were taken twice monthly from ungrazed portions of the windrows and were analyzed to determine quality changes over time. Heifers were weighed on consecutive days at the beginning and the conclusion of the trial, and approximately every 30 days between. No differences (*P* > 0.05) were observed between treatments for beginning weight, final weight, 89 day ADG, and 30 day ADG for the three periods. The similarity in weight gain between treatments is likely due to the extremely low levels of precipitation during the trial, which prevented the triticale from growing. Continuous access to growing triticale, coupled with very low precipitation, may also have been a factor in low contribution from the triticale to the diet. Windrow quality was maintained throughout the trial. Crude Protein increased, possibly as

a result of leaching of other compounds. This leaching, as evidenced by decreasing NDF, left more protein as a percent of the whole. In conclusion, seeding triticale between windrowed millet offers no benefit if the triticale is not able to provide a substantial portion of the diet. However, windrowed millet is a viable, low cost option for winter-feeding.

**Key Words:** Heifer calves, ADG, Windrow grazing

**M228 Forage intake and in vivo digestibility of two rhizoma peanut genotypes harvested for hay in the tropics.** T. Ruiz\* and L. Rivera-Estremera, *University of Puerto Rico, Mayaguez.*

Rhizoma perennial peanut (RPP) is a forage legume that has shown high nutritive value and yield potential when grown in the tropics. Two genotypes, TARS line nos. 17033 (PI No. 276233) and 17097 (PI No. 262839) with the highest and second highest DM yield, respectively, have an excellent potential for commercial release in the Caribbean. The apparent digestibility and intake of hay from these lines was determined in a feeding trial with young sheep (25 kg), during November and December of 2001. Animals were fed ad libitum to stimulate maximum consumption of hay from the two RPP lines and coastcross no. 1 Bermudagrass. Intake and apparent digestibility of DM and organic matter (OM) were similar between RPP lines. Compared to Bermudagrass, intake of DM (1.01 vs. .74kg/d), OM (.92 vs. .68 kg/d), and apparent digestibility of DM (57.7 vs. 47.7%) and OM (59.8 vs. 50.7%) were higher ( $P < .01$ ) for the RPP hays. The apparent digestibility of CP was higher in 17033 compared to 17097 (64.6 vs. 59.4%) legume hay. The CP digestibility in the RPP hays was close to being twice that of the Bermudagrass hay (33.9%). Despite differences in DM and OM consumption among the treatments, the experimental animals consumed similar amounts of NDF (.50 kg/d). It can be concluded that these two RPP genotypes show similar quality potential which is greater than that of Bermudagrass hay harvested at a similar stage of maturity.

**Key Words:** Tropical legume, Bermudagrass hay, Rhizoma perennial peanut

**M229 Apparent digestible dry matter intake of ammoniated wheat straw diets in beef cows as affected by wheat middlings and biotin supplementation.** R.D. Wiedmeier\*<sup>1</sup>, P.R. Schmidt<sup>1</sup>, B.A. Kent<sup>1</sup>, and D.R. ZoBell<sup>1</sup>, <sup>1</sup>Utah State University, Logan, Utah.

The objective of this study was to determine the effect of supplemental wheat middlings (WM) and biotin on intake and digestibility of ammoniated wheat straw (AWS) diets. Sixteen fall calving, lactating beef cows and their calves were stratified into four groups and placed in four pens, four cows and calves/pen. Each pen had a creep feeding area for calves with alfalfa hay (AH) offered ad-libitum. Two pens received 4.58 kg of AH and 0.22 kg of vitamin-mineral premix/cow/d. The other two pens received 4.08 kg of WM and 0.19 kg of vitamin-mineral premix/cow/d. All pens received ad-libitum access to AWS with intake measured daily. After a 60 d adaptation period apparent nutrient digestibility was estimated twice at 30 d intervals, each with a 5 d diet

and fecal collection period and acid insoluble ash (AIA) as an internal marker. Intake of AWS was higher ( $P = 0.0001$ ) when supplemented with WM compared to AH (12.41 vs 8.65 kg DM/cow/d, respectively). Digestibility of DM was also higher ( $P = 0.005$ ) when supplemented with WM compared to AH (53.1% vs 47.7%, respectively). As a result, DDMI was 9.22 vs 6.42 kg/cow/d. After weaning, 12 of the dry, pregnant cows were stratified into six groups of two cows each per pen. Three of the pens received 2.73 kg/cow/d of WM supplement that was fortified with 30 mg of biotin (WMWB). The other three pens received 2.73 kg/cow/d of WM supplement without biotin (WMWOB) fortification. All pens received ad-libitum access to AWS with intakes measured daily. After a 30 d adaptation period, apparent nutrient digestibility was estimated with a 5 d diet and fecal collection period and AIA as an internal marker. Intake of AWS was not affected by biotin fortification ( $P = 0.89$ , 12.68, WMWOB vs 12.48, WMWB kg DM/cow/d). However, biotin fortification enhanced ( $P = 0.008$ ) DM digestibility (52.75%, WMWOB vs 61.15%, WMWB). Thus, DDMI was improved by 14.6% with biotin fortification (8.13, WMWOB vs 9.32, WMWB kg/cow/d).

**Key Words:** Beef, Supplementation, Digestibility

**M230 Influence of supplementing soybean hulls to steers consuming endophyte infected tall fescue pasture.** R. B. Pugh\*, J. B. Pulliam, J. C. Waller, and C. J. Richards, *University of Tennessee, Knoxville TN.*

Six steers ( $289 \pm 2$  kg BW) fitted with ruminal and duodenal cannulas were used in a crossover design to evaluate intake and site of nutrient digestion of fresh clipped endophyte infected tall fescue (*Festuca arundinacea*) pasture with or without soybean hull supplementation at 0.70% BW (DM basis). Steers were placed in metabolism units within an environmentally controlled room and provided with free choice access to fresh forage, water and a vitamin/mineral block. The spring growth of tall fescue was harvested daily for feeding during the experiment. Supplement was fed at 0700 with approximately 65% of the estimated daily forage. Additional forage was stored in a cooler and fed at 1900 to maintain a fresh forage supply. Periods were 21 d with 15 d of adaptation and six d of sample collection. Chromic oxide was dosed twice d starting on d nine for use as a digesta flow marker. Duodenal samples were taken 4 times d with times shifting one hour each d to represent all hours of a d. Soybean hull supplementation decreased ( $P < 0.01$ ) forage intake from 2.6 to 2.2% BW, but increased ( $P < 0.01$ ) total DMI from 2.6 to 2.9% BW. Apparent ruminal DM digestibility percentage (61%) was not affected ( $P > 0.10$ ). Crude protein intake was not different ( $P > 0.10$ ) between treatments, but duodenal CP flow for the supplemented treatment (775 g/d) was greater ( $P > 0.01$ ) than the control treatment (563 g/d). Ruminal pH was not affected (6.5;  $P > 0.15$ ) and ruminal ammonia nitrogen concentration was decreased ( $P < 0.01$ ) from 3.7 to 2.3 mM with soybean hull supplementation. Supplementation of soybean hulls at a rate of 0.70% BW to calves consuming fresh tall fescue decreased forage consumption, but resulted in greater total intake, no change in percentage of ruminal dry matter digestion and greater flow of protein to the duodenum.

**Key Words:** Feed supplementations, Digestion, Forage

## International Animal Agriculture

**M231 Nitrogenous fractions of *Pithecellobium dulce* in tropical dry forest.** T. Clavero\* and R. Razz, *Centro de Transferencia de Tecnología en Pastos y Forrajes. La Universidad del Zulia. Venezuela.*

In an *Pithecellobium dulce* plantation located in the western part of Venezuela a trial was carried out to assess the content of the nitrogenous fractions during different growing seasons. Three growing seasons were studied (maximum, P1; mean, P2 and minimum, P3; rainfall). The experiment was laid out as randomized block design with four replications. The data showed significant differences ( $P \leq 0.05$ ) for total nitrogen content (TN), rumen soluble nitrogen (SN) and non protein nitrogen of the soluble nitrogen (NPN/SN) in relation to growing season. The solubility of the total nitrogen ranged from 38.3 to 45%. The highest values of TN and SN were reported during the maximum rainfall. Nitrogen fixed to the cell wall of the insoluble nitrogen and nitrogen in fiber acid

detergent (NFAD) were not affected for growing season. *Pithecellobium dulce* has an adequate content of TN, SN and NPN/SN and represent an alternative as source of nitrogen for ruminant in tropical conditions.

**Key Words:** Nitrogenous fractions, *Pithecellobium dulce*

**M232 Silage quality of *Leucaena leucocephala* ensiled with molasses.** T. Clavero\* and R. Razz, *Centro de Transferencia de Tecnología en Pastos y Forrajes. La Universidad del Zulia. Venezuela.*

The study aimed to evaluate the influence of molasses in ensiling leucaena tops in western Venezuela. Chopped fresh plant materials of about 1 cm length were ensiled into laboratory silo and stored at 25C. The experimental design was a completely random with a 3x3 factorial arrangement. Factors studied were three rates of legumes:molasses, 1:4, 1:8 and