M155 Effects of stocking method and rate on seasonal cow-calf performance and forage quality. W. E. Wyatt*[1], B. C. Venuto[2], J. M. Gillespie[3], and D. C. Blouin[3], [1]*Louisiana State University Agricultural Center, Jenerette,* [2]*Grazing Lands Research Laboratory, USDA, ARS, El Reno, OK,* [3]*Louisiana State University Agricultural Center, Baton Rouge.*

Effects of stocking method and rate on cow-calf performance and forage quality were evaluated by the following treatments: continuous-stocked pastures at a low (1.2; CL), medium (2.0; CM), and high rate (2.7 cows per ha; CH) and rotational-stocked pasture (8 paddocks) at a high rate (2.7 cows per ha; RH). Brangus cows and calves were stocked on replicated treatment pastures on a year-around basis for three years. Cows were weighed prior to calving (January), prior to breeding (April), at weaning (October), and again the following January. Spring-born calves were weighed at birth, in April, and at weaning. Seasons corresponding to weigh periods were February-April (ES), May-June (LS), and July-October (S). The LS period represented a transition from annual ryegrass (principal forage in ES) to common bermudagrass-dallisgrass (principal forages in S) forage bases. Statistical analyses were conducted using a generalized linear mixed-model procedure. Cow weight gains and calf ADG were similar (P>.2) among treatments in ES. In LS, CL cows lost less weight than CM (P<.01; -33 vs -48 kg), and CH cows lost less weight than RH (P<.01; -39 vs -54 kg). Calf ADG in LS was greater for CL than for CM (P<.01; .93 vs .8 kg) and was greater for CM than for CH (.72 kg; P<.01), but similar (P=.54) between CH and RH calves. In LS, forage CP (12.7 vs 11.1 %) and IVTD (60.9 vs 57.3 %) were greater for CH than for RH (P<.05). In S, CM cows gained more weight than CL cows (P<.05; 34 vs 28 kg) and than CH cows (P<.01; 34 vs 18 kg) and CH cows gained more weight than RH cows (P<.01; 18 vs 11 kg). In S, CL and CM calves had similar ADG (P=.76; .98 and .96 kg), but CM was greater than CH (.78 kg; P<.01) and CH was greater than RH (.7 kg; P<.05). In S, forage CP was greater for CH than for RH (P<.01; 13.3 vs 11.7 %). Selected forage IVTD tended (P<.1) to be higher for CM than for CH. Stocking rate and method affected cow-calf performance and forage quality in late-spring and summer (warm-season, perennial grasses), but had less impact during the early-spring (cool-season, perennial grasses).

Key Words: Stocking Rate, Stocking Method, Cow-Calf

M156 Evaluation of ensiled sorghums with and without condensed tannins as feeds for ruminants. H. Carneiro*[1], P. B. Arcuri[1], J. A. Rodrigues[2], F. S. Sobrinho[1], S. S. Brum[1], and M. Villaquiran[3], [1]*Embrapa Gado de Leite Juiz de Fora, MG, Brazil,* [2]*Embrapa Milho e Sorgo Sete Lagoas, MG, Brazil,* [3]*E (Kika) de la Garza American Institute for Goat Research, Langston University, Langston, OK.*

Historically, there is a believe that condensed tannins (CT) are responsible for low digestibility of plant material and are recognized as anti-nutritional factors in diets of monogastric animals. High CT concentrations can reduce the absorption of protein from the small intestine of monogastric. However, in ruminant diets low concentrations (1-3% DM) can be beneficial by reducing ruminal degradation of forage protein, which outweigh any detrimental effects of reduced protein availability in the small intestine. A total of 10 Sorghum cultivars (lines CMSXS114 Tannin (T) and CMSXS165 Without Tannin (WT), Hybrids 9953101(T), 9953130(T), BR601 (WT), BR701 (T), BR700 (T), and AG2005 (WT), and Varieties BR 501(WT), and BR506 (WT)) with 8 replications were ensiled in PVC silos of 3 kg per silo for 60 d and then analyzed for CT, (colorimetric analysis by the butanol-HCl method) CP, NDF, ADF, and in situ and in vitro (4, 24, and 48 h) digestibilities. Condensed tannins from quebracho were purified using affinity chromatography with sephadex LH-20 and used as a standard. Low concentration of CT have been defined as 10 g/kg DM or less and medium as 10 to 50 g/kg DM or more. Hybrid BR701 had the highest concentration of CT among the sorghums (P<0.05) with 7 g/kg DM. Differences among sorghums were not detected for NDF (P=0.10), ADF (P=0.10), or in vitro digestibility (P=0.09). The highest CP content was noted for line CMSXS165 (9.74 g/kg; P<0.05). Concentrations of CP in CMSXS114 (8.32 g/kg), BR 700 (7.44 g/kg), and BR701 (8.05 g/kg) were above the overall mean (7.4 g/kg). The Hybrid BR700 showed the fastest rate of ruminal degradation of these 3 in the 4 h (P<0.05), followed by CMSXS114 and CMSXS165. The two latter were sorghums isogenic lines that differ only in CT concentration. It was concluded that digestibility was not affected by CT level; however, relative CT concentrations were low. Therefore, we would do not anticipate significant effects of CT content on DM intake, digestibilities, or performance in cattle fed these sorghum silages.

Key Words: Silage, Tannin, Ruminant Nutrition

Ruminant Nutrition I

M157 Effect of increasing sodium bicarbonate proportion in high concentrate diets on ruminal fermentation in finishing beef heifers. L. González*, A. Ferret, S. Calsamiglia, and X. Manteca, *Universitat Autònoma de Barcelona Edifici V, Campus UAB, Bellaterra, Barcelona, Spain.*

Four rumen fistulated Holstein heifers (264 ± 12 kg initial BW) were used in a 4 x 4 Latin square design to determine the effect of increasing levels of sodium bicarbonate (0, 1, 2 and 4 %, on DM basis) on ruminal fermentation. The main ingredients of the concentrate were: 33% barley grain, 32% corn grain, 16% tapioca and 10% soybean meal. Heifers were allowed to consume concentrate and barley straw on an ad libitum basis, which resulted in a mean of 12 to 88 forage to concentrate ratio. Linear, quadratic and cubic effects were analyzed with the Type 1 analysis of variance of the PROC MIXED procedure of SAS with animal and period considered random effects. Mean ruminal pH and total area under the pH curve tended to increase linearly (P < 0.15) with increasing buffer proportion. The lowest pH (5.65 ± 0.09) was similar across treatments. Hours in which pH was below 5.8 tended (P = 0.10) to a quadratic effect, the values being 12.6, 3.6, 3.2 and 4.7 h, for 0, 1, 2 and 4 % of sodium bicarbonate, respectively. Average ammonia nitrogen concentration was not affected by treatment (2.44 ± 0.87 mgN/100mL). Total VFA concentration was not affected by treatment (143 ± 12 mM). Molar proportion of propionate decreased linearly (P < 0.05) and acetate tended to increase linearly (P < 0.10) with increasing buffer proportion in the diet. Acetate to propionate ratio, molar percentage of butyrate and branch-chained VFA increased linearly (P < 0.05) as sodium bicarbonate proportion increased in the diet. Valerate was not affected by treatment. Data suggests that increasing sodium bicarbonate beyond 1% does not bring any further benefits to overall pH and ruminal fermentation conditions. Factors other than sodium bicarbonate proportion used as a buffer must play a role in the control of the effects of high concentrate diets on ruminal fermentation.

Key Words: Beef Heifers, Rumen Fermentation, Sodium Bicarbonate

M158 Effects of sodium bicarbonate on ruminal pH and feed intake in feedlot cattle. L. Paton*[1], M.A.G. von Keyserlingk[1], K. A. Beauchemin[2], and D. M. Veira[3], [1]*University of British Columbia Animal Welfare Program, University of British Columbia, Vancouver, British Columbia, Canada,* [2]*Agriculture and Agri-Food Canada, Lethbridge, Alberta, Canada,* [3]*Agriculture and Agri-Food Canada, Kamloops, British Columbia, Canada.*

The objective of this study was to determine whether sodium bicarbonate ($NaHCO_3$) could reduce the risk of acidosis in cattle receiving high concentrate diets. Ruminally cannulated Jersey steers (n=3) and Holstein cows (n=3), previously adapted to a high concentrate diet, were used in a repeated 3x3 Latin square to study the effects of $NaHCO_3$ on daily feed intake and ruminal pH. Cattle were provided ad libitum access to a control diet of steam-rolled barley, barley silage, and a protein-mineral supplement at 80, 12 and 8% (DM basis), respectively. Treatments were control, control plus free choice $NaHCO_3$ mixture and control supplemented with 0.7% $NaHCO_3$ (% DM basis). The free choice $NaHCO_3$ mixture was offered as 30% dried molasses and 70% $NaHCO_3$ based on a previous palatability trial. Periods consisted of 11 d adaptation and 3 d of continuous ruminal pH measurements using indwelling electrodes. Daily DMI (mean ± SE) did not differ between the control (7.95 ± 1.34 kg/d) and free choice $NaHCO_3$ (8.27 ± 0.86 kg/d) (P = 0.67) or the $NaHCO_3$ supplemented diet (7.94 ± 0.48 kg/d) (P = 0.99). Mean lowest feed intake for the control diet, free choice $NaHCO_3$ diet and 0.7% $NaHCO_3$ supplemented diet were 2.98 kg/d, 5.51 kg/d and 6.89 kg/d, respectively. Considerable variation in daily free choice

$NaHCO_3$ intake (104.6 ± 45.6 g/d) was also observed. Control mean ruminal pH (5.81 ± 0.09) did not differ from the free choice $NaHCO_3$ diet (5.88 ± 0.08) ($P = 0.43$) or the $NaHCO_3$ supplemented diet (5.92 ± 0.10) ($P = 0.39$). Variation in control ruminal pH did not differ from the free choice $NaHCO_3$ ($P = 0.43$) or the $NaHCO_3$ supplemented diet ($P = 0.47$). These results suggest that supplementing a feedlot diet with either 0.7% $NaHCO_3$ as a component of the diet or free choice has no effect on total daily DMI or daily mean ruminal pH when compared to the control diet.

Key Words: Acidosis, Feedlot Cattle, Rumen pH

M159 Effects of monensin and different dose levels of essential oils on feed intake, growth performance and feed efficiency of beef cattle. C. Benchaar*[1,2], E. Charmley[3], and J. Duynisveld[3], [1]*Dairy and Swine R&D Centre, Agriculture and Agri-Food Canada, Lennoxville, Quebec, Canada,* [2]*Nova Scotia Agricultural College, Truro, Nova Scotia, Canada,* [3]*Crop and Livestock Research Centre, Agriculture and Agri-Food Canada, Nappan, Nova Scotia, Canada.*

The objective of this study was to investigate the effects of dietary addition of monensin (Rumensin®; MO) or different dose levels of a commercial mixture of essential oils (Vertan®; EO) on feed intake, growth performance and feed efficiency of beef cattle. The mixture of EO consisted of thymol, eugenol, vanillin and limonene. Twenty steers and twenty heifers (Angus x Herford, initial BW = 369 ± 29 kg) were assigned to ten blocks of four cattle according to BW and fed for *ad libitum* intake a TMR comprising 75% grass/legume silage and 25% of rolled barley (dry matter basis). Within each block, cattle were randomly assigned to one of four experimental treatments; unsupplemented TMR (Control, CO) or TMR supplemented with MO (220 mg/d) or EO (2 and 4 g/d). During the experiment (98 and 82 days duration for the steers and heifers; respectively), feed intake was recorded daily and animals were weighed at the start and end of the trial and at two week intervals during the trial. Data were analyzed as a randomized block design using the PROC MIXED procedure of SAS. Specific prior contrasts were used to test differences between CO and diets supplemented with MO and EO, and to determine the linear or quadratic response to EO dose level. Dry matter intake (DMI) was not affected by the addition of EO (8.6 kg/d; $P > 0.05$). However, DMI was 10 % lower ($P < 0.01$) for cattle fed MO compared to those fed CO. Average daily gain (ADG) was similar between cattle fed CO and those consuming supplemented diets (1.2 kg/d; $P > 0.05$)). Feed efficiency (DMI to ADG ratio) was not different between cattle fed CO and those receiving MO and EO treatments (7.0; $P > 0.05$)). However, a quadratic effect of EO dose level was observed ($P < 0.05$). Feed efficiency was decreased by the addition of 2 g of EO/d (6.6 vs 7.0), where as it was increased when the diet was supplemented with 4 g of EO/d (7.8 vs. 7.0). Results from this study suggest that further work is required to determine the optimum level of EO supplementation to improve feed efficiency in beef cattle.

Key Words: Monensin, Essential Oils, Beef Performance

M160 Monensin or decoquinate in high concentrate diets fed to Santa Ines lambs. I. Susin*[1,2], C. Q. Mendes[1,2], A. V. Pires[1,2], and I. U. Packer[1,2], [1]*University of São Paulo,* [2]*ESALQ.*

Feedlot lamb meat production has increased in Brazil. However, feedlot lambs are more susceptible to coccidiosis occurrence. Addition of an anticoccidial drug to the diet may improve lamb performance. Two trials were performed to evaluate the effects of using decoquinate or monensin on feedlot lamb performance. In each experiment, animals were assigned to a complete randomized block design according to body weight and age at beginning of the trial. Trial 1: Forty-two Santa Ines ram lambs (initial BW 19.2 ± 0.1 kg and 81 ± 1.4 d old) were fed a 95% concentrate and 5% raw sugarcane bagasse diet for 56 days. To the control diet (CON) was added either decoquinate (DEC, 17 mg/kg DM) or sodium monensin (MON, 25 mg/kg DM). Both DEC and MON were effective in reducing oocysts per gram of feces as compared to the control diet (P<0.001). However, there were no differences on performance among treatments. Average daily gain (ADG), dry matter intake (DMI), feed conversion (FC) and hot carcass yield (HCY) were 270, 287 and 271 g/day; 0.94, 0.97 and 0.95 kg/day; 3.48, 3.43 and 3.51 kg DMI/kg gain and 46.8%, 47% and 47.2% for treatments CON, DEC and MON, respectively. Trial 2: Forty-eight Santa Ines ewe lambs (initial BW 18.4 ± 0.1 kg and 89 ± 2.5 d old) were fed the same diet of Trial 1 for 56 days (Phase 1). In Phase 2, the same ewe lambs were fed a 70% concentrate and 30% coastcross hay diet during an additional 56 day period. There were no differences among treatments in Phase 1 for ADG, DMI and FC (186, 199 and 183 g/day; 0.77, 0.81 and 0.74 kg/day; 4.2, 4.1 and 4.1 kg DMI/kg gain for treatments CON, DEC and MON, respectively). In Phase 2, however, ewe lambs on MON treatment had a higher ADG and better FC (P=0.03). There was no difference on DMI. ADG, FC and DMI in Phase 2 were 121, 121 and 149 g/day; 8.7, 8.8 and 7.4 kg DMI/kg gain; 1.05, 1.07 and 1.1 kg/d for CON, DEC and MON, respectively. Adding monensin to a 70:30 (concentrate:roughage ratio) diet for ewe lambs improved ADG and FC 19 and 15%, respectively. The addition of monensin or decoquinate in feedlot lamb diets control oocyst discharge; monensin also improves ADG and feed efficiency in older ewe lambs.

Key Words: Hair Sheep, Ionophore, Performance

M161 Effects of yeast culture in barley-based backgrounding and finishing diets for cattle on health, growth performance, and fecal *Escherichia coli* populations. Y. Wang*[1], T. A. McAllister[1], S. J. Bach[1], D. J. Gibb[1], and I. Yoon[2], [1]*Agriculture and Agri-Food Canada Research Centre, Lethbridge, Canada,* [2]*Diamond V Mills, Inc., Cedar Rapids, IA.*

The effects of a naturally fermented *Saccharomyces cerevisiae* feed additive (Diamond V XP#8482 Yeast Culture, YC) on health, growth performance and fecal *Escherichia coli* were assessed using 390 newly weaned British × Charolais crossbred steers (292.5 ± 1.23 kg initial BW) in a completely randomized study that included backgrounding (BKGD) and finishing (FNSH) periods. Barley silage/barley grain-based feedlot diets were fed as is (control) or amended with YC to provide 56.7 g/d to each steer for the first 28 d, followed by 28.3 g/d to the end of BKGD (treatment YC-B) or through to the end of FNSH (treatment YC-BF). Feed intake, ADG, and gain/feed were determined on a per-pen basis ($n = 10$) at 4-wk intervals. Fecal samples collected from each steer ($n = 130$) were analyzed for total *E. coli* counts (at end of BKGD) and presence of *E. coli* O157:H7 (and end of BKGD and end of FNSH). Carcass weight, fat cover, longissimus area, and dressing percentage were recorded at harvest (commercial abattoir). Growth rates averaged 1.26 kg/d during BKGD and 1.32 kg/d during FNSH. Feeding YC did not affect ($P > 0.05$) DMI, ADG or gain efficiency of the steers during BKGD or FNSH, nor were treatment effects on carcass traits observed ($P > 0.05$). Prevalence of *E. coli*O157:H7 was low. At the end of BKGD, this pathogen was detected in only four steers from a single YC-BF pen. At the end of FNSH, *E. coli* O157:H7 was present in fecal samples from two control steers (in 1 pen) and 13 YC-B steers (in 3 pens), but none in the YC-BF group. Total fecal *E. coli* counts at the end of BKGD were similar across treatments. Three deaths due to bloat were recorded in the control group, plus removal of one YC-B steer. There were no fatalities due to bloat in the YC-BF group. In the present study, YC did not affect health, growth performance or fecal shedding of *E. coli* O157:H7 by feedlot cattle.

Key Words: *E. coli* O157:H7, Feedlot Cattle, Yeast Culture

M162 Effects of alcohol-fermented feedstuff with live yeast on growth characteristics, serum metabolites, and meat compositions in Korean native bulls. S. Jong Suh*, P. Byung Ki, and H. Byong Ju, *Department of Animal Resources Science, Kangwon National University, Chunchon, Korea.*

The effects of alcohol-fermented feedstuff with live yeast (AFF) on average daily gain, serum metabolites, and meat compositions were investigated using forty Korean native bulls (initial wt: 255.9, final wt: 649.2). The AFF (cracked corn:cracked oat:water:molasses:live yeast=48.48%:12.12%:30.30%:6.07%:3.03%) was fermented anaerobically in an incubator at 30° for 48 hours. Experimental diets were commercial feed, AFF, and rice straw. The feeding of rice straw was ad libitum feeding in control and treatment. Bulls were individually fed for 14 months. The experiment was composed of two groups: control (100% of commercial feed), treatment (50% of commercial feed and 50% of AFF). Average daily gain (ADG) was higher in treatment than in control (P<0.05; 1.06 vs 0.89). Total gain, total dry matter intake (TDMI), and feed conversion were not different between treatment and control. The blood cholesterol and triglyceride concentration were higher in treatment than in control, but the blood urea nitrogen (BUN) concentration of treatment was lower than that of control during growing (200–400)

period. The blood glucose, cholesterol, and triglyceride concentration were high in treatment, compared to control (P<0.05) during finishing (400–700) period. The ether extract content of longissimus dorsi (LD) muscles of treatment was higher than that of control (P<0.05). The essential and nonessential amino acid content of LD muscles were similar between control and treatment. The saturated fatty acid content of LD muscles was lower in treatment than in control, but the unsaturated fatty acid content of LD muscles was high in treatment, compared to control. The oleic acid content of LD muscles was significantly higher in treatment than in control (P<0.05). Consequently, the increase of ADG and unsaturated fatty acid content was observed in treatment according to feeding the AFF. Therefore, it is expected that the AFF will be effective to improve growth performance and meat quality in Korean native bulls.

Key Words: Alcohol-Fermented Feedstuff with Live Yeast, Korean Native Bulls, Meat Composition

M163 Rate and extent of *in situ* DM disappearance of feedstuffs in cows fed different strains of yeast.

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An *in situ* experiment was conducted to determine rate and extent of DM disappearance (DMD) of corn grain (CG), sorghum grain (SG), alfalfa hay (AH) and brown mid-rib forage sorghum silage (SS) in the presence of different strains of yeast. Four mature rumen cannulated non-lactating cows were fed a control diet (C), or C diet plus 20 g/d P7, 20 g/d SC47 or 40 g/d DV-XP strains of yeast in a 4X4 Latin square design. A 13% high concentrate diet (9.5 kg/d) consisting of 80% of steam flaked corn, 10% soybean hulls and 10% protein/vitamin/mineral supplement was fed to each cow twice a day (60% at 0800 h and 40% at 1600 h). Yeast strains were top dressed on the respective diet at the morning feeding and mixed by hand. Cows were fed their respective diet in each period of the Latin square for 14 d. On d 12 of each period, duplicate *in situ* digestion bags (10 X 20 cm) containing substrate (12.5 mg/cm^2 of bag surface area) were incubated for 72, 48, 24, 12, 6, 3, 1.5, 0.5 and 0 h. Immediately after submersion of the 0 h bags of substrate into the ruminal fluid, all bags were removed and rinsed with tap water. After an initial rinse, all bags were placed into an automatic clothes washing machine and rinsed using 4 to 6 gentle cycles of agitation until rinse water was clear. Bags were then dried at 60 C for 48 h and weighed to determine DMD. The rate of DMD for CG, SG, AH and SS was 2.7, 2.1, 1.88 and 0.94 %/h, respectively. P7 and SC47 increased (P =0.0075) rate of DMD of CG over that of C and DV-XP (3.28 and 3.43 vs 1.96 and 2.52 %/h, respectively). Yeast strains did not change the rate of DMD of SG, AH or SS (P > 0.10). The extent of DMD was similar across all treatments for CG (95.4%), SG (89.3%) and AH (74.54%). The extent of DMD of SS was decreased (P = 0.04) when DV-XP was fed compared C, P7 and SC47 (56.0% vs 76.9, 74.0 and 69.5, respectively). These data indicate that various yeast strains affect rate or extent of DMD of CG and SS in this study.

Key Words: Cattle, DM Disappearance, Yeast

M164 Fermentable and nutritional characteristics of fermented feedstuffs added Aspergillus oryzae and Saccharomyces cerevisiae.

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This study was conducted to compare and evaluate fermentable and nutritional characteristics of fermented brewery meal with Aspergillus oryzae (AO) and Saccharomyces cerevisiae (SC). Experiments were divided into three treatment groups; FFAO (fermented feedstuff with 1% of Aspergillus oryzae), FFSC (fermented feedstuff with 1% of Saccharomyces cerevisiae), and FFAS (fermented feedstuff with 0.5% of Aspergillus oryzae and 0.5% of Saccharomyces cerevisiae). For changes of crude protein contents by 48 hours fermentation, there were no significant difference among treatments. Ether extract contents were significantly increased by 48 hours fermentation (P<0.05). Neutral detergent fiber contents of FFAO, FFSC and FFAS were significantly decreased by 48 hours fermentation (P<0.05), but acid detergent fiber and acid detergent lignin contents were not different. The pH of FFAO and FFAS was decreased more rapidly than that of FFSC, reaching a plateau after 24 hours (P<0.05). Alcohol content was increased rapidly until 18 hours in FFAO and was increased rapidly until 12 hours in FFSC and FFAS, and alcohol content of FFAO, FFSC and FFAS was maintained constantly after 24 hours (P<0.05). The ammonia N content of FFAO, FFSC and FFAS was 0.022, 0.073 and 0.040% at 48 hours, respectively, and then ammonia N was over twice higher in FFSC compared with FFAO and FFAS (P<0.05). Dextrose content was increased until 6 hours in FFAO, but it was rapidly decreased in FFSC and FFAS until 6 hours (P<0.05). Lactate content was higher in FFAO and FFAS compared with FFSC (P<0.05). Consequently, if AO is added for the formulation of fermented feedstuff with brewery meal, which has high moisture content, ether extract, alcohol, and lactate contents were increased, but NDF and ammonia N contents were reduced. Therefor, it is expected that AO will be effective to increase the feed value and the preservation of fermented feedstuff with a high moisture content.

Key Words: Aspergillus oryzae, Saccharomyces cerevisiae, Fermented Feedstuff

M165 Effects of chlortetracycline (CTC) and steroidal implant on growth and plasma growth hormone (GH) and thyroid hormone release after challenge with thyrotropin-releasing hormone (TRH) and GH-releasing hormone (GHRH) in beef steers.

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Twenty-four Simmental-Angus steers (365 kg ± 4) were used to test the hypothesis that CTC, in the absence and presence of steroidal implant, alters composition of tissue accretion by attenuating GH and thyroid-stimulating hormone (TSH) release. Steers were assigned randomly to a 2 x 2 factorial arrangement of treatments of either 0 or 350 mg CTC/d, with and without estrogenic implant (EI). Steers received ad libitum amounts of a 80:20 concentrate-forage diet formulated to provide 105% of the MP requirement for steers gaining 1.6 kg/d. On d 0, 15, 30, 56 and 106, steers received a challenge injection via jugular catheter of 1.0 μg/kg BW TRH + 0.1 μg/kg BW GHRH and blood samples were collected from 30 to 360 min post-challenge. Steers were slaughtered after d 112 to determine carcass characteristics. Across the feeding period, DMI was unaffected (P #8805 0.17) by treatment; however, EI increased (P #8804 0.01) rate and efficiency of gain. Treatment did not affect (P #8805 0.2) area under the response curve (AUC) for GH, TSH, or thyroxine; however, AUC for triiodothyronine (T_3) tended to be greater (P = 0.14) for EI steers following each GHRH + TRH challenge. Carcass weight was greater (P = 0.05) and longissimus fat cover was lower (P = 0.02) in steers fed CTC in the absence of EI, but not in the presence of EI (interaction, P = 0.03). Marbling score was 13% greater (P = 0.18) for steers fed CTC. In conclusion, subtherapeutic feeding of CTC had subtle effects on carcass characteristics, but did not attenuate the release of GH or TSH in response to GHRH + TRH challenge. Conversely, steroidal implant increased tissue accretion and tended to increase circulating T_3 following GHRH + TRH challenge.

Key Words: Chlortetracycline, Carcass Quality, Beef Cattle

M166 Effects of salinomycin and virginiamycin on performance and carcass traits of feedlot steers.

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Seventy-two Nellore steers, with an initial BW of 416±26 kg and approximately 36 months of age, were fed for 69 days at the experimental feedlot from University of Sao Paulo. The animals were blocked by initial weight and ramdomly allocated to 24 pens, with three steers per pen. Steers were fed four dietary salinomycin and virginiamycin supplementation groups: control (CONT), 15 ppm of salinomycin (SAL), 16 ppm of virginiamycin (VIRG) and 10 ppm of salinomycin plus 8 ppm of virginiamycin (SAL+VIRG), mixed on ground dry corn. The commercial products used were Coxistac® (Salinomycin) and Phigrow® (Virginiamycin). During the trial period, steers were fed once daily, with meals delivered at 0700 h. Diets contained a higher proportion of roughage than normally observed in feedlots using *B. taurus* animals: 77% of DM as concentrate, 40.8% NDF, 13.5% CP and 70.5% TDN. All statistical analyses were conducted using the GLM procedure of SAS. No differences were observed for average daily gain (ADG)

for the CONT treatment compared to SAL or VIRG. But surprisingly the ADG of the SAL+VIRG treatment was 17.9% higher (P<0.05) than CONT. SAL and VIRG treated steers had lower (P<0.05) DMI than SAL+VIRG steers: 10.1±0.4, 10.2±0.4, and 11.3±0.4 kg/d, and 2.24±0.08, 2.25±0.08, and 2.46±0.08% of BW, respectively. CONT animals showed intermediate (P>0.05) intakes. Feed efficiencies were not different (P>0.05) among groups. Treatments with higher gains had also greater intakes. Nevertheless, even without statistical differences, there were improvements of 5.6, 8.3, and 8.0% in feed efficiency, respectively for SAL, VIRG and SAL+VIRG, over controls. Few differences were observed on carcass traits between supplemented and control steers. Among them, steers fed SAL had higher backfat thickness than (P<0.01) CONT and than (P<0.05) VIRG and SAL+VIRG steers: 8.7±0.7 vs. 6.3±0.7, 6.8±0.7 and 6.8±0.7 mm, respectively. The improvements in efficiency are very consistent with previous research and would have important economical and environmental impact.

Key Words: Beef Cattle, Ionophores, Antibiotics

M167 Effects of semduramicin on performance and carcass traits of feedlot steers.

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Forty-three Nellore steers, approximately 36 months of age, were individually fed in outdoor pens with electronic Calan gate feeders at University of Sao Paulo experimental feedlot. The animals were blocked by initial weight and ramdomly assigned to four levels of dietary Aviax®: 0, 45, 67.5, or 90 mg semduramicin/head/day. After a 27-day adaptation period, steers had an average shrunk weight of 457±18 kg at the beginning and 540±19 kg at the end of the trial. During the 62-day experimental period, steers were fed once daily at 0900 h. Because *B. indicus* steers are more liable to develop acidosis, roughage content was higher than normally observed in feedlots using *B. taurus*: 77% of DM as concentrate, 40.8% NDF, 13.5% CP and 70.5% TDN. Data were analyzed using the REG and the GLM procedures of SAS. Average daily gain was not affected (P>0.05) by semduramicin supplementation, although steers treated with 67.5 mg had increased daily gains of 0.136 kg/day above controls. Steers supplemented with 90 mg had lower dry matter intakes (P<0.05) than steers supplemented with 67.5 mg of semduramicin. During the evaluation period, intakes for steers supplemented with 67.5 and 90 mg were: 11.73±0.30 and 10.73±0.28 kg/day, and 2.35±0.06 and 2.12±0.05% of BW, respectively. Feed efficiency (BWG/DMI) was not different (P>0.05) between treated and non-treated steers. Improvements in overall feed efficiency were observed to be: 2.8, 7.4, and 7.3% for treatments 45, 67.5, and 90 mg, respectively, over controls (P>0.05). However, there was an improvement in feed conversion efficiency determined as residual feed intake calculated by regression (P<0.05). Carcass characteristics from supplemented steers did not differ (P>0.05) from the controls. The improvements in efficiency are very consistent with previous research with other ionophore molecules and would have important economical and environmental impact.

Key Words: Beef Cattle, Nellore, Ionophores

M168 Chlortetracycline, but not Synovex-S, differentially affects tissue expression of high-affinity glutamate transporters in fattening steers.

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Chlortetracycline (CTC) fed sub-therapeutically and estrogenic growth implants (Synovex-S; S) are used to alter the amount and site of skeletal muscle and/or adipose tissue accretion of fattening cattle. However, effect(s) of these nutrient-repartitioning agents on nutrient absorption capacity are unknown. Because the expression of two high-affinity glutamate transporters, GLT-1 and EAAC1, by tissues of fattening steers is sensitive to physiological load (Gissendanner et al., 2003, FASEB J. 17(5):A738), this study was conducted to determine if expression of GLT-1 or EAAC1 was affected by none (control; C), S (d0 and d56 implanted) and/or CTC (350 mg/d) treatment (n = 6) of Simmental x Angus steers (BW = 350 ± 10 kg) fed a finishing diet (see companion abstract, Kitts et al., 2004) for 112 d. Immunoblot analysis was used to determine the relative content of EAAC1 and GLT-1 in plasma membrane vesicles isolated from the duodenum (D), jejunum (J), ileum (I), liver (L), skeletal muscle (M, longissimus dorsi), subcutaneous fat (SF), omental fat (OF) and interstitial fat (IF). EAAC1 and GLT-1 content of D, J, and I (P > 0.48), and EAAC1 content of L and M (P > 0.53), were not affected by treatments. In contrast, for CTC steers, M GLT-1 content was 128% greater (P < 0.01) than C steers, whereas L GLT-1 content was 236% and 160% greater (P < 0.008) than C and S, respectively. For adipose tissues, SF EAAC1 content did not differ (P > 0.94), but OF EAAC1 content of CTC steers was 74% greater (P < 0.078) than C. CTC steers also contained 319% more (P < 0.053) IF EAAC1 than S, but not C (P > 0.26) animals. OF and IF GLT-1 did not exhibit a treatment effect (P > 0.33) in contrast to SF GLT-1 content, which was 524% (P < 0.08) and 237% (P < 0.09) greater in CTC than for C and S steers, respectively. Although Synovex-S had no effect, CTC appears to increase the capacity for glutamate absorption by up-regulating GLT-1 (L, M, SF) and EAAC1 (OF, IF) expression, in contrast to having no effect on intestinal epithelium.

Key Words: Gene Expression, SLC1A1, SLC1A2

M169 Influence of genotype and diet on steer performance.

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Objectives were to evaluate genotype and diet effects on steer performance during the growing period and subsequent responses to a high concentrate diet during the finishing period. Fifty-one [MARC III (M; 14) and Brahman cross (Bx; 37)] steers were allotted to eight pens and individually fed chopped bromegrass hay (BG; N=26; DM=0.85, CP=9.5%, ME=2.19 Mcal/kg) or a corn silage based diet (CS; N=25; DM=0.51, CP=11.9%, ME=2.75 Mcal/kg) for 119 d (PD1) followed by a high corn diet (HC; DM=0.79, CP=11.7, ME=3.08 Mcal/kg) to a target wt of 560 kg (PD2). Data were analyzed by ANOVA with genotype, diet (BG, CS), and the two-way interaction included. The interaction was not significant. Initial (273 kg) and final wts (559 kg) did not differ due to genotype or diet, but wt of BG (325 kg) steers was less than CS (384 kg) steers at the end of PD1. ADG and intake of DM, CP, and ME were less (P<0.05) for Bx than for M during PD1, PD2 and total, but efficiency of M and Bx was similar (P>0.40). Carcass wt, marbling, quality grade, and REA were similar (P>0.12), but Bx steers had greater backfat (1.26 vs. 0.87 cm) and yield grades (P=0.07) than M steers. During PD1, daily DMI (6.91 vs. 7.11 kg) was similar, but CP (0.66 vs. 0.85 kg) and ME (15.2 vs. 19.5 Mcal) intake of BG was less (P<0.001) than CS. DMI/gain (21.5 vs. 6.9), CP intake/gain (2.06 vs. 0.83), and ME intake/gain (47.1 vs. 19.2 Mcal/kg) were greater in BG. CS manure accumulated more total VFA but less branched-chain VFA and aromatics than BG manure. When fed the HC diet (PD2), feed intake, ADG, and efficiency were improved (P<0.02) in the BG vs. CS steers. Shedding of E. coli 0157 was associated with reduced DMI and ADG (P<0.10). Over the total study, ADG was lower (0.97 vs. 1.03 kg), and DMI (8.50 vs. 7.62) and DMI/gain (8.09 vs. 7.17) were greater in BG than in CS fed steers, but neither CP intake/gain (0.86 vs. 0.84) nor ME intake/gain (22.2 vs. 21.1) differed. Carcass weight, backfat, and yield grade were greater (P<0.04) for CS than for BG, but marbling, quality grade, and REA did not differ.

Key Words: Efficiency, Odor, *E. coli*

M170 Zinc increases differentiation of bovine intramuscular adipocytes by suppressing nitric oxide production and increasing PPARγ2 gene expression.

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Zinc (Zn) is a micromineral that functions as a cofactor of many enzymes and is known, recently, to be involved in adipocyte metabolism, insulin resistance, and obesity. This study was conducted to determine the effects of Zn on the differentiation of bovine intramuscular adipocytes and on the production of nitric oxide (NO). Preadipocytes were isolated from intramuscular fat depots of 26-mo-old (adult) Korean (Hanwoo) steers and maintained in Dubelcco's Modified Eagles's Media (DMEM) containing 5% FBS. At confluence, the cells were treated with 10 μg/mL insulin, 0.25 μM dexamethasone, and 0.5 mM 1-methyl-3-isobutyl-xanthine to induce differentiation (accumulation of lipid droplets) for 48 h. Zinc was supplemented to the differentiation media in the form of either zinc chloride ($ZnCl_2$) or zinc sulfate ($ZnSO_4$) to attain the final concentrations of 0, 5, 25, 50 and 100 μM. Glycerol-3-phosphate dehydrogenase (GPDH) activity, an index of adipocytes

differentiation, was significantly ($P < 0.05$) increased as the concentration of both forms of Zn in media increased, showing the highest activity (25.74 ng/min/mg protein) at 25 μM $ZnSO_4$ at 10 d after differentiation induction. On the other hand, supplementation of Zn into the media of bovine intramuscular adipocytes tended ($P > 0.05$) to decrease (from 15 μM to 10.5 μM) the production of NO. Peroxisome proliferator-activated receptor gamma 2 (PPARγ2) gene expression in bovine intramuscular adipocytes was increased at 10 d after differentiation induction by treatment with Zn. The current results indicate that Zn strongly promotes lipogenic activity in cultured bovine intramuscular adipocytes via suppression of NO production. These data further indicate that Zn may increase adipocyte differentiation by stimulating PPARγ2 gene expression.

Key Words: Zinc, Nitric oxide, PPARγ2

M171 Performance and residual feed intake differences between steers housed in individual or group pens. P. V. Paulino*[1,2], F. C. Castro[1], A. C. Magnabosco[1,3], and R. D. Sainz[1], [1]*University of California, Davis,* [2]*Universidade Federal de Vicosa, Vicosa, MG Brasil,* [3]*Universidade Catolica de Goias, Goiania, GO, Brasil.*

Residual feed intake (RFI) is a useful measure of feed efficiency, but it requires individual records of dry matter intake (DMI) as well as body weight gain (ADG). There is some question as to the behavioral differences in animals fed individually vs. those in a group. Thirty AngusxHereford (AX) and 30 (AngusxHereford)xGelbvieh (GX) steers were fed a corn-based diet on an *ad libitum* basis for 84 days in individual (n = 24) or in group pens (n = 36, 6/pen). Feed intakes were recorded weekly and steers were weighed every 28 days. Average ADG was estimated by individual or pen as the slope of the regression of body wt and time. Residual feed intake was calculated as the difference between observed dry matter intake (DMI) and that predicted by regression: $E(DMI) = 0.0491\ BW^{0.75} + 2.07\ ADG$, $R^2 = 0.81$. DMI required for maintenance (DMI-M) was estimated as DMI - 2.07 ADG, i.e., assuming a constant net efficiency for gain. DMI, ADG, RFI and DMI-M were analyzed using the GLM procedure of Minitab. Model effects were genotype, housing, and their interaction. DMI was higher ($P < 0.05$) for AX (8.17 kg/d) than GX (6.89 kg/d) steers and for animals housed in group (8.18 kg/d) compared to individual pens (6.87 kg/d). Consequently, AX steers gained more ($P < 0.05$) weight (1.37 kg/d) than GX steers (0.97 kg/d), and animals in individual pens gained more ($P < 0.05$) than those housed in groups (1.29 and 1.06 kg/d, respectively). RFI was higher ($P < 0.05$) in AX than GX steers. A significant ($P < 0.05$) genotype x housing interaction was detected only for RFI, because the difference in RFI between genotypes was larger for the animals housed in group pens than for those housed individually. For both genotypes, animals housed in group pens had higher RFI values than animals housed individually. This could have been due to higher maintenance requirements, since DMI-M was higher in AX than GX steers (+8.5%, $P < 0.05$), and in group-fed than individually-fed steers (+10.1%, $P < 0.05$). Type of housing had significant effects on performance and feed efficiency in the feedlot and this effect was not uniform across genotypes. These results raise questions about the protocols for measuring RFI. Financial Support: CAPES

Key Words: Residual Feed Intake, Beef Cattle, Feed Efficiency

M172 Effect of supplemental chromium on tissue chromium concentrations in cattle. J. W. Spears*[1], K. E. Lloyd[1], M. E. Tiffany[1], and M. T. Socha[2], [1]*North Carolina State University, Raleigh,* [2]*Zinpro Corp, Eden Prairie, MD.*

Supplemental chromium (Cr) has increased performance of dairy cows and immunity of stressed beef calves. Experiments were conducted to determine the effects of supplemental Cr on: 1) tissue Cr concentrations in finishing beef steers and dairy cows and 2) placental transfer of Cr in calves. In Exp. 1, liver and kidney samples were obtained at harvest from 36 Angus and Angus-cross steers (initial BW 332 kg) that received either: 1) control (no supplemental Cr), 2) 0.4 mg Cr/kg DM from Cr-nicotinic acid complex (CrNA), 3) 0.8 mg Cr/kg DM from CrNA or 4) 0.8 mg Cr/kg DM from Cr chloride. Experimental diets were fed for 146 d. Chromium concentrations were low in liver ($\overline{X}$ = 11.4 μg/kg DM) and kidney ($\overline{X}$ = 20.6 μg/kg DM), and were not affected by Cr supplementation. Twenty-four Angus and Angus-cross steers (initial BW 288 kg) were randomly assigned to treatments consisting of 0, 0.2, 0.4 or 0.8 mg supplemental Cr/kg DM from Cr-L-methionine (MiCroPlex®; CrMet) in Exp. 2. Steers were fed a growing diet for 125 d prior to harvest. Control steers had higher ($P< 0.05$) muscle Cr concentrations than Cr-supplemented steers. Liver ($\overline{X}$ = 41.3 μg/kg DM) Cr concentrations were not affected by treatment. In Exp. 3, 18 Holstein cows, at approximately 35 d prepartum, were assigned to either 0 or 0.06 mg Cr/kg metabolic BW from CrMet daily via gelatin capsule. Calves were harvested at birth prior to nursing to determine placenta transfer of Cr. Cows continued to receive treatments until 30 d postpartum, at which time they were harvested. Calves born to Cr-supplemented dams had higher ($P< 0.01$) Cr concentrations at birth in semitendinosus muscle (98 vs 68 μg/kg) than controls. Supplemental Cr did not affect Cr concentrations in liver, heart or kidney of calves. Similarly, Cr concentrations in tissues of cows were not affected by supplemental Cr. These studies indicate that supplementing low concentrations of Cr to ruminant diets had minimum effects on tissue Cr concentrations.

Key Words: Chromium, Cattle

M173 Magnesium sulfate affects water consumption and drinking behavior of beef cattle. A. S. Grout[1], D. M. Veira*[2], D. M. Weary[1], M. A. G. von Keyserlingk[1], and D. Fraser[1], [1]*Animal Welfare Program, University of British Columbia, Vancouver, British Columbia, Canada,* [2]*Agriculture and Agri-Food Canada, Kemloops, British Columbia, Canada.*

Sulfate (SO_4) salts of Na and Mg are common in rangeland water sources and pose problems for animal health, production and welfare. This experiment considered the effect of Na_2SO_4 and $MgSO_4$ on water consumption, fecal DM and drinking behavior of cattle. Sixteen yearling Hereford and Hereford Angus cattle (initial weight: 421 ± 24 kg) were watered twice daily with tapwater (16 ppm SO_4) or water containing Na_2SO_4 at concentrations of 2000 ppm SO_4 (low Na_2SO_4), $MgSO_4$ at 2000 ppm SO_4 (low $MgSO_4$) or $MgSO_4$ at 4000 ppm SO_4 (high $MgSO_4$) in 21-d treatment periods separated by 7-d interim periods when all animals were given tapwater. Treatments were applied in an incomplete Latin Square where each animal was exposed to 3 of the 4 treatments yielding 8 animals for each treatment comparison. Paired t-tests were used for analysis of average daily water consumption, fecal DM and refusals to drink. Variability in water consumption patterns was assessed by Wilcoxon paired sample tests. Daily water consumption was highest for tapwater (41.3 ± 6.6 L/d; $P < 0.01$) and lowest for high $MgSO_4$-water (24.4 ± 9.0 L/d; $P < 0.01$). Response to high $MgSO_4$-water was highly variable, with mean daily consumption ranging from 12.4 to 40.9 L. After 11 d on treatment, fecal DM was not different for any of the treatments, but was higher ($P < 0.03$) after 21 d of high $MgSO_4$-water. Of the 42 drinking opportunities per treatment (twice per day × 21 d), cattle refused to drink 10.1 ± 6.3 times on high $MgSO_4$-water compared to 1.5 ± 1.9 times on tapwater ($P < 0.05$). Variation in intake was larger for high $MgSO_4$-water (SD of 42 intakes = 11.7) than for tapwater (6.3) and low $MgSO_4$-water (8.9) ($P < 0.05$). These findings indicate that high levels of $MgSO_4$ in water can lead to lower and more variable water consumption sufficient to increase fecal DM. Some cattle also forgo drinking when offered high $MgSO_4$-water, further indicating that this water is unacceptable to cattle.

Key Words: Water Quality, Sulfate, Drinking Behavior

M174 Selenium concentration of colostrum and milk from beef cows receiving different forms of selenium supplementation. P. A. Davis*, L. R. McDowell, R. Van Alstyne, E. Y. Matsuda-Fugisaki, and N. S. Wilkinson, *Department of Animal Sciences, University of Florida, Gainesville.*

Forty-three Angus cows (125-150d gestation) were stratified by age and randomly assigned to five groups receiving either no selenium (Se) supplementation (control), 5 ml sodium selenite via subcutaneous injection (Mu-Se, Burns Biotech Labs, Inc. Oakland, CA) every four mo, 9 ml barium selenate via subcutaneous injection (Deposel, Grampian Pharmaceuticals Ltd, Lancashire, UK), sodium selenite, or selenized yeast (Se-Plex, Alltech, Nicholasville, KY) via free-choice (FC) salt-based mineral mixtures (26 ppm Se) in a one year experiment to evaluate the effects of selenium supplementation methods on milk Se concentration. Animals on each treatment grazed bahiagrass pastures and received bahiagrass hay (<0.02 ppm Se DM basis) during winter. Colostrum and

subsequent milk was collected at parturition, 30, 90, and 180 d postpartum. Samples were analyzed for selenium concentration using a fluorometric method. Colostrum Se concentration did not differ (P<0.05) among control, Deposel, Mu-Se and FC sodium selenite treatments and were below critical level (0.05 ppm) at 0.038, 0.035, 0.035, and 0.038 ppm, respectively. Sel-Plex was higher (P<0.05) than control and all other treatments at 0.071ppm. At 30 d postpartum, Sel-Plex was higher (P<0.05) than control and both injectable products. FC sodium selenite was higher (P<0.05) than both Mu-Se and Deposel and tended to be higher than control (P=0.07). At 90 d postpartum, milk Se concentrations did not differ among treatments with Sel-Plex tending (P=0.07) to be higher than Mu-Se. Milk Se concentrations did not differ at 180 d among control, Deposel, Mu-Se, and FC sodium selenite, however, Sel-Plex was higher (P<0.05) than all other treatments at 0.042 ppm. At no time during the study did either injectable Se source produce milk Se concentrations higher than control or above the critical level. FC sodium selenite outperformed both injectable products only at 30 d. Overall, milk Se concentrations from cows receiving Sel-Plex were higher than all other treatments.

Key Words: Beef Cattle, Colostrum, Selenium Supplementation

M175 Effect of high-level copper supplementation on copper status and performance of beef heifers consuming molasses-based supplements. J. D. Arthington* and F. M. Pate, *University of Florida, Range Cattle Research and Education Center, Ona, FL.*

The objective of this study was to examine the effects of high-levels of Cu supplementation on the performance and Cu status of growing steers consuming molasses-based supplements. Twenty-four crossbred heifers were stratified by BW and randomly assigned to individual pens. Four treatments, consisting of a complete mineral supplement fortified with 0, 15, 60, and 120 ppm supplemental Cu (Cu sulfate), were randomly assigned to pens (6 pens/treatment). Treatments were offered 3 times weekly in molasses-cottonseed meal slurry (1.5 kg of TDN and 0.3 kg of CP/hd). All heifers were offered free-choice access to ground stargrass hay. Individual BW, jugular blood, and liver biopsy samples were collected d 0, 42, and 84. Forage DM refusal was determined daily. Diet DM digestibility was estimated over a 21 d period (beginning on d 42) by the use of a sustained release chromic oxide bolus (Captec, New Zealand). Heifers consuming the highest rate of supplemental Cu (120 mg/kg) tended (P = 0.13) to have a lesser ADG compared to heifers supplemented with 15 mg/kg of Cu (0.18 vs. 0.05 kg/d; SEM = 0.06). There was no significant sampling day x treatment interaction for liver Cu accumulation, however average liver Cu concentrations among all treatments decreased (P < 0.05). Therefore, data were also analyzed combining treatments that provided 60 and 120 mg/kg of supplemental Cu into a single treatment (High Cu). Heifers supplemented with 15 mg/kg Cu had a greater (P < 0.05) increase in liver Cu concentration compared to 0 ppm and High-Cu treatments (average change = -200, 5, -109 ppm DM for Control, 15 ppm, and High-Cu treatments, respectively; SEM = 46.8). Forage DMI was lower (P = 0.07) for heifers receiving no supplemental Cu compared to all other treatments (6.6 vs. 5.8 kg/d; SEM = 0.37). Apparent forage digestibility was not affected (P > 0.05) by Cu treatment. These data suggest that high rates of Cu supplementation (Cu sulfate; > 60 ppm total Cu) results in a decline in liver Cu accumulation into the liver of beef heifers consuming molasses supplements.

Key Words: Cattle, Copper, Molasses

M176 Supplemental phosphorus removal for finishing yearling Holstein steers. A. M. Brokman*[1], J. W. Lehmkuhler[1], and D. J. Undersander[1], [1]*University of Wisconsin-Madison, Madison,* [2]*University of Wisconsin, Madison.*

Two experiments were performed to determine responses of removing supplemental phosphorus from the finishing ration offered to yearling Holstein steers. In Experiment 1, 96 Holstein steers (419 kg) were blocked into four weight groups and assigned to eight pens. Steers were fed a diet consisting of approximately 74% corn, 18% corn silage and 8% supplement on a DM basis. Dietary treatments, supplemental phosphorus (DC) or no supplemental phosphorus (NDC), were randomly assigned to pens within each block. The phosphorus (dicalcium phosphate) was pre-incorporated into the protein/mineral pellet at a level to achieve 0.3% in the complete ration. Steers were implanted with an estrogenic product on d 0. Steers in heavier weight blocks were harvested after 82 d to avoid heavy carcass weight discounts. The remaining steers were harvested on d 125. Carcass data were collected following a 24-hr chill. No differences (P>0.05) were detected in carcass characteristics. NDC tended to be heavier at the end of the trial (P=0.07). During period three NDC resulted in heavier weights (P<0.05) and a trend for better gain efficiency (P=0.09). The overall gain efficiency for NDC was better than DC (P<0.05). Experiment 2 consisted of 78 Holstein steers (491 kg) blocked into two weight groups. Steers were fed a TMR consisting of approximately 81% corn, 8% supplement, 6% corn silage, and 5% alfalfa haylage on a DM basis. Steers were implanted as in Experiment 1. Steers were harvested on d 84 and 112 d on test. Carcass data were collected after a 48-hr chill. NDC carcasses tended to have a higher trim weight (P=0.09) and a lower percent trimmed than DC carcasses (P=0.05). No differences (P>0.05) were detected in overall ADG (DC=1.63 kg vs. NDC=1.63 kg), weights, overall dry matter intake or gain efficiency (DC=0.15 vs. NDC=0.15). A trend existed for DC to have higher DMI (P=0.10) during period three in comparison to NDC. Removing supplemental phosphorus from the feedlot diet did not produce adverse effects on steer performance or carcass characteristics for yearling Holstein steers.

Key Words: Beef, Holstein, Feedlot

M177 Evaluation of machine milking and weigh-suckle-weigh technique for quantification of milk production at six or twelve hour udder-fill intervals. W. J. Sexten*, D. B. Faulkner, and J. M. Dahlquist, *University of Illinois, Urbana.*

A randomized complete block design with a 2 x 2 factorial arrangement was utilized to evaluate the effects of collection method and udder-fill interval on milk production estimates collected during middle (Exp. 1) and peak lactation (Exp. 2). Each cow represented a block to which all four of the possible treatment combinations were applied. Factors tested were milk collection method, using a portable milk machine (MM) or weigh-suckle-weigh (WSW), and udder-fill intervals of 6 h (6) or 12 h (12). Twenty-four Simmental cows were utilized in Exp. 1 (n = 96) that were 119.4 ± 2.8 d postpartum. The 24 Simmental cows used in Exp. 2 (n = 96) were 64.5 ± 0.05 d postpartum. A collection method by udder-fill interval interaction was observed (P #8804 0.01) in Exp. 1 and 2. Milk machine estimates did not differ ($P = 0.11$) due to udder-fill interval, while WSW estimates were lower ($P < 0.05$) at 6 h than 12 h in both Exp. Estimates taken using a 6 h udder-fill interval were lower ($P < 0.001$) for WSW than MM in Exp. 1 and 2. In Exp. 1, 12 h estimates did not differ ($P = 0.81$) due to collection method however in Exp. 2 estimates taken using MM-12 tended higher ($P < 0.10$) than WSW-12. A positive correlation (P #8804 0.001) was observed between WSW estimates at 6 and 12 h in Exp 1 (0.77) and Exp. 2 (0.62). Milk machine estimates at 6 and 12-h were positively correlated ($P < 0.01$) in Exp. 1 (0.62) and Exp. 2 (0.62). Weigh-suckle-weigh and MM estimates were not correlated ($P > 0.05$) at any udder fill interval. Regression of WSW-12 on WSW-6, MM-12 and MM-6 confirmed correlation results, as WSW-6 in Exp. 1 was the only estimate predicted by WSW-12. The quadratic effect of WSW-12 did not influence ($P > 0.15$) predictions indicating calf capacity for milk consumption did not influence milk production estimates. These experiments suggest milk production estimates taken using different collection methods are not comparable.

Key Words: Milk Production, Machine Milking, Weigh-Suckle-Weigh

M178 Effect of esterase enzyme treatment on the in situ rumen degradability and soluble carbohydrate content of tropical grasses. N. A. Krueger*, A. T. Adesogan, D. B. Dean, and W. K. Krueger*, *University of Florida, Gainesville.*

Previous work showed that application of an esterase enzyme preparation (Depol 740, Biocatalyst, U.K.) increased the digestibility in vitro of tropical grasses. This study examined the effect of the same enzyme preparation on the water soluble carbohydrate (WSC) fraction and the in situ degradability of three tropical grass hays. The enzyme was applied at 0, 0.5, 1, 2, and 3 g/100g DM on hay produced from 12-wk regrowths of common bahiagrass (B), Coastal bermudagrass (C), and Tifton 85 bermudagrass (T) 24 h before ruminal incubation. Duplicate samples of each forage were incubated in each of two cows for 0, 3, 6,

9, 12, 24, 48, 72, 96, and 120 h. The cows diet consisted of bermudagrass hay supplemented with 0.4 kg/d of soybean meal. Treatments were arranged in a 2 x 3 x 5 factorial design. The McDonald model, $P= A+B(1-\exp^{-c(t-L)})$, was fitted to the in situ data. There was a cubic increase (P = 0.04) in the WSC fraction as enzyme application increased. Increasing enzyme application rate also produced quartic increases in the wash fraction (P = 0.0036), degradation rate (P=0.0047), effective degradability and total degradability (P = 0.0053; 643, 651, 622, 663, 661, and 648 g/kg DM) of the hays. The potentially degradable fraction (B) also tended to increase (P = 0.071) with increasing enzyme rate whereas the lag phase decreased cubically (P = 0.0106). The highest degradation rate (0.03 per hour) occurred at the 1% enzyme application rate but the shortest lag phase occurred at the 3% rate. In conclusion, application of the esterase enzyme enhanced the release of WSC from the hays and increased the rate and extent of degradation of the hays.

Key Words: Tropical Grass, Esterase, Degradation

M179 Effect of exogenous amylase and corn type on performance and carcass characteristics of finishing beef heifers. S. M. Speight*[1], K. C. Hanson[1], J. Tricarico[2], K. R. McLeod[1], and D. L. Harmon, [1]*University of Kentucky, Lexington,* [2]*Alltech Biotechnology, Inc., Nicholasville, KY.*

Two experiments were conducted to evaluate the efficacy of feeding a fungal amylase preparation on the performance and metabolism of beef cattle fed high grain diets. Experiment 1 used 12 rumen cannulated steers divided into one of three dietary treatments: 1) control, no enzyme; 2) 5 g/d amylase; or 3) 10 g/d amylase enzyme preparation. The diet consisted of 50% concentrate (corn-based), 50% corn silage. There was no effect of exogenous amylase on daily dry matter intake, VFA proportions, total concentrations, acetate:propionate or ruminal pH. In situ starch disappearance was also unaffected by treatment. In Experiment 2, 96 crossbred heifers were fed finishing diets until slaughter to evaluate the effects of corn type and inclusion of an exogenous amylase preparation on animal performance and carcass characteristics. Animals were assigned randomly to a 2 × 3 factorial arrangement of treatments in a completely randomized design. Factors were corn type (dry vs. high moisture) and amount of exogenous amylase preparation (0, 7.5, or 15 g amylase/(hd·d)). There were no differences in corn type throughout the study. During the first 28 d, average daily gain increased linearly (P < 0.05) with amylase supplementation. However, this increase in gain was not observed during the remainder of the trial. The increased average daily gain during the first 28 d was largely the result of increased intake (quadratic P < 0.05), as feed efficiency was not affected. The greatest longissimus area (P < 0.05) and lowest (P < 0.05) yield grades, as well as a tendency (P < 0.10) for lower back fat, were observed in heifers receiving amylase at 7.5 g/(hd·d). These studies suggest that the amylase preparation used may be beneficial for starting calves on feed but we saw no effects on fermentation or starch degradation that would suggest long term benefits with addition to finishing diets.

Key Words: Amylase, Supplementation, Cattle

M180 Effect of an exogenous fibrolytic enzyme on intake and ruminal variables in lambs fed Guinea grass (*Panicum maximum* var. Mombasa) hay. J. H. Avellaneda-Cevallos[1], S. S. González*[2], J. M. Pinos-Rodríguez[3], A. Hernández[2], R. Bárcena-Gama[2], M. Cobos[2], and D. Hernández-Sánchez[2], [1]*Universidad Técnica Estatal de Quevedo UTEQ, Quevedo, Ecuador,* [2]*Colegio de Postgraduados Montecillo, Estado de México, México,* [3]*Universidad Autónoma de San Luis Potosí UASLP, Estado de San Luis Potosí, México.*

This study was performed to evaluate the effect of an exogenous fibrolytic enzyme (enzyme; Fibrozyme) on intake, digestion and ruminal variables in lambs fed Guinea grass hay. Four Suffolk lambs fitted with permanent ruminal and duodenal cannulas were fed only Guinea hay cut 35 d (11.4% CP) or 90 d (6.4% CP) after regrowth. Experimental design was a repeated Latin Square (4x4) with a factorial arrangement of treatments (2x2; enzyme, 0 and 3 g; Guinea hay 35 and 90 d). Guinea 90 d increased (P<0.05) DM flow to duodenum and feces. Lambs fed Guinea 35 d showed an increased digestion of DM (P<0.05) and OM (P<0.01) in the rumen and intestine; higher (P<0.01) intake, ruminal and total CP degradation, and retained N; and increased (P<0.01) rate of passage. NDF intake (P<0.09) and flow to duodenum and feces (P<0.01) was higher, but ruminal and total digestion was lower (P<0.01) for lambs fed Guinea 90 d. ADF flow to duodenum and feces was increased (P<0.01) by Guinea 90 d; whereas ruminal, intestinal and total ADF digestion was increased (P<0.01) by Guinea 35 d. ADF flow to duodenum was decreased (P<0.01), but ADF ruminal degradation (P<0.01) and hemicellulose intestinal digestion (P<0.08) were increased, by enzyme addition for both hays. Lambs fed Guinea 35 d showed higher (P<0.01) intake, ruminal and total degradation of hemicellulose, as well as increased (P<0.01) ammonia-N (0, 3, 6, 9 and 12 h). pH (0, 3, 6, 9 and 12 h) was higher (P<0.01) for lambs fed Guinea 35 d. According to these results, there were differences between Guinea hay 35 and 90 d for most of the variables, whereas the exogenous fibrolytic enzyme improved digestion of ADF and hemicellulose.

Key Words: Intake and Digestion, Exogenous Fibrolytic Enzyme, Tropical Grass

M181 Evaluation of modified sodium silicate as a grain conditioner for corn and grain sorghum. C. R. Richardson*[1], K. F. Wilson[1], T. C. Bramble[1], J. H. Mikus[1], and I. Cisneros[2], [1]*Texas Tech University, Lubbock,* [2]*Concorde Technologies, Odessa, TX.*

Laboratory experiments at Texas Tech Univ. and two trials at a commercial feedyard feedmill were conducted to determine the effects of a modified sodium silicate product (RumiSil) on conditioning corn and grain sorghum. RumiSil has a pH of 11.2, freezing point of 0° C, specific gravity of 1.05, and low corrosive properties. Time required for the uptake of 6% added moisture by corn and grain sorghum was determined in roll jars and recorded with a stopwatch. Treatments were 0, 0.5, 1.0, 1.5, and 2.0 ml of RumiSil diluted with water to make 100 ml of each solution and were added to increase moisture content by 6 percentage points. RumiSil decreased (P < 0.05) time to absorb the 6% added moisture at levels of 0.5 and 1.0, with a further reduction (P < 0.05) at levels of 1.5 and 2.0 for both grains. In vitro DMD was increased (P < 0.05) for corn at the lowest level of RumiSil, while grain sorghum was improved (P < 0.05) at the two highest levels. Two trials were conducted to compare the 1.5 level of RumiSil to water alone in flaking corn at four flake weights. In trial one, the average starch availability was higher across flake densities (water 39.5%, SD 8.35 vs. RumiSil 52.0%, SD 8.21). In trial two, starch availability was 42.3 (SD 7.46) and 47.8 (SD 7.18) for water and RumiSil, respectively.

Key Words: Steam Flaking, Grain Processing, Grain Conditioner

M182 Effects of replacing rice straw with wormwood (*Artemisia Montana* Pampan) silage in the diets of Korean Hanwoo steers on performance, carcass characteristics and muscle fatty acid profile. S. C. Kim*[1], J. H. Kim*[2], J. H. Shin[2], A. T. Adesogan[1], and Y. D. Ko[2], [1]*Department of Animal Science, University of Florida, Gainesville,* [2]*Division of Applied Life Science, Gyeongsang National University, Jinju, Korea.*

This study was conducted to examine the performance, carcass characteristics and muscle fatty acid profile of Hanwoo steers fed diets containing four levels of wormwood silage. Twenty Hanwoo steers (326 ± 23kg) with similar (P>0.05) initial body weights across treatments were fed at 3 % of body weight on a DM basis for 12 months. The steers were individually fed a basal diet of rice straw (30%) and supplementary concentrates (70%; corn grain, 36.5%; wheat grain, 15.0%; coconut meal, 11%; wheat flour, 5.0%; corn gluten, 3%; palm meal, 6%). The steers were allotted to one of four dietary treatments, which were designed to progressively substitute rice straw with 0, 5, 10 and 15% of wormwood silage in the basal diet. Feed intake was calculated daily and body weight was measured monthly. At the end of the trial, the steers were slaughtered and graded by trained carcass evaluators, using the Korean meat-grading scheme. The fatty acid profile of meat samples (300g) obtained from the loin and top round muscles was analyzed by gas chromatography. Final body weight, average daily gain and feed conversion efficiency were improved (P<0.05) by substituting 5, 10 and 15% of straw with wormwood silage, but there were no differences in performance between the levels of wormwood silage substitution. Compared to steers in the control group, steers fed diets containing wormwood silage had greater (P<0.05) carcass weight, carcass quality, and loin-eye area and less (P<0.05) backfat thickness. Steers fed wormwood silage also had higher (P<0.05) muscle CLA content and higher (P<0.05) omega 6:omega 3 fatty acid ratios than steers in the control group. It is concluded that substituting rice straw with wormwood silage

improved the performance, carcass characteristics and muscle fatty acid profile of Hanwoo steers.

Key Words: Wormwood Silage, Hanwoo Steer, Conjugated Linoleic Acid

M183 Rumen digestibility of receiving rations for feedlot steers containing wheat midds and soybean hulls. P. M. Walker*[1], K. E. Earing[1], L. A. Mathews[1], and J. E. Ringler[2], [1]*Illinois State University, Normal,* [2]*University of Kentucky, Lexington.*

Six Simmental-Angus, ruminally fistulated steers were used in a two period crossover design in situ trial to evaluate the rumen digestibility of a wheat midd-soybean hull ration (WS) and a shelled corn-commercial protein supplement ration (SC). Steers were randomly assigned to treatment rations at the beginning of the first experiment period (WS containing 74.1 % wheat midds and soybean hulls, and SC containing 75% shelled corn and 25% of 33% CP commercial protein supplement). Steers were allowed ad libitum access to water and grass hay. Treatment rations were fed once daily at 1600 h at .95% BW (wet wt. basis). Each experiment period was 17d with a 14-d adaptation period. On d 15, 3 Dacron bags containing 10g:bag were placed into the rumen of each steer at 0, 12, 24, 36, 48, 60 and 66h. All bags were removed at 72 h. Each time Dacron bags were placed into the rumen, rumen fluid was collected and pH analyzed. Feed samples were analyzed for OM, N, NDF, ADF, AIA and ash. Crude protein and HC were determined by calculation) N% 6.25= CP and NDF-ADF= HC). WS contained 85.56% OM, 2.50% N, 15.63% CP, 68.34% NDF, 42.53% HC, 25.81% ADF, 19.99% cellulose, 0.14% AIA and 14.46% ash. The SC contained 95.16% OM, 2.46% N, 15.38% CP, 44.43% NDF, 38.72% HC, 5.81% ADF, 3.27% cellulose, 0.05% AIA and 4.84% ash. Rumen pH was similar between WS and SC ranging from 6.5 to 6.7. Rumen disappearance for OM and CP was not different (P> 0.05) between WS and SC at each time interval through 36 h of digestion comparing 59.83 ± 12.90% and 61.03 ± 30.55% and 72.18 ± 21.17% and 72.33 ± 6.06% at 36 h, respectively. Rumen disappearance for ADF and cellulose was not different (P> 0.05) between WS and SC by 72 h of digestion comparing 64.10 ± 12.32% and 63.86 ± 22.27% and 65.53 ± 28.43% and 63.54 ± 27.17%, respectively. Rumen disappearance for OM, CP and NDF was greater (P< 0.05) by 72 h of digestion for SC than WS. The rumen digestibility of higher fiber rations containing wheat midds and soybean hulls appears similar to a ration lower in NDF and ADF.

Key Words: Wheat Midds, Soybean Hulls, Rumen Digestibility

M184 Effect of vitamin E and method of administration on performance and meat color of beef cattle. I. García*[1], R. Alderete[1], A. Alarcón[1], C. Rodríguez[1], J. Ortega[1], J. Pedraza[2], and O. Medina[2], [1]*Facultad de Zootecnia, Universidad Autónoma de Chihuahua Periferico Fco. R. Almada km. 1.5 C.P. 31031. Chihuahua, Chih. México,* [2]*Facultad de Química, Universidad Nacional Autónoma de México Cd. Universitaria, Del. Coyoacan, C.P. 04510. Distrito Federal, México.*

The objective of the present study was to evaluate the effect of vitamin E (VitE) and the method of administration on performance of beef cattle and meat color. VitE was applied to thirty four crossed Charolais and Brangus heifers either by subcutaneous administration (SUB, 167 IU/a/d applied at 1, 30, 60 and 90 d of trial, n=16) or in finishing diet (DIE, 500 IU/a/d for 110 d, n=18); and a third group received no VitE and was taken as the control (CON, n=16). Animals were fed in pens and pen was the experimental unit. Performance parameters (body weight, BW; average daily gain, ADG; hot carcass weight, HCW; carcass yield, CY; and rib eye area, REA) as well as quality characteristics (color, L*, a*, b*; electrical conductivity, EC; water holding capacity, WHC) of packed meat were evaluated. A subsampling was done within experimental group (SUB n=9; DIE n=11 and CON n=10) to evaluate the effect of vitE on *L. dorsi* color during storage (4 C) for up to 28 d *postmortem* (3, 7, 14, 21 and 28 d). Thirty more *L. dorsi* steaks (one/subsampling animal) were aerobically packed (polyvinyl chloride PVC) and stored (4°C) for daily evaluation during 8 d. Variables evaluated during time (BW, ADG, color and WHC) were analyzed with PROC MIXED, considering the animal effect as random. HCW, CY and REA data was analyzed with PROC GLM of SAS. VitE administration method did not showed advantages (P>0.05) on performance parameters. No difference (P>0.05) in color and WHC of vacuum packaged steaks was observed among treatments. Likewise L* and b* values of PVC packaged steaks did not change (P>0.05) among treatments. However redness value (a*) of CON showed a linear tendency (P<0.05) during storage, and the tendency for DIE and SUB was quadratic (P<0.05). DIE and SUB had greater value (P<0.05) than CON after day 4 (12.09±0.43 and 11.43±0.47 *vs* 10.28±0.45) and DIE had greater value (P<0.05) than SUB at days 7 and 8. VitE concentration (μg/mg muscle) was higher for DIE (3.3±0.4) than SUB (2.2±0.5) and CON (1.3±0.4). It is concluded that VitE applied subcutaneously or in feed improves color stability of aerobic packaged beef steaks.

Key Words: Vitamin E, Beef, Color Meat

M185 Effect of monensin on milk production, composition and body condition score of Murrah buffalo cows in early lactation. A. M. Jorge*[1] and C. Andrighetto[2], [1]*UNESP-FMVZ-DPEA-Botucatu,* [2]*UNESP-FMVZ-PGZOO-Botucatu.*

This experiment was carried out at the Buffaloes Production Area of the Unesp FMVZ Botucatu/SP/Brazil. Twenty four Murrah buffalo cows, were submitted to two treatments T1 (0 mg of monensin/buffalo cow/day) T2 (300mg of monensin/buffalo cow/day) evaluated on 150 first days of lactation. The total ration was composed by sorghum silage, elephant grass, and ration. The effect of monensin on milk production, milk composition and body condition score of buffaloes cows in early lactation. The milk control was done weekly, milk was collected for analysis of protein, fat and total solids were mensured, the buffaloes cows was weighed and given body condition score. The design was completely randomised. There no statistical differences (P>.05) between treatments for daily milk production, total milk production, corrected for 270 days, milk production on peak of lactation, mozzarela production, percentage of protein, total solids, protein:fat ratio, weight and body condition score. Monensin influenced positively (P<.05) daily protein (T1 = 147.10 g, T2 = 162.07 g) and fat production, (T1 = 226.90g, T2 = 259.62g) and fat percentage (T1 = 5.41%, T2 = 5.84%).

Key Words: Ionophor, Lactation, Water Buffalo

M186 The effect of Acid Buf in dairy cow diets on production response and rumen parameters. C. W. Cruywagen*[1], J. P. Swiegers[2], S. J. Taylor[3], and E. Coetzee[4], [1]*Department of Animal Sciences, University of Stellenbosch, Stellenbosch, South Africa,* [2]*Bokomo Feeds, Malmesbury, South Africa,* [3]*Celtic Sea Minerals, Carrigaline, Co. Cork, Ireland,* [4]*Formufeed, Villiersdorp, South Africa.*

A high concentrate TMR, formulated to be potentially acidotic, was used to construct five dietary treatments in which Acid Buf, the skeletal remains of the seaweed *Lithothamnium calcareum*, was included at increasing levels of 0.125, 0.3, 0.6, 0.9 and 1.2% of dietary DM. The response to Acid Buf included at the 0.3, 0.6 and 0.9% levels was measured using three groups of nine Holstein cows fed individually via Calan gates from calving to 70 DIM. Milk production was monitored daily and milk samples were taken weekly and analyzed for protein, fat and lactose. Cows were weighed and condition scored at 0, 28, 56 and 70 DIM. The response to Acid Buf at levels lower (0.125%) and higher (1.2%) than the main treatment levels was similarly measured but using group fed cows. Milk yield was adjusted by covariate analysis against initial performance. Adjusted average milk yield was 44.6, 41.4 and 39.3 liters/cow/day (P<0.05) and efficiency of feed into milk was 1.83, 1.75 and 1.67 kg milk/kg feed for treatments containing 0.3, 0.6 and 0.9% Acid Buf, respectively. Adjusted milk output increased significantly (P<0.05) as the Acid Buf inclusion was increased from 0.125 to 0.3% of DM but there was no significant effect on milk yield by increasing the level of Acid Buf from 0.9 to 1.2%. The five dietary treatments were also fed individually to five ruminally cannulated lactating Holstein cows in a latin square arrangement. Every cow received each diet for a period of 22 days prior to a collection period of 8 days. Rumen pH was monitored continuously every 10 minutes for 4 days using a portable data logging system and in-dwelling electrodes. Samples of rumen liquor were collected on two consecutive days, 2 hours before the morning feeding and again at 2, 6 and 10 hours after this feed allocation. Samples were analyzed for VFA and NH_3-N. The impact of feeding on rumen pH was clearly visible and increasing the dose of Acid Buf in the diet increased rumen pH throughout the period of measurement. However, the optimum dose of Acid Buf to optimize milk output and the efficiency of feed into milk was 0.3% of dietary DM or 80g/day.

Key Words: Acid Buf, Milk Production, Rumen Parameters

M187 Effect of malate supplementation on rumen fermentation and milk production in postpartum cows. M. Devant[1] and A. Bach*[1,2], [1]*IRTA-Unitat de Remugants, Barcelona, Spain,* [2]*ICREA, Barcelona, Spain.*

A total of 38 Holstein cows were assigned to either Control or MALATE groups between 21 and 28 d prior to calving date to evaluate the effects of pre- and post-partum malate supplementation on rumen fermentation and milk production. Control cows (n=18) received a concentrate of 40% extruded corn, 30% soybean meal, 7.5% carob bean, 6.5% barley, 5% propylenglycol, 5% bypass fat, 3.45% sugar cane, 2.5% yeast, and, 0.05% binder. MALATE cows (n=20) received the same concentrate but yeast, and propylenglycol, and bypass fat were partially replaced by 4% of Rumalato (Norel& Nature, Spain) to provide 84 g/d of malate. Before calving, all cows were fed a TMR ad libitum and 1 kg/d of either MALATE or Control concentrate at a feeding station. After calving, cows were fed a TMR ad libitum and 1 to 3 kg/d of concentrate was gradually increased by 300 g/d . Milk production was recorded daily and milk composition monthly during the first 90 lactation days. Rumenocentesis was conducted 4 times for each cow at 7, 35, 63, and 90 d postpartum 4 hours after TMR delivery to determine rumen pH. A tendency (P = 0.096) in milk yield x week interaction was found. MALATE cows produced more milk at the 4^{th} and 5^{th} weeks postpartum than Control cows (37.1 and 38.4 kg/d vs 33.4 and 35.7 kg/d, respectively). Malate supplementation did not affect milk fat and protein contents (3.87 vs 3.67% and 3.15 vs 3.16%; Control vs MALATE, respectively). Mean rumen pH was not affected by treatment (P > 0 .05; 6.19 vs 6.28, Control vs MALATE, respectively. Ruminal pH at 7d postpartum was lower (P = 0.08) than at 36, 63, 91 d postpartum (6.11, 6.19, 6.23, and 6.41, respectively). Mean concentrate intake was greater in MALATE than in Control cows (P < 0.05; 2.23 vs 1.96 kg/d, respectively). Although cows supplemented with malate consumed more concentrate, rumen pH did not decrease, indicating that malate may effectively prevent rumen acidosis. Also, supplementation of malate may result in increased milk production during peak of lactation.

Key Words: Malate, Milk, Rumen

M188 The effect of an inoculant containing *Lactobacillus buchneri* 40788 on fermentation and aerobic stability of corn silage at two packing densities. M. Antoniali[1], O. C. M. Queiroz[2], R. J. Schmidt*[3], and L. Kung, Jr[3], [1]*Universidade Estadual Paulista Jaboticabal, SP Brazil,* [2]*Universidade de Sao Paulo Piracicaba, SP, Brazil,* [3]*University of Delaware, Newark.*

Whole-plant corn was harvested at 1/3 milkline (38% DM) and packed in 20-L laboratory silos to investigate the effects of inoculation and packing density on silage fermentation. Treatments were: 1) untreated forage, tightly packed at 241 kg DM/m^3 (15 lb/ft^3); 2) forage inoculated with *L. buchneri* 40788 (400,000 cfu/g of forage) and *Pediococcus pentosaceus* (100,000 cfu/g) (Lallemand Animal Nutrition, Milwaukee, WI), tightly packed; 3) untreated forage, loosely packed at 194 kg DM/m^3 (12 lb/ft^3); and 4) inoculated and loosely packed. The experimental design was a 2 × 2 factorial arrangement of treatments. The effects of packing density, inoculation, and their interactions were tested. The results are detailed in the table below. After 60 d of ensiling, treatments had no effects on silage pH. Silages that were loosely packed had more acetic acid ($P < 0.05$) and unexplainably more lactic acid bacteria (LAB) ($P < 0.05$) than did silages that were tightly packed. Inoculation, regardless of packing density, resulted in silages with higher concentrations of acetic acid ($P < 0.05$) and lower lactic:acetic acid ratios ($P < 0.05$), lower concentrations of water soluble carbohydrates (WSC) ($P < 0.05$), and fewer yeasts and molds ($P < 0.05$). The results of this study show that application of an inoculant containing *L. buchneri* 40788 is effective at improving the aerobic stability of corn silage under a variety of packing densities.

Item	Loose pack Untreated	Loose pack Inoculated	Tight pack Untreated	Tight pack Inoculated	S.E.	Effects [3]
Lactic acid, %	4.64	4.29	4.41	4.53	0.23	
Acetic acid, %	1.69	2.23	1.60	2.08	0.04	I, P
Lact:Acet ratio	2.74	1.92	2.75	2.18	0.06	I
WSC, %	1.40	0.97	1.26	0.82	0.21	I
LAB[2]	6.80	8.70	6.68	8.58	0.23	I, P
Yeasts[2]	3.92	2.70	4.05	1.66	0.67	I
Molds[2]	3.97	2.57	3.73	1.81	0.72	I
Stability[3], h	27.5	34.5	31.0	60.0	7.10	I

[1]Effect of I = inoculant or P = pack density, $P < 0.05$,
[2]$\log_{10}$ cfu/g,
[3]Hours before a 2°C rise in temperature after exposure to air

Key Words: Aerobic Stability, *Lactobacillus buchneri*, Silage

M189 Effect of feeding *Aspergillus oryzae* fermentation culture to lactating dairy cows on milk yield, composition, and rumen fermentation. T. Sato*, T. Takano, and K. Murata, *ZENNOH National Federation of Agricultural Co-operative Associations 1708-2 Tsukuriya Tsukuba Ibaraki, Japan.*

The objective of this study was to evaluate the effect of feeding *Aspergillus oryzae* fermentation culture (AO) on the performance of lactating dairy cows and rumen fermentation. Twelve multiparous Holstein cows between 40-130 days in milk and three ruminally cannulated lactating cows were randomly assigned to one of three treatments: 1) Control, 2) Control + 25g/head/d (AO1), and 3) Control + 50g/head/d (AO2). Cows were housed in a tie-stall barn for the duration of the experiment and individually fed for ad libitum intake twice a day at 0800 and 1700 h. The experiment followed a 33 Latin square design with three 21-day periods. Samples and data were collected during the final 7 days of each period. The TMR (DM basis) were 46:54 forage:concentrate for all treatments. The main dietary ingredients were alfalfa-hay, timothy-hay, ground corn, whole cottonseed, beet pulp, soybean meal and Japanese commercial supplement. The control TMR was balanced using CPM Dairy (version 3.0.4a). The respective levels of AO product were mixed in the TMR and purchased from Nichimo Co., Ltd. (Tokyo, Japan). Feeding AO to lactating dairy cows improved milk production and lactose % in milk. Milk production (kg/d) was higher (P<0.05) in AO1 and AO2 than control (33.4, 34.1 and 32.2). Lactose (%) and % solid not fat (SNF) in AO2 was higher (P<0.05) than control (4.6, 4.55; and 8.86, 8.74; respectively). Ruminal pH and volatile fatty acids of rumen fluid (mM) from 2 to 4 h after feeding were higher for AO1 and AO2 than control (6.3, 6.4, 6.0; and 120.9, 121.4, 105.9). There were no treatment differences in dry matter intake, milk fat % and yield, milk crude protein %, milk urea nitrogen, and somatic cell counts. In conclusion, feeding *Aspergillus oryzae* fermentation culture to dairy cows altered rumen parameters at 2 and 4 h postfeeding which may explain the increase in milk yield realized from feeding AO at both 25g and 50g/head/d.

Key Words: Dairy Cow, *Aspergillus oryzae*, Rumen Fermentation

M190 Effect of live yeast Saccharomyces cerevisiae on milk production, quality and health status of Saanen dairy goats. R. Paratte*[1], A. Stella[1], G. Cigalino[1], G. Soncini[1], L. Valnegri[1], E. Chevaux[2], G. Savoini[1], and V. Dell'Orto[1], [1]*Dept. of Vet. Sci. Tech. Food Safety, University of Milan via Celoria, 10 Milaon-Italy,* [2]*Lallemand SA rue de Brequetiers, 19 Blagnac Cedex-France.*

The effect of a live yeast supplement in dairy goats has been examined in a limited number of studies. While the yeast culture does contain some viable cell, the yeast live cell supplement contain higher numbers of 100% active Saccharomyces cerevisiae (SC). 57 Saanen dairy goats were utilized to investigate the effects of the supplementation of SC during the first half of lactation. Goats were assigned according to parity and milk production during the first three weeks of lactation in two groups. All goats were fed a total mixed ration (TMR) containing 40% commercial concentrate, 28% triticale silage, 22% hay, 10% dried beet pulp. Treatments lasted for 15 weeks starting from week 3 of lactation and were: control (C)-TMR; (SC)-TMR mixed with 0.2g of SC ($4x10^9$ CFU/g, Levucell SC20). DMI, BCS and milk yield were recorded for 126d postpartum with milk samples analysed weekly for fat, protein, lactose, urea and SCC. Blood samples were analysed monthly for urea, glucose, BHBA, NEFA, GOT/AST and GGT. In order to monitor intestinal microflora, faeces were monthly analysed for total bacterial load, enterobacteria,

E. coli, coliforms, lactic bacteria, clostrides, moulds, yeasts. BCS, DMI and milk yield (C: 2.23Kg±0.04; SC: 2.37Kg±0.02) were positive affected by the treatment (P<0.05). Milk fat content was lower and milk urea content was higher in treated goats (P<0.05). Plasma metabolites were similar among treatments. NEFA was not affected by the treatment, although there was a non significant trend toward lower values in the treated animals (P=0.06). SC did not affect liver functionality, AST/GOT and GGT were similar among treatments. E. coli faeces content was positively reduced (C: 2.39; SC: 0.72; log10 CFU/g, SE 0.25) by the treatment where lactic bacteria content was significantly higher (P<0.001). Yeast in the faeces was confirmed by the microbiological analyses (P<0.001). SC increased milk yield and reduced E.coli in faeces.

Key Words: Live Yeast, Dairy Goat

M191 Dose response of a direct-fed microbial on milk yield, milk components, body weight, and days to first ovulation in primi- and multiparous Holstein cows. D. R. Stein*[1], D. T. Allen[1], K. W. Gates[1], T. G. Rehberger[2], K. J. Mertz[2], D. A. Jones[1], and L. J. Spicer[1], [1]*Oklahoma State University, Stillwater,* [2]*Agtech Products, Inc., Waukesha, WI.*

From 14 d before parturiation to 175 d postpartum, 38 primi- (pp) and multiparous (mp) Holstein cows were blocked by expected milk production and randomly assigned to treatment groups: Control, n=13, received a total mixed ration (TMR); Low treatment, n=11, received control TMR plus Low dose (1X/head/d) of Propionibacterium strain P169 (P169); High treatment, n=14, received control TMR plus High dose (10X/head/d) of P169. Rumen fluid was collected at -14d, +60d, +120d, and +175 d of lactation. Milk samples were collected twice weekly and analyzed for milk components. Daily milk production (4% fat-corrected milk; FCM) was influenced by treatment ($P < 0.01$) such that FCM (averaged across pp and mp cows) was greater ($P < 0.05$) in the High (32 ± 0.5 kg/d) and Low (33 ± 0.5 kg/d) P169 vs Control (30 ± 0.5 kg/d) cows; FCM did not differ between the High and Low P169 groups. Milk lactose was affected by treatment x age ($P < 0.03$) with High P169 pp and mp cows having a higher percentage lactose (5.04 and 5.10 ± 0.04 %, respectively), than the Low P169 pp and mp cows (4.89 and 4.91 ± 0.04 %, respectively) or the Control pp and mp cows (4.93 and 4.77 ± 0.04 %, respectively). Weekly body weights (BW) from wk 1 to 25 were greater ($P < 0.05$) in High P169 mp cows (635 ± 18 kg) than Low P169 (604 ± 16 kg) and Control (601 ± 17 kg) mp cows. BW in pp cows (528 ± 13 kg) did not differ ($P > 0.10$). P169 treatments influenced the fold differences of rumen propionate ($P < 0.05$) which were greater in High P169 ($5.69 \pm .70$) vs Low P169 ($2.91 \pm .65$) and Control ($2.74 \pm .62$) groups at 60,120, and 175 d. No main effects or interactions were found for days to first ovulation (progesterone conc. greater than or equal to 1.0 ng/ml). We conclude that P169 may hold potential as an effective direct-fed microbial to increase milk production.

Key Words: Propionibacteria, Milk Yield, Direct-Fed Microbial

M192 Effect of forage to concentrate ratio on B-vitamins in different ruminal fractions. D. E. Santschi*[1], J. Chiquette[2], R. Berthiaume[2], R. Martineau[3], J. J. Matte[2], A. F. Mustafa[1], and C. L. Girard[2], [1]*McGill University Ste-Anne-de-Bellevue, Qc, Fanada,* [2]*Dairy and Swine R&D Centre Lennoxville, Qc, Canada,* [3]*Universite Laval, Qc, Canada.*

Six ruminally canulated lactating Holstein cows (78 ± 13 DIM) were used in a cross-over design to evaluate the effects of forage to concentrate ratio on B-vitamin concentrations in ruminal contents. Diets were formulated to have forage to concentrate ratios of 60:40 (high-forage, HF) and 40:60 (low-forage, LF), and contained respectively (DM basis) 43.0 and 23.5% mixed silage, 16.9 and 16.4% corn silage, 28.4 and 40.0% high moisture corn, 4.0 and 8.6% soybean meal, 5.3 and 8.6% protein supplement, and 2.3 and 2.7% mineral and vitamin premix (without B-vitamins). Rations were fed as a TMR in 12 daily meals (at 95% of the ad libitum DMI of the HF diet). Ruminal samples (250 g of solid and 1.23 L of liquid material) were collected at the end of each 4-wk adaptation period and ruminal fractions were separated (1989. Br. J. Nutr. 61:725). B-vitamins were analyzed in the particle-free fluid (PFF) and in the freeze-dried liquid- and solid-associated bacteria (LAB and SAB). B-vitamin concentrations were similar for LAB and SAB, and were 125 to 5000 times higher than in PFF. The concentrations of B-vitamins in SAB were as follows for the HF and LF diet respectively: riboflavin (40.51 vs 47.79 μg/g; P=0.01), pyridoxamine (7.04 vs 9.05 μg/g; P=0.06), pyridoxine (0.95 vs 0.63 μg/g; P≤0.01) and true B12 (4.00 vs 3.08 μg/g; P≤0.01). The HF diet also yielded higher concentrations of true B12 in the LAB fraction (6.34 vs 4.75 μg/g; P=0.07) and of pyridoxine (98.62 vs 57.15 ng/ml) and biotin (24.32 vs 18.53 ng/ml) in the PFF (P≤0.04). Therefore, B-vitamins were present mainly in the bacterial fractions of the rumen while only limited amounts were found in the surrounding fluid. A change in the forage to concentrate ratio had a greater effect on vitamin synthesis by the bacteria associated to the solid fraction than by those present in the liquid portion of the rumen. In conclusion, it appears that ruminal B-vitamin synthesis is altered by changes in the forage to concentrate ratio, which suggests that the supply of vitamins to dairy cows is influenced by the diet composition.

Key Words: Cow, B-Citamins, Forage:Concentrate Ratio

M193 A statistical evaluation of early- or mid-lactation dairy cow responses to dietary sodium bicarbonate. W. Hu* and M. R. Murphy, *University of Illinois, Urbana.*

Our objectives were to examine, using mixed model statistical analysis, effects of dietary $NaHCO_3$ on the performance of early- or mid-lactation dairy cows and to determine if an optimal amount of buffer inclusion exists for these cows. A database was developed from 27 studies published between 1980 and 1999 that included a total of 30 trials, 73 dietary treatments, and 369 cows. Dietary $NaHCO_3$ was categorized according to amount in the diet as control (0%), moderate (0.70 to 1.0%), or high (1.05 to 1.5%); $NaHCO_3$ concentrations outside these ranges were not included. Forage type was categorized as corn silage (CS) when it was the sole or main dietary forage or as forage other than CS (NCS) when alfalfa hay, or silages based on alfalfa, barley, sorghum, triticale, or wheat were the sole or main dietary forages. The statistical model included the fixed effects of buffer concentration and forage type, and the random effect of study. Dry matter intake did not differ among buffer treatments for cows fed NCS; however, cows fed CS without $NaHCO_3$ addition consumed 1.24 kg/d less dry matter ($P < 0.02$) than cows fed buffer. Intake was not affected in cows fed CS with dietary $NaHCO_3$. Milk production, milk protein percentage, and protein yield were unaffected by buffer treatments regardless of forage type; however, milk fat percentage of cows fed CS-based diets was 0.27 percentage units higher when $NaHCO_3$ was included ($P < 0.02$). The 4% fat-corrected milk was also higher for buffered compared to unbuffered diets, by 1.86 kg/d ($P < 0.02$). Addition of $NaHCO_3$ at 0.70 to 1.0% of dietary dry matter, based on contrast analyses, appeared optimal for early- or mid-lactation cows fed CS-based diets. Forage type was confounded with acid detergent fiber content of the diet; therefore, differences in response to buffer treatments related to forage type might be explained by variation in the fiber contents of the forages themselves.

Key Words: Sodium Bicarbonate, Performance, Dairy Cows

M194 Fate of supplemental B-vitamins in the gastrointestinal tract of dairy cows. D. E. Santschi*[1], R. Berthiaume[2], J. J. Matte[2], A. F. Mustafa[1], and C. L. Girard[2], [1]*McGill University Ste-Anne-de-Bellevue, Qc, Canada,* [2]*Dairy and Swine R&D Centre, Lennoxville, Qc, Canada.*

Four lactating Holstein cows equipped with ruminal, duodenal (30cm from pylorus) and ileal (60cm from ileo-cecal valve) canulae were used to evaluate disappearance of supplemental B-vitamins in the rumen and the small intestine. Cows were fed a TMR with chromic oxide in 12 daily meals. Each study consisted of a control (Ctrl; no vitamins) and a vitamin supplementation period (Trt). Daily amounts (mg) for studies 1 and 2 were respectively: B1:300,15; B2:1600,1.6; B6:800,40; B9:2600,130; B12:500,0.5. In study 1, vitamins were added to the feed 5 days prior to and during the 4 collection days. In study 2, vitamins were infused post-ruminally one day prior to and during the 4 collection days. Disappearance prior to the small intestine was calculated as the amount of vitamins appearing at the duodenum relative to the quantity given. Intestinal disappearance was calculated as the amount disappearing between the two intestinal canulae compared with the amount arriving at the duodenum. Important ruminal disappearance was noted in study 1 (68% B1, 99% B2, 41% B6, 97% B9 and 63% B12), but there was almost no disappearance of post-ruminally infused vitamins prior to the duodenum, confirming that extensive destruction occurs in the rumen. The negative intestinal disappearance for B9 during the control periods

suggested extensive recycling of this vitamin (probably through the enterohepatic cycle), leading to underestimation of the true disappearance rate. The proportion of vitamins disappearing from the small intestine was not decreased by supplementation (P≥0.09). For all vitamins but B2 in study 1, absolute amounts being absorbed were greater during the Trt than the Ctrl periods, suggesting that B-vitamin supply in dairy cows is increased by supplementation, although losses in the rumen are extensive.

	Study 1			Study 2		
	% Disappearance	% Disappearance		% Disappearance	% Disappearance	
Vitamins	(Ctrl)	(Trt)	P	(Ctrl)	(Trt)	P
B1	77 (7)	55 (13)	0.09	73 (6)	67 (5)	0.47
B2	35 (3)	36 (4)	0.88	37 (4)	37 (4)	0.79
B6	46 (12)	88 (2)	0.09	50 (14)	72 (2)	0.23
B9	neg	10 (5)	-	neg	16 (5)	-
B12	11 (4)	15 (4)	0.40	11 (2)	16 (7)	0.55

Mean (SEM)

Key Words: Cow, B-Vitamins, Gastrointestinal Tract

M195 Ruminal degradability of nitrogen, phosphorus, and potassium from dairy feedstuffs. A. N. Hristov*[1], A. Melgar[1], A. E. Foley[1], and R. Kincaid[2], [1]*Department of Animal and Veterinary Science, University of Idaho, Moscow,* [2]*Department of Animal Sciences, Washington State University, Pullman.*

The objective of this study was to determine ruminal degradability parameters of nitrogen (N), phosphorus (P), and potassium (K) from feedstuffs common in Northwest dairy diets. Alfalfa hay (AA), corn silage (CS), and whole cottonseed (WCS) were oven dried and ground through a 2-mm sieve. Barley grain (BG), corn grain (CG), and whole soybeans (SB) were coarsely ground. All feeds were sieved through a 100-mm screen and particles retained on the sieve were incubated *in sacco* in the rumen of three lactating dairy cows for up to 72 h. Ruminal microorganisms were labeled through a continuous intraruminal infusion of $(^{15}NH_4)_2SO_4$; ^{15}N was used to correct the nylon bag residues for microbial (N, P, K) contamination. The soluble/instantly degradable fraction of N was greatest ($P < 0.05$) for CS (82.9±1.76%) and lowest ($P < 0.05$; except *vs.* BG) for CG (6.5±2.05%). Alfalfa hay and WCS had the greatest ($P < 0.05$) rates of N degradation (13.4±2.28 and 14.9±3.07 %/h, respectively). Alfalfa hay, CS, and WCS had the greatest ($P < 0.05$) effective degradability (ED) of N (82.3±1.08, 87.5±1.09, and 82.2±1.06, respectively). P was very soluble in AA, CG, CS, and WCS (from 63.0±11.2, WCS to 97.0±5.48%, CS), but not BG and SB. Rates of P degradability did not differ ($P > 0.05$) among feedstuffs. ED of P were: 93.0±4.26, 58.0±4.65 ($P < 0.05$), 83.8±4.26, 97.8±4.15, 76.3±7.14, and 92.1±4.24% (AA, BG, CG, CS, SB, and WCS, respectively). Solubility of K in AA, BG, SB, and WCS was 98.5±1.53, 62.7±1.66, 60.0±1.59, and 92.6±0.99%, respectively. ED of K was high for all feedstuffs (from 94.0±0.59, BG to 99.7±0.67%, AA). Although the K degradation parameters for CG and CS could not be estimated, K solubilities were 94 and 99%, respectively. Ruminal degradability of N varied, but P and K were very soluble and rapidly degradable in most of the feedstuffs studied.

Key Words: Nitrogen, Phosphorus, Potassium

M196 Effects of a fibrolytic enzyme formulation on forages, co-products, and byproducts fermented in vitro. K. F. Wilson*[1], G. V. Pollard[2], and C. R. Richardson[3], [1]*Animal Feed Technologies, Greeley, CO,* [2]*Texas State University, San Marcos,* [3]*Texas Tech University, Lubbock.*

The effectiveness of enzymes in animal feeding has been well proven, however, due to the constant influx of new co-products and byproducts the affects of enzyme formulations on these ingredients are unknown. Therefore, an in vitro dry-matter digestibility study was designed to determine the effect of Cattle-Ase™ C on a broad spectrum of forages, co-products, and byproducts. The feedstuffs evaluated were alfalfa, wheat straw, sorghum sudan grass, almond hulls, corn cobs, cotton moats, peanut hulls, rice hulls, soy hulls, beet pulp, corn/barley middlings, distillers grains, wheat middlings, and sweetbran™ and ranged broadly in chemical analysis and fiber level. Alfalfa, cellulose, cornstarch, and ground corn were used as indicator ingredients to the evaluated feedstuffs. Dry-matter disappearance was evaluated utilizing the Moore modification of the two-stage Tilley-Terry procedure at incubation times of 24 h and 48 h. A 0.7 g sample of ingredient was combined with 50-mL of buffer and rumen fluid mixture and placed in a 39°C water bath for the predetermined incubation times. Results showed that at 24 h, Cattle-Ase improved ($P < 0.10$) dry-matter digestibly for the higher fiber ingredients such as sorghum sudan grass, almond hulls, corn cobs, cotton moats, soy hulls, and corn/barley middlings. On average for the 24 h period, Cattle-Ase improved digestibly by 31.6%. The only difference ($P < 0.10$) observed at 48 h was for sweetbran. On average for the 48 h period Cattle-Ase only improved digestibly by 7.7%. The likely attributing effect to Cattle-Ase not improving ($P > 0.10$) digestion at 48 h treatment would be a loss of fermentable energy associated to these types of feedstuffs. In previous experiments, Cattle-Ase improved in vitro dry-matter digestibility across times and feedstuffs by over 20%. Therefore, these results substantiate the benefit of including enzymes in a feeding regime in which products containing higher fiber levels are used.

Key Words: Fibrolytic Enzymes, Co-Products, Byproducts

M197 Effects of fibrolytic enzymes and fat supplementation on fiber digestibility, nitrogen metabolism and fermentation profile in continuous culture system. A. Bouattour, L. Castillejos, R. Casals, S. Calsamiglia*, and E. Albanell, *Universitat Autonoma de Barcelona.*

Eight dual flow continuous culture fermenters (1320 mL) were used in a 2x2 factorial design in two consecutive periods of 8 days (5 for adaptation and 3 for sampling) to study the effects of an exogenous fibrolytic enzyme (E: 0 vs 2 ml/kg DM) complex (Promote®, Agribrands International) and sunflower oil (SF: 0 vs 28 g/kg DM) on rumen microbial fermentation and nutrients digestibility. The enzyme was sprayed on the forage and immediately dried at 55C for 48 h, and the non enzyme treatments were sprayed with water and processed identically. Diets (95 g DM/d of a 60 to 40 forage to concentrate ratio, 17.9% CP, 42.2% NDF) were fed in three equal amounts along the day. Fermentation conditions (temperature = 39C, pH = 6.4, and liquid = 10%/h and solid = 5%/h dilution rates) were maintained constant. Effluent samples were taken from a composite of the three sampling days, and bacteria were isolated from fermenter flasks on the last day of each period for chemical analysis. There were no effects of E on true digestion of OM (47.5%), NDF (38.5%), and ADF (43.3%). Fat digestibility increased ($P < 0.0001$) from 32.1 to 52.4% in SF treatment and decreased ($P < 0.05$) from 46.3 to 38.2 % in E treatment. The SF decreased ($P < 0.01$) the total VFA concentration (mM) from 103.4 to 95.4 and E decreased ($P < 0.025$) it from 102.8 to 95.9. There was an E by SF interaction for butyrate ($P < 0.038$) and isobutyrate ($P = 0.068$) proportions. Ammonia N concentration (9.72 mg N/dL), the flow (g/d) of total N (3.04), ammonia N (0.31), non ammonia N (2.74), bacterial N (1.00), and dietary N (1.74), CP degradation (33.4 %), and efficiency of microbial protein synthesis (23.3 g N/kg OM truly digested) were not affected by dietary treatments. The use of fibrolytic enzymes and sunflower oil decreased the concentration of total VFA but did not affect fiber digestion. Acknowledgment: financial support from CICYT-Spain (project AGL-2001-2617).

Key Words: Fibrolytic Enzymes, Sunflower Oil, Rumen Fermentation

M198 Effects of fibrolytic enzymes on in vitro ruminal degradation and gas production of alfalfa hay. J.-S. Eun*[1], S.-H. Hong[2], K. Beauchemin[1], and M. Bauer[3], [1]*Agriculture and Agri-Food Canada, Lethbridge, AM, Canada,* [2]*Sahmyook College, Cheongnyangni, Seoul, Korea,* [3]*Syngenta Biotechnology Inc., Research Triangle Park, NC.*

A series of recombinant, single activity enzyme products (supplied by Zymetrics, MN), including 13 cellulases (**END**) and 10 xylanases (**XY**), were evaluated for their potential to improve ruminal degradation of forages in vitro. Enzyme activities were determined at pH 5.3-5.4 and 37°C using 1.0 to 1.4% substrate (arabinoxylan from wheat for endoxylanase and beta-glucan from barley for glucanase; Megazyme, Ireland). Based on these enzyme activities, a dose level (1000 U/kg) was chosen for the addition of enzymes. One gram of alfalfa hay DM was weighed into fermentation bottles (125 mL capacity). Because the enzyme products were freeze-dried, they were resuspended by adding H_2O, and then the

enzyme solution was added to the corresponding bottles in 6 replications. Forty milliliters of anaerobic buffer medium adjusted to pH 6.0 was added to the bottles. The strained ruminal fluid was inoculated into culture bottles and incubated for 18 h. Headspace gas produced by substrate fermentation was measured at 2, 6, 12, and 18 h post inoculation. Apparent OM degradation (**OMD**) was determined after 18 h of incubation. Data were analyzed using the Proc Mixed procedure of SAS 8.1. Total gas production measured at the end of incubation (18 h) was higher ($P < 0.05$) for most of the END (except for END A and END C) compared with the control (alfalfa without enzyme). Addition of END increased ($P < 0.05$) OMD (except for the same 2 END products). Total gas production and OMD were increased by 5 XY enzymes, but these were not the same XY products in each case. Increases in OMD ranged from 5.4% to 14.1% and from 5.6% to 16.3% for the END and XY enzymes, respectively. Addition of END or XY decreased the partitioning factor of fermentation calculated as mg OM degraded/mL gas produced. In summary, some of the pure END and XY enzymes we tested increased in vitro degradation of alfalfa hay, and they greatly influenced partitioning of fermented substrate.

Key Words: Cellulases, Xylanases, In Vitro Degradation

M199 Ranges of optimal cellulase activity of commercial fibrolytic enzyme preparations used in ruminant diets. E. González*, E. Albanell, G. Caja, and R. Casals, *Grup de Recerca en Remugants, Departament de Cincia Animal i dels Aliments, Universitat Autònoma de Barcelona, Bellaterra, Spain.*

An in vitro study was conducted to investigate factors by which cellulase activity of fibrolytic enzyme preparations for ruminants are affected. Two liquid commercial enzyme products, Promote (PRO) and Cellupract AL 100 (CEL), both isolated from aerobic fungus (Trichoderma longibrachiatum and Trichoderma reensi) and with recognized cellulase activity, were used to examine the effects of pH, temperature, enzyme dose, and its interactions. Cellulase activity was determined in a factorial design (3 4 3) for three pH (4.0, 5.5 and 6.5), four temperatures (30, 40, 50 and 70 C), and three doses (1, 2 or 3 g /kg DM of substrate). Average and extreme values for experimental treatments were selected according to practical criteria either for current ruminal or industrial conditions. Carboxymethyl cellulose (CMC) was used as substrate, and concentrations of reducing sugars were determined in absence of ruminal liquor by the Nelson-Somogyi copper reduction method with glucose as standard. There were no significant differences for the average enzymatic activities between products (561 and 631 μmol of released sugar min^{-1} g^{-1} for CEL and PRO, respectively). Cellulolytic activity was highly affected ($P < 0.001$) by pH, temperature, and enzyme doses, as well as by pH x temperature and pH x temperature x doses interactions. Maximum cellulolytic activities were obtained for pH 4.0, temperature 50C and the greatest dose (3 g /kg DM) on average (854, 2047 and 905 μmol of released sugar min^{-1} g^{-1} of the enzyme applied, respectively). Optimal interactive cellulolytic activities were obtained for the sets pH 4.0-50C, and for pH 4.0-50C, with an enzyme dose of 3 g /kg DM (2931 and 4608 μmol of released sugar min^{-1} g^{-1} of the enzyme applied, respectively). Optimal conditions for commercial enzyme products evaluated in this experiment, demonstrated to be out of the normal ranges in ruminal environment.

Key Words: Fibrolytic Enzymes, Cellulase Activity

M200 Effects of a supplemental amylase enzyme preparation on lactational performance in commercial dairy herds. 1. Whole herd responses. G. A. Harrison* and J. M. Tricarico, *Alltech Biotechnology, Inc., Nicholasville, KY.*

Field trials with a supplemental amylase preparation (Amaize^{TM}, Alltech Biotechnology Inc., Nicholasville, KY) were conducted during 2002 and 2003 in 45 commercial dairy herds across the U.S. and Canada (approximately 8150 cows). Number of cows, days in milk, milk production and composition were collected from two consecutive monthly Dairy Herd Improvement (DHI) test records. Fat-corrected (FCM) and energy-corrected milk (ECM) were calculated from milk yield and composition measurements. Herds began receiving supplemental amylase after the first monthly DHI test. The amylase preparation was added to the base herd ration at the rate of 12 grams/head/day. Cows were fed supplemental amylase, on average, for 26 d before the second monthly DHI test. Response to enzyme supplementation was evaluated using a Students t-test on the difference obtained by subtracting the second from the first monthly test. The null and alternate hypotheses were the difference equals zero or greater than zero, respectively. Data were weighted by herd size. Milk yield was greater during the enzyme treatment test period (32.0 vs 31.7 kg, P=0.059) when data from all 45 herds were included in the analysis. The dataset included twelve trials conducted with herds in the Southeastern U.S. in the summer of 2002 during severe heat stress. When data from all herds with an initial DHI test in June or July of 2002 were excluded (leaving 32 herds in the dataset), amylase supplementation increased milk yield (32.8 vs. 31.8 kg, P=0.001), FCM yield (34.3 vs. 33.7 kg, P=0.072), ECM yield (33.8 vs. 33.1 kg, P=0.051), and milk protein yield (1.02 vs. 0.99 kg, P=0.014). In addition, milk fat percentage was reduced (3.80 vs. 3.87, P=0.037) but milk fat yield was not affected by amylase supplementation in those 32 herds. Amylase supplementation increased milk yield in 56% of the herds when data from all herds were included in the analysis and increased milk yield in 72% of the herds when data from summer 2002 trials were excluded.

Key Words: Amylase, Dairy Cows, Field Study

M201 Effect of a supplemental amylase enzyme preparation on lactational performance in commercial dairy herds. 2. Individual cow responses. G. A. Harrison* and J. M. Tricarico, *Alltech Biotechnology, Inc., Nicholasville, KY.*

Individual cow data from field trials with a supplemental amylase preparation (Amaize^{TM}, Alltech Biotechnology Inc., Nicholasville, KY) conducted during 2002 and 2003 in 12 commercial dairy herds were included in this summary. Days in milk (DIM), milk production, and composition were collected from downloaded Dairy Herd Improvement (DHI) test records. Fat-corrected (FCM) and energy-corrected milk (ECM) were calculated from milk yield and composition measurements. The dataset included 1079 cows with three consecutive DHI tests and initial DIM>60. Herd was used as the experimental unit and weighted herd means were used in the analysis. Amylase was added to the base herd ration at the rate of 12 grams/head/day. Herds began receiving supplemental amylase after DHI test 1. Diets containing amylase were fed for an average of 24 days prior to DHI test 2. Amylase was removed from the diets after test 2 and the base diets (no amylase) were fed for an average of 22 day prior to DHI test 3. The response to amylase supplementation was evaluated by a contrast between test 2 (amylase) and tests 1 and 3 (no amylase) as described by McGillard and Stallings, 1998 (J. Dairy Sci. 81:1353). Predicted milk yield and composition for test 2 were calculated based on test 1 and 3 measurements adjusted for changes in DIM. For test 2, actual milk was greater than predicted milk yield (33.3 vs. 32.2 kg, P=0.101) while actual milk fat percentage was lower than predicted (3.77 vs. 3.90, P=0.013). Actual milk protein percentage, FCM, and ECM were not different from predicted, though actual milk protein yield did tend to be higher than predicted (1.03 vs. 1.00 kg, P=0.153). Summarizing individual cow records yielded comparable results to the whole herd summary. In cows greater than 60 DIM, actual milk was 1.1 kg greater than predicted milk based on the increase in DIM. Actual milk fat percentage was lower than predicted, but the increase in milk yield resulted in similar fat and numerically greater protein yields.

Key Words: Amylase, Dairy Cows, Field Study

M202 Effect of increased residual water-soluble carbohydrate concentration in ryegrass silage on intake, milk production, and N excretion in dairy cows. J. M. Moorby*, W. J. Fisher, and R. T. Evans, *Institute of Grassland and Environmental Research, Aberystwyth, UK.*

To study the effects of increased residual water-soluble carbohydrates (WSC) in grass silage, 16 multiparous mid-lactation Holstein-Friesian dairy cows were offered one of two ryegrass silages (n = 8 per treatment) over 2 consecutive 7 wk periods (wk 8-14 and 15-21 of lactation). During each period silages made from a high WSC variety of ryegrass (HS; var. AberDart) or a control ryegrass (var. Fennema) were compared, offered ad libitum with 5 kg/d concentrates. In period 1 (P1) the two silages were second cuts, while in period 2 (P2) the silages were third cuts. Four cows per treatment underwent whole-body N partitioning and feed digestibility measurements for 6 d in the last week of each period. Silage DM was similar for both varieties during each period (means of 25% for P1 and 23% for P2). WSC was higher (P<0.05) in HS silage fed during P1 (2.4% vs 1.7% of DM), but not in P2. Crude

protein was higher (P<0.05) in HS silage in both periods (18.2% vs 17.3% in P1, and 17.7% vs 16.9% in P2). In P1 feed DMI and milk yields were similar for both diets (means of 17.3 kg DMI/d and 27.8 kg milk/d). In P2 DMI was higher (P<0.05) for cows fed the HS diet (16.2 vs 15.0 kg/d), but milk yields were similar (mean 22.5 kg/d). Milk fat concentrations and yields of cows fed HS were higher (P<0.05) in both periods. Milk protein concentrations were also higher on the HS diet in both periods, but protein yields were only higher (P<0.05) in P2. In P1, cows given the HS diet with higher WSC excreted a lower (P<0.05) proportion of their feed N in urine, but in P2 when the HS silage had similar WSC content to control, urine N excretions were similar. In P1, feed whole-tract digestibility was similar for both diets, but in P2 it was higher (P<0.05) for the control diet. Although differences in silage WSC content were small, it is concluded that when cows are fed ryegrass silages containing higher concentrations of WSC they yield milk with improved composition and partition less of the dietary N to urine.

Key Words: Dairy Cows, Grass Silage, Water-Soluble Carbohydrates

M203 An evaluation of FuzZPellet™ whole cottonseed product on milk production in post-peak Holstein cows.

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Thirty-nine (29 multiparous, 10 primiparous) Holstein cows, approximately 110 DIM at trial initiation, were assigned to either WCS (10% of the ration DM as whole cottonseed) or FuzZ (10% of the ration DM as pelleted cottonseed product, FuzZPellet™ , Buckeye Technology, Memphis, TN) diets in an 8-wk randomized complete block design. On a DM basis, the ration contained 34% corn silage, 23% alfalfa hay, 13% ground corn and 19% protein-mineral-vitamin blend; TMR nutrient parameters (DM basis) were 17.9% CP, 21% ADF, 30% NDF, 5.7% crude fat, 37% NFC, 18% forage NDF. Milk samples taken at the weeks 0, 4 and 8 were analyzed for percent CLA; blood samples taken at weeks 4 and 8 were analyzed for percent gossypol. Cows received Posilac per label instructions. When covaried for milk production, FuzZ produced more milk than WCS (44.9 vs. 43.0 kg/d, P=0.05); multiparous and primiparous animals had similar numerical response (46.0 vs. 44.0, P=0.08, 41.9 vs. 39.7, P>0.20, respectively). Compared to WCS, FuzZ had higher (P<0.10) milk protein yield (1.32, 1.25 kg/d) and milk lactose yield (2.17, 2.03 kg/d) and tended (P<0.20) to have higher milk protein content (2.96, 2.90%) and lower milk fat content (3.36, 3.62%) and MUN (12.9, 14.0 mg/dl). DMI (25.6, 26.1 kg/d), 3.5% FCM (43.7, 43.9 kg/d), 4.0% SCM (40.5, 40.0 kg/d), milk fat yield (1.50, 1.55 kg/d), milk lactose content (4.84, 4.73%), milk total solids content (12.03, 12.12%), milk solids yield (5.39, 5.20 kg/d) and SCC (345, 230, 1000/ml) were similar (P>0.20) for FuzZ and WCS, respectively. Feed gossypol content was 0.80% (FuzZ) and 0.63% (WCS). Blood gossypol was lower for FuzZ at weeks 4 (1.73, 2.14 ug/ml, P=0.02) and 8 (1.82, 2.40 ug/ml, P=0.001). CLA content in milk fat was similar. FuzZPellet™ pelleted whole cottonseed product provides both production and handling advantages.

Key Words: Whole Cottonseed, Milk Production, Gossypol

M204 Effect of feeding red clover or ryegrass silage to dry dairy cows on milk productivity in the next lactation.

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To investigate effects of feeding a high protein silage to dry cows on their subsequent lactational performance, 48 Holstein-Friesian dairy cows were offered ad libitum access to either red clover silage (RC; 22.4% DM, 18.9% crude protein [CP]) or ryegrass silage (RS; 28.0% DM, 17.2% CP) for the last 4 wk of the dry period (DP). After calving, all animals received the same diet of ad libitum ryegrass silage (29.2% DM, 18.1% CP) with a grain based concentrate (24% CP) at 6 kg/d. BW and BCS were recorded weekly until 2 wk before predicted calving date, after which BW was recorded daily until calving, and BCS and ultrasound scans of the *Longissimus dorsi* were recorded every 3 d until calving. BCS and muscle scans were also recorded weekly during lactation. After calving, milk yields were recorded daily and samples for component assays were collected weekly until wk 10 of lactation. DM intake was similar for the two groups during the DP (13.3 vs. 12.8 kg DM/d for cows offered RC and RS respectively). There was no difference in DM intake over the first 10 wk of lactation (17.2 vs. 17.0 kg DM/d). Mean BW (659 kg), BCS (2.5; 0 to 5 scale), milk yield (32.3 kg/d) and milk composition over the first 10 wk of lactation were not affected by DP treatment, although milk fat percentage over the first 4 wk of lactation was higher (P<0.05) from cows offered RS during the DP (4.0% vs. 4.3%). Calf birth weights were higher (P<0.05) from cows fed RC during the last 4 wk of gestation (bulls: 43.2 vs. 42.1 kg; heifers: 41.8 vs. 39.5 kg), while mean *L. dorsi* depth tended (P<0.1) to be smaller in RC fed cows vs. those fed the GS diet (39.1 vs. 41.4 mm). Feeding RC during the dry period offered little benefit over RS in terms of subsequent lactational performance, although RC may have induced tissue repartitioning at the end of gestation, leading to higher birth weights in calves and smaller *L. dorsi* depths in the cows.

Key Words: Body Condition Score, Calf Birth Weight, *Longissimus dorsi*

M205 Coffee hulls in diets of dairy cows: Nitrogenous compounds balance.

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The nitrogenous compounds balance of dairy cows fed with four levels (0.0, 8.75, 17.5 and 26.25% DM) of coffee hulls in substitution of ground corn in their concentrate ration, which corresponding to levels of 0.0, 3.5, 7.0 and 10.5% of the total DM in the diet were evaluated. Twelve Holstein-Zebu dairy cows were used in the experiment and they were assigned to three 4 x 4 Latin square design, squares were design using milk production period. All isoproteic diets, 14% CP, contained 60% of corn silage and 40% of concentrate on dry matter basis. The estimative of the faecal excretion was done by indigestible acid detergent fiber (IADF) use as marker. The daily total nitrogen compounds (TN) and urea excretion on urine was obtained by spot urine samples. The regression analysis not verified effect of the coffee hulls levels on total nitrogen intake (441.3 g/day), N-urine excretion (190.8 g/day) and N-milk (114.7 g/day). However, was verified linear effect (P< 0,05) on faecal N excretion and N balance, have been estimated increase of 1.244 and a reduction of 1.793 g/coffee hulls units addicioned, respectively. The high N concentrations present on the fiber fraction of coffee hulls as neutral detergent insoluble nitrogen (NDIN) and acid deterget insolube nitrogen (ADIN), can has been the major responsable by higher faecal N excretion and for negative N balance on animals feeds with higher levels of coffee hulls.

Key Words: Agroindustrial Residue, Concentrate Ration, Nitrogen Balance

M206 Treated extruded soybean meal as a source of fat and protein for dairy cows.

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Two experiments were conducted to study the influence of lignosulfonate-treated or lignosulfonate plus calcium oxide-treated, extruded, partially expelled soybean meals as undegradable protein and bypass fat sources on lactation performance and ruminal fermentation characteristics of dairy cows. In experiment 1, nine lactating dairy cows were used in a replicated 3 x 3 Latin square design with cows being blocked according to milk yield. Each period was 3 weeks in duration with the first 2 weeks for diet adaptation and the last week for data collection. Cows were fed a total mixed diet containing 440 g/kg forage and 560 g/kg grain with one of three extruded soybean meals fed at 110 g/kg of the dietary dry matter. The three soybean meals were 1) twice-extruded soybean meal (ESM), which was used as the control; 2) lignosulfonate-treated, twice-extruded soybean meal (LSM); and 3) calcium oxide plus lignosulfonate-treated, twice extruded soybean meal (CLSM). In experiment 2, 3 ruminally cannulated cows were used in a 3 x 3 Latin square to study the influence of method of treatment of soybean meal on ruminal fermentation characteristics. Treatments and experimental procedures were the same as described in experiment 1. Feeding treated soybean meal to cows in LSM and CLSM treatments did not improve feed intake, milk yield, fat yield, or milk composition in experiments 1 and 2, except that cows fed the LSM and CLSM treatments produced less milk protein compared with the ESM treatment. The proportion of linoleic acid in milk fat of cows fed ESM, LSM, and

CLSM was 4.66^{b}, 4.67^{b}, and 4.89^{a} % of fat, respectively ($P < 0.01$). Ruminal pH, ammonia concentration, and total volatile fatty acids were not affected by treatment. An increased proportion of linoleic acid in milk fat suggests that there is a potential use of calcium salts of fatty acids in protecting the lipid portion of extruded soybean meal and further research is needed to explore this potential with full-fat extruded soybeans.

Key Words: Treated Soybean Meal, Cow, Milk

M207 Forage quality of legume hays fed to dairy cows in the tropics.

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Quality of rhizoma perennial peanut (RPP), alfalfa (AH), and Bermudagrass hay (BGH) was evaluated when fed to lactating cows in the tropics during summer. Nine Holstein cows in mid-lactation were assigned to treatments according to a 3x3 Latin Square Design. The three hays were fed ad libitum in individual hay feeders. Concentrate allotment was based on milk production at 1kg/ 2.25 kg of milk produced. Production of milk from cows consuming BGH, AH, and RPP hay was 18.9, 20.5, and 20.0 kg/cow/day, respectively. Differences among treatments were not statistically significant (P>.05). Fat and protein content of milk were not different among treatments. Composition of the consumed rations was on average 46% hay DM. Hay consumption tended to be lower when RPP hay was fed, these differences were reflected in a significant difference (P<.05) in the DM consumed (16.0, 16.6, and 14.9 kg/cow/DM for BGH, AH, and RPP hays). However, when expressed as a percentage of bodyweight, differences in hay (1.27%) and total DM intake ((2.75%) were not statistically significant. Cows consuming high levels of concentrate supplementation and having low milk yields, do not increase production when fed hays with high nutritive value and quality potential. Under these conditions the use of legume hays with high quality potential is not recommended.

Key Words: Rhizoma Perennial Peanut, Bermudagrass, Hay

M208 Lactational response of Holstein dairy cows to grinding and heat processing of cottonseed.

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The objective of this study was to evaluate the effect of processing (grinding and heating) of whole cottonseed (WCS) on milk composition and production of Holstein lactating cows during early lactation. Multiparious cows (n=8) averaging 84.50±10.34 days in milk and 36.10±4.46 milk yield (MY) were used in a 44 Latin square design. Cows were divided into four groups, receiving one of the following treatments: 1) WCS; 2) Ground cottonseed (GCS); 3) GCS heated in 140°C and steeped for 2.5 minute (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute (GHCS2). Diets were similar CP, NDF and NEL. The percentage of whole or processed was fixed at 14%. Total mixed diets were fed individually free choice twice daily. Each period consisted of 21 days and the last 7 days were used to determine milk composition and production. MY was significantly (P<0.01) affected by the diets and was greatest for HGCS2 (34.13 kg/d) and the lowest for WCS (31.13kg/d). Supplementation with HGCS2 resulted in increased milk fat percentage (P<0.05) (3.68%, 3.33%, 3.59% and 3.98% for 1,2,3 and 4 treatments, respectively) and milk fat yield (P<0.01). Milk fat yield showed the same pattern of response as observed for milk fat percent. Milk protein percent was progressively increased, averaging 3.21%, 3.02%, 3.42% and 3.42% for 1,2,3 and 4 treatments, respectively. This represented a 6.5% increase between WCS and HGCS2. Milk protein yield tended (P<0.05) to be higher for cows fed CHCS1 and GHCS2 than for cows fed WCS and GCS. Results indicate that heat associated with grinding process was sufficient to decrease ruminal degradation of the cottonseed protein.

Key Words: Whole Cottonseed, Grinding and Heat Treatment, Dairy Cow

M209 Factors affecting the concentration of hydrogen sulfide in the rumen gas of dairy cows.

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Our earlier work identified a range of potentially useful diagnostic gases in the rumen head-space. Some of these gases, or their derivatives, are present in breath and could be monitored using sensors incorporated into feeding or milking equipment. Hydrogen sulfide is present at high concentrations in rumen gas and concentrations change rapidly after a meal. The current study investigated the relationship between the addition of sulfur-containing compounds to the rumen and concentrations of hydrogen sulfide in rumen gas. This work used lactating Holstein-Friesian dairy cows with established rumen cannulae. All cows had *ad libitum* access to ryegrass silage prior to the experiments. Silage was taken away prior to each run and test feeds were given when hydrogen sulfide concentrations had declined close to zero (3.5 h later). The first experiment was a Latin Square with 4 cows, 4 periods and 4 treatments- a control (C; no addition) and three iso-sulfur additions to the rumen: 9.98 g sodium sulfate (SS; in 100 ml water), 8.52 g L-cysteine (cys; in 100 ml water) or 9.32 g L-methionine (met). The second experiment was a two-period cross-over design with 4 cows and 2 feeds: freshly-cut ryegrass or freshly-cut white clover. Cows received 9.5 kg of one of the forages and consumed their allocation within 25 min. Samples of rumen head-space gas were obtained at 30 min intervals for 4 h and hydrogen sulfide concentrations were measured immediately. Hydrogen sulfide concentrations increased rapidly (within 30 min), peaked after 1 h and declined close to zero after 4 h. Hydrogen sulfide concentrations at 1 h after test feeds were given were 9, 133, 466, and 98 ppm for C, SS, cys and met respectively (s.e.d. = 64.9; $P < 0.001$). Contrary to expectations, concentrations of hydrogen sulfide were much lower after cows consumed white clover in comparison with ryegrass (83 vs. 604 ppm at 1 h after feeding; s.e.d. = 102.6; $P < 0.001$). Subsequent investigation suggests that this results from the use of sulfide in detoxifying HCN produced from white clover.

Key Words: Rumen, Hydrogen Sulfide, Clover

M210 Sorting by dairy cows fed a dry diet in a tie-stall or free-stall barn.

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The objectives were to compare sorting in tie- vs. free-stall barns and also to measure its relation with milk composition. Forty multiparous and 20 primiparous lactating Holstein cows were utilized in a Cross-over design, with 21-d periods. At the beginning of the study cows averaged 102 DIM and produced 37.7 kg of milk daily. Cows were divided into two homogeneous groups; one group was housed in a free-stall during period one and tie-stall during period two; and *vice versa* for group two. In the free-stall 10 extra cows were also present. Animals were fed the same diet once daily in the free-stall and twice daily at 1100 and 1500 in the tie-stall to obtain approximately 10% daily refusals. Diet consisted of 10.3% wheat straw, 30.2% alfalfa hay, 20.2% corn silage, and 39.3% grain mix (DM basis). Individual cows sorting was estimated in both barns utilizing naturally occurring alkanes and determined directly in the tie-stall barn. The alkanes technique did not work and free-stall individual sorting values are not available. Therefore, only group average sorting in the free-stall was measured and compared to the group average in the tie-stall. Group average sorting was analyzed including treatment and period in the model. Sequence effect and true error were combined. Group average sorting against the longest particles was 63.3% in the free- vs. 73.2% in the tie-stall ($P = 0.03$). There were no significant differences in sorting between the two facilities of the other particles. There were no significant correlations between individual sorting measured in tie-stall and milk production and milk composition. Individual sorting of the longest particles was negatively correlated (r = -0.57, $P < 0.001$), and of finer particles was positively correlated (r = 0.67, $P < 0.001$), with the percentage of refusals. Sorting estimates made with individual cows in tie-stall is likely to underestimate average sorting in a free-stall barn. Sorting variability among cows in a free-stall setting is not available, but may also differ from that observed in a tie-stall barn.

Key Words: Sorting, Dairy Cows

M211 Utilization of rejected milk in dairy farms by ensiling with rice hulls for animal feeding.

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In Puerto Rico, milk that does not meet minimum standards for human consumption is dumped in the waste lagoons of the dairy farms, contributing to pollution and not allowing for its nutrient utilization. Rice hulls, although of very low nutritional value, is abundant and accessible especially in the greater dairy cattle zone of the island. The

purpose of the current study was to examine the maximum amount of milk (M) that can be recycled and fermented with rice hulls (RC) to obtain stable silage for use in animal feeding. The experiment was performed with seven treatments in triplicates: 1) Control (39%water 61% rice hulls w/w), 2) 35M:65RC, 3) 42M:58RC, 4) 45M:55RC, 5) 50M:50RC 6) 60M:40RC and 7) 70M:30RC w/w, ensiled in sealed jars of PVC pipes. For pH and the fermentation products value studies, three samples from each treatment were drawn at 0, 14 and 28d. Data was analyzed as a completely randomized design with a 7 (TRT) x 3 (length of fermentation) factorial arrangement of treatments. Results shows pH level was about 3.8 at 14d and 3.9 at 28d for all treatments with 50M or more. Major fermentation product was lactic acid in all treatment except control, which was butyric acid. Lactic acid concentration was highest (P<0.05) for 50 and 60M treatments reaching a level of about 2% by 14d and remained at that level by 28d. For the 70M it reached a peak of 1.76% at 14d. Butyric, acetic, propionic and isobutyric acids concentrations remained below 0.5% in all treatments. Lactic acid in the control was almost undetectable showing the incapacity of rice hulls to provide enough substrate to promote fermentation. Results indicate that proportions of 50 and 60M ensiled well. Ensiling milk with other more nutritive materials, such as straw or hay, should be even more successful as a method of preserving the nutrients of discarded milk for animal feeding and therefore contributing to reducing soil and water contamination.

Key Words: Rejected Milk, Rice Hulls, Silage

M212 Effect of different whole cottonseed concentrations on some hematologic data in dairy cattle.

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The effects of different concentrations of whole cottonseed (WCS) in the diet on blood parameters (% hematocrit, hemoglobin, MCHC and osmotic fragility of red blood cells) were examined in lactating cows. Four Holstein cows were assigned to a 4X4 Latin Square design with four stages. All stages had 14 d of adaptation and 7 d of data collection periods. All plasma samples were collected before the morning feeding and milking from vena jugularis. The dietary treatments included 0% (control; C), 12.7 % (W-I), 25 % (W-II) and 37.5 % (W-III) WCS of total diet. Total WCS in the diet was calculated to be 0 (control), 1 (W-I), 2 (W-II), 3 (W-III) kg/d. No significant effects of WCS concentration in diet fed were observed for mean % hematocrit (C=40.75 ± 1.55,W-I=41.00 ± 3.19, W-II=40.25 ± 5.03 and W-III=43.25 ± 4.96), hemoglobin (C=10.93 ± 0.72, W-I=11.19 ± 1.01, W-II=10.26 ± 0.56, and W-III=10.89 ± 0,31 g/L) or MCHC (C=267 ± 12, W-I=277 ± 30, W-II=270 ± 40 and W-III=263 ± 35 g/L). Osmotic fragility of erythrocytes showed no treatment effect. Mean milk yield was increased numerically but not significantly by WCS concentrations in the diet (C=18.30 ± 0.77, W-I=19.77 ± 0.73, W-II=20.09 ± 0.81, and W-III=20.45 ± 0.91 kg/d; P>0.1). Short time feeding of up to 37.5% WCS had no negative effects on the hematology of animals. Further studies may be needed to determine whether high concentrations of WCS can be fed safely for longer time periods.

Key Words: Whole Cotton Seed, Osmotic Fragility, MCHC

M213 Effects of conservation of timothy on nitrogen metabolism in lactating dairy cows.

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The effects of three methods of conservation of timothy (*Phleum pratense L.*) on N metabolism were investigated in a replicated 3 x 3 Latin square design with 35-day periods. Treatments were: 1) sun-cured hay (**H**), 2) formic acid-treated silage (**F**), and 3) bacterial-inoculated silage (**I**). Percentages of DM were 88.1, 42.3 and 44.5 (SEM=0.96), and percentages of CP (DM basis) were 10.2, 12.0 and 12.2 (SEM=0.27) for **H**, **F** and **I**, respectively. A similar concentrate (14.4% CP; 69.8% ground corn and 13.6% soybean meal) was offered in all treatments at a forage-to-concentrate ratio of 60:40. Six ruminally- and intestinally-cannulated Holstein cows (DIM=162) were randomly assigned to treatments and fed 12 equal meals daily. Cows were allowed to adjust to their diet for a 2-w period, followed by a 6-d total collection period of urine and feces. The DMI averaged 16.0 kg/d (P=0.15). Nitrogen intake was 15% lower with hay (**H**) than for silages (**F+I**), yet neither milk production (20.4 vs. 20.2 kg/d; P=0.63) nor milk protein content (3.09 vs. 3.12; P=0.95) was different. Nitrogen apparent digestibility was 3.8% lower (P=0.03) for **H** than for **F+I**. At those levels of N intake, cows fed **H** were 9.8% more efficient (P=0.06) to convert digested N into milk N than cows fed **F+I**, yet they retained 13.2% less nitrogen (P=0.04). The proportion of digested N lost in urine was 6.3% lower (P=0.04) with restrictively (**F**) rather than extensively (**I**) fermented silage, yet N secreted into milk was not increased.

	Treatments				Contrasts[a]	P
Item	**H**	**F**	**I**	SEM	**H** vs. **F+I**	**F** vs. **I**
N intake (g/d)	295	341	351	24.91	<0.01	0.35
% of N intake						
Fecal N	37.8	33.4	34.6	1.84	0.03	0.44
Urine N	33.3	29.5	32.8	2.38	0.28	0.13
Milk N	32.4	27.6	28.4	1.99	0.08	0.74
N retained	-1.7	9.5	4.1	3.48	0.04	0.18
% of N digested						
Urine N	50.4	44.2	50.5	3.07	0.25	0.04
Milk N	52.5	41.7	43.7	4.02	0.06	0.68
N retained	-3.2	14.1	5.8	5.48	0.04	0.19

[a]**H** vs **F+I**: hay vs. silages;
F vs. **I**: formic acid-treated vs. bacterial-inoculated silage

Key Words: Nitrogen Balance, Formic Acid-Treatment, Bacterial Inoculation

M214 Fermentation characteristics of ensiling wet corn distillers grains in combination with wet beet pulp.

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The objective of this study was to evaluate the fermentation and preservation characteristics of ensiling WDG with WBP. Combinations of WBP and WDG were ensiled in silo bags as follows: 1) 100% WBP; 2) 66% WBP + 33% WDG; 3) 33% WBP + 66% WDG; and 4) 100% WDG. Samples from each treatment were collected for analyses prior to ensiling. Samples were collected at d 4, 8, 21, and 112 for analysis. The initial pH was the greatest for 100% WBP and decreased (P < 0.05) as concentration of WDG increased (4.2, 3.9, 3.6, and 3.3 for 100%, 66%, 33%, and 0% WBP, respectively). Dry matter of the feedstuffs prior to ensiling was 23.1, 26.5, 30.2, and 33.0% for 100%, 66%, 33%, and 0% WBP, respectively. Concentrations of ammonia-nitrogen (0.95, 2.98, 5.83, and 6.75% DM) and crude protein (8.6, 18.4, 25.4, and 30.5% of DM) increased with increasing concentrations of WDG. Lactic acid prior to ensiling was greatest for 100% WDG (6.41% of DM) and decreased as WBP was included in the treatments. Propionic and butyric acids were not present prior to ensiling. Acetic acid prior to ensiling was highest (P < 0.05) for 100% WBP (1.06% of DM) and decreased as WDG was included in the treatments. By d 4 the pH of all feeds were below 4.0 and did not change throughout the experiment. Acetic acid increased (P < 0.05) over time in all treatments, and was highest for the 100% WBP (5.17% of DM). Ensiling WBP and WDG can be an effective method of preserving both wet co-products. The low initial pH for all treatments and the increased acetic acid over time, suggests preservation is enhanced by combining both feedstuffs. Although both feedstuffs are an excellent energy source for ruminants, they have a different nutrient profile. High concentrations of CP, fat, P, and S present in WDG are matched with low concentrations in WBP. Combining both feedstuffs result in blends that are easier to formulate into dairy cattle rations.

Key Words: Wet Distillers Grains, Wet Beet Pulp, Fermentation

M215 Effect of two forms of lauric acid on ruminal protozoa and fermentation pattern in dairy cows.

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Reducing ruminal protozoa may improve N utilization. Medium-chain saturated fatty acids such as lauric acid (C12:0) have been shown to suppress protozoa. Six Holstein cows fitted with ruminal cannulae were

used to test the effectiveness of two different forms of lauric acid (LA) for suppressing protozoal population in the rumen; ruminal parameters and DMI also were measured. Cows were randomly assigned to three treatments: 1) Control, 2) 160g/d of LA, or 3) 160g/d of sodium laurate (NaLA, dissolved in 1,600 ml of water). Both LA and NaLA were given in a single dose into the rumen via cannulae before morning feeding. The TMR contained (DM basis): 15% alfalfa silage, 40% corn silage, 30% rolled high moisture corn, 14% soybean meal, 16.6% CP and 29% NDF. Cows were fed ad libitum, protozoal counts were done daily, pH was measured weekly, and ruminal fluid was collected in the last week and analyzed for metabolites. Data were analyzed using proc mixed in SAS. The results are reported in the table below. Protozoa declined rapidly with dosing of both LA and NaLA, approaching the final populations within 3 days. Ruminal ammonia and total free AA decreased with LA and NaLA in parallel to protozoa, suggesting reduced intraruminal turnover of bacterial protein. The results showed that LA, which is less expensive, was equivalent to NaLA for reducing ruminal protozoa, obviating the need to convert LA to NaLA under practical conditions.

Item	Control	LA	NaLA7SEM	P>F	
DMI, kg/d	25.3[a]	23.8[a]	21.7[b]	0.5	0.07
Ammonia, mM	6.6[a]	2.6[c]	4.6[b]	0.5	<0.01
Total free AA, mM	10.4[a]	6.6[b]	3.9[c]	0.8	<0.01
pH	6.25[b]	6.38[b]	6.69[a]	0.09	0.08
Total VFA, mM	75.6	71.6	63.6	13.7	0.83
Acetate, mM	42.6	38.0	38.6	7.6	0.90
Propionate, mM	18.7	20.0	15.4	5.13	0.82
Butyrate, mM	10.0[a]	8.0[ab]	5.7[b]	0.8	0.09
Isobutyrate, mM	0.98	0.91	0.92	0.10	0.89
Isovalerate, mM	1.53	1.92	1.71	0.13	0.18
Valerate, mM	1.76	2.66	1.23	0.37	0.15
Protozoa, x 10^6 cells/ml	5.90[a]	0.37[b]	0.51[b]	0.34	<0.01

Key Words: Lauric Acid, Protozoa, Dairy Cows

M216 Effects of forage source on the response of milk fatty acid composition to soybean and marine algal oil supplementation in ewes. C. K. Reynolds*[1], S. C. Loerch[1], G. D. Lowe[1], D. D. Clevenger[1], P. A. Tirabasso[1], V. L. Cannon[1], and J. R. Abril[2], [1]*The Ohio State University, Wooster,* [2]*Martek Biosciences, Boulder, CO.*

Milk conjugated linoleic acid (CLA) is increased by a mixture of fish and sunflower oils to a greater extent than feeding the oils individually. Our objective was to determine in ewes (78.4 kg BW) the effects of diet forage source on the response of milk fatty acid (FA) composition to an oil supplement (3% of ration DM) based (2:1 respectively, wt:wt) on soybean oil and marine oil in dry microalgae (DHA Gold, Martek Biosciences) high in C18:2 (n-6) and C22:6 (n-3), respectively. Hampshire X Dorset ewes (48) were assigned to one of 4 treatments and 12 pens in a 2 X 2 factorial completely randomized design blocked on the basis of lambing date and number of lambs suckled. Control rations (60:40 forage:concentrate, DM basis) based on alfalfa pellets (AL) or corn silage (CS) were each fed to 6 pens from lambing. After 3 wk adaptation 3 pens each fed AL or CS were switched to similar rations with added oil (ALO and CSO). Milk yield over 3 h and composition were measured at 42 d postpartum. DMI was lower ($P < 0.02$) for CS vs. AL and for oil, but milk yield was not affected. Milk fat content was increased by oil ($P < 0.1$) and milk protein content was higher for AL vs. CS ($P < 0.04$). Total CLA was increased ($P < 0.01$) for CS vs. AL and by oil, and the response to oil was greater for CS ($P < 0.04$). Similarly, total *trans*-C18:1 and C22:6 (n-3) were higher for CS vs. AL and for oil, with a greater response to oil for CS ($P < 0.06$ and 0.01, respectively). In conclusion, milk fatty acid responses to feeding vegetable and marine oils were affected by forage source. Despite large increases in *trans*-C18:1 concentration, milk fat content was increased by feeding unsaturated oils to ewes.

	AL	ALO	CS	CSO	SEM
DMI, kg/d	4.2	3.6	3.5	3.3	0.1
Milk yield, kg/d	1.7	2.3	2.2	2.0	0.2
Milk fat, g/kg	79.6	92.6	70.7	83.9	6.6
Milk protein, g/kg	58.8	63.1	51.2	53.8	3.2
Total CLA, g/100 g FA	0.4	0.8	1.0	1.6	0.1
Total *trans*-C18:1, g/100 g FA	5.6	12.6	7.1	18.3	1.0
C22:6 (n-3), g/100 g FA	0.0	1.4	0.1	1.9	0.1

Key Words: Forage, Fatty Acids, CLA

M217 Use of liquid whey, urea and molasses as additives to ensiled wheat straw. F. T. Sleiman*, N. J. Rebeiz, M. G. Uwayjan, M. T. Farran, R. A. Zurayk, E. K. Barbour, and S. K. Hamadeh, *American University of Beirut.*

Changes in fermentation pattern, consumption and apparent digestibility of wheat straw (S) ensiled with liquid whey (W), urea (U) and molasses (M) were studied using 12 Awassi ram lambs averaging 6 months in age and 36.7 kg BW. The study consisted of a 3 wk trial and a 1 wk collection period. The experimental treatments were: I) 100% S, II) 41% S +58% W + 1% U, III) 41% S + 55% W + 1% U + 3% M, and IV) 41% S + 54% W + 1% U + 4% M. In addition to ad libitum feeding of straw treatments, each lamb received 1 kg concentrate (14% CP on DM basis) per day. Variations in silage temperatures, recorded at 3 days interval for 30 days, were not significantly different (P>0.05) among the silage treatments (II, III and IV) and averaged 15.5, 18.0 and 17.2 °C, respectively. PH of treatment III was significantly lower (P<0.05) than those of II and IV over the 4 wk ensiling period and averaged 4.56 Vs 4.87 and 4.98, respectively. All lambs had positive but non significant (P>0.05) weight gains at the end of the trial with the highest body weight change recorded for treatment III as compared to I, II and IV (338.5 Vs 194.5, 230.5 and 316.9 g/d, respectively). Silage DMI of W treatments (II, III, and IV) were not significantly different (P>0.05); but these intakes were significantly higher (P<0.05) than that of treatment I and averaged 686, 736 and 707 Vs 435 g/d, respectively. Apparent digestibility of DM was not significantly different (P>0.05) among all treatments and averaged 69.3%. CP digestibility of treatment II was significantly higher (p<0.05) than other treatments (79.7 Vs 59.0 and 60.3% for treatments I, III and IV, respectively). Digestibility of the fiber fractions of II, III and IV were significantly higher (P<0.05) than treatment I; CF (60.2, 66.1 and 62.2 Vs 48.6%), ADF (61.2, 65.8 and 63.5 Vs 46.0%) and NDF (66.7, 71.2 and 68.2 Vs 60.7%). However, digestibility of CF, ADF and NDF of the W supplemented treatments were not different (P>0.05). Results of this study indicate that additives as used improved feed acceptability, animal response, fermentation characteristics and digestibility of ensiled wheat straw.

Key Words: Liquid Whey, Wheat Straw, Ram Lambs

M218 Undegradable intake protein content and digestibility of brome, birdsfoot trefoil, and heat-treated alfalfa samples. H. L. Haugen, S. K. Ivan*, and T. J. Klopfenstein, *University of Nebraska, Lincoln.*

Two experiments were conducted using two ruminally and duodenally fistulated steers (658 kg) to determine the digestibility of undegradable intake protein (UIP) of smooth bromegrass (*Bromus inermis*), birdsfoot trefoil (BFT; *Lotus corniculatus*), and heat-treated alfalfa (*Medicago sativa* L.) using the mobile nylon bag method. Undegradable intake protein was determined using neutral detergent insoluble crude protein at a single in situ incubation time point based on 75% of the mean retention time estimated from in vitro dry matter disappearance plus a 10 h passage lag. In the first experiment, UIP (% DM) of brome in June and July was 1.82 and 1.71, respectively (P = 0.11). Undegradable intake protein (% DM) of BFT increased from 1.30 in June to 1.94 in July (P < 0.01). Total tract indigestible protein (IDP) of brome and BFT increased in July (P < 0.05). Digestible UIP decreased in July for brome (P < 0.01) and tended to increase for BFT (P = 0.07). The disappearance of UIP of BFT increased 0.19 percentage units (DM) in July (P < 0.01). In the second experiment, alfalfa from plots fertilized with low (66 kg N ha^{-1}) and high (200 kg N ha^{-1}) amounts were dried to simulate three preservation methods: dehydrated (100°C, 10 h), sun-cured

(50°C, 15 h), or lyophilized (-50°C, 72 h) alfalfa. Undegradable intake protein (% DM) was estimated as in experiment one and was 3.13, 2.10, and 1.84 for dehydrated, sun-cured, and lyophilized alfalfa, respectively. Total tract IDP was increased ($P < 0.05$) for dehydrated alfalfa (1.66 % DM) above sun-cured (1.54 % DM) or lyophilized alfalfa (1.57 % DM). Digestible UIP was greater ($P < 0.01$) for dehydrated (46.4%) than sun-cured (25.6%) or lyophilized alfalfa (14.7%) as a result of greater UIP flow to the lower tract. Heat-treated alfalfa samples increased net UIP absorbance in the lower tract as 1.47, 0.56, and 0.27 more percentage units of UIP (% DM) of dehydrated, sun-cured, and lyophilized alfalfa, respectively, disappeared. Overall, UIP digestibility of these forages was low.

Key Words: Undegradable Intake Protein, Undegradable Intake Protein Digestibility, Forages

M219 Preliminarly report on dry matter degradability of Cassia tora. J. A. Vergara-Lopez* and R. E. Maldonado, *Instituto Nacional de Investigaciones Agricolas (INIA) municipio Catatumbo, estado Sulia, Venezuela*.

To evaluate dry matter degradability of Cassia tora (CT) in a tropical dry forest of Venezuela, two Criollo Limonero steers fitted with permanent rumen cannulae and 506 ± 3.5 kg LW, were used. Animals were housed in a feedlot during 14-d and fed with a mixture of Aleman-grass Maraquita in a 80:20 ratio. Samples of CT and Aleman-grass (AG) were cutted from paddock, dried at 105°C in a forced air oven to asess dry matter and milled to 3 mm. Dry samples were weighed in nylon bags (50 μm pore size) and incubated on 0, 6, 12, 24, 48 and 72 h and analysed for dry matter in a forced air oven at 105°C. Ruminal degradability data were fitted by the model d=a+b(1-e-ct), which were analyzed by ANOVA and least square differences test for means comparation. Initial solubility (a) was higher (p<0,001) in CT than AG (20.83 ± 0.43 and 22.21 ± 0.36 for AG and CT, respectively); while b was higher (p<0,001) in AG than CT (58.35 ± 0.81 and 38.77 ± 0.62 for AG and CT, respectively). Fractional rate of degradation (c) was lower (p<0,001) in AG than CT (0.050 ± 0.002 and 0.120 ± 0.011 for AG and CT, respectively), and a+b was higher (p<0,001) in AG than CT (79.22 ± 1.08 and 60.95 ± 0.69 for AG and CT, respectively). Cassia tora had a lower dry matter rumen degradability than Aleman-grass.

Key Words: Cassia tora, Echinocloa polystachya, Ruminal Degradability

M220 Roundup ready® alfalfa is compositionally equivalent to conventional alfalfa. M. McCann*[1], G. Rogan[1], and S. Fitzpatrick[2], [1]*Monsanto Company, St. Louis, MO,* [2]*Forage Genetics International, West Salem, WI*.

Roundup Ready® alfalfa has been genetically modified to contain the *cp4 epsps* gene that confers resistance to Roundup® agricultural herbicides. As part of the food/feed safety evaluation, compositional equivalence studies were performed on forage collected from different cutting samples in replicated field trials over two years. Data were collected for proximates (protein, fat, ash and moisture), acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, amino acids, and minerals (calcium, copper, iron, magnesium, manganese, phosphorous, potassium, sodium and zinc), as well as carbohydrates by calculation. Roundup Ready® alfalfa was compared to its null-segregant control line to determine any statistical differences at the 5% level of significance (P<0.05). Additionally, commercial alfalfa varieties were included to provide population intervals. Results from the analyses in these studies showed that for the majority of comparisons made (310 out of 385), there were no statistically significant differences. For those few comparisons that showed differences between the test and control samples, it is unlikely they were biologically meaningful, since the differences were not consistently observed across field sites, test values were within the population intervals, or test values were observed to be similar to literature and historical ranges. These data are consistent with the conclusion that Roundup Ready® alfalfa forage is compositionally equivalent to the forage produced from other commercial alfalfa varieties currently on the market.

Key Words: Composition, Alfalfa, Equivalence

M221 Digestibility of *Streptomyces* solubles and effects of its inclusion in diets of lactating dairy cows. M. R. Murphy, M. A. Shah, W. Hu*, A. C. Norman, and C. J. Laesch, *University of Illinois, Urbana*.

Our objective was to determine the digestibility of *Streptomyces* solubles (a 14% crude protein, 10% fat, and 48% dry matter product of the pharmaceutical industry) and effects of its inclusion in diets of lactating dairy cows. Sixteen Jersey cows averaging 131 days in milk were randomly assigned to 4 4 Latin squares with 21-d periods after blocking by parity and rBST. Treatment diets were 50% concentrate, 35% corn silage, and 15% alfalfa silage (on a dry matter basis) and included 0, 2, 4, or 8% *Streptomyces* solubles. Apparent digestibilities of basal diet and *Streptomyces* solubles dry matter were estimated to be 70(SE = 1) and 104(22)%, respectively; digestibility of dietary dry matter tended ($P < 0.11$) to increase linearly with inclusion of *Streptomyces solubles*. Milk fat percentage and 4% fat-corrected milk production increased ($P < 0.05$) when *Streptomyces* solubles were included in the diet, from 5.04 to 5.23% and 26.9 to 28.1 kg/d. Milk and 4% fat-corrected milk production changed quadratically ($P < 0.05$) with *Streptomyces* solubles inclusion and dry matter intake tended ($P < 0.08$) to as well (24.0, 24.4, and 23.1; 27.8, 29.2, and 27.4; and 21.5, 22.3, and 21.7 kg/d at 2, 4, and 8% *Streptomyces* solubles). Body weight decreased linearly ($P < 0.01$) with inclusion of *Streptomyces* solubles and milk protein percentage tended ($P < 0.06$) to also (479, 473, and 467 kg; and 3.96, 3.96, and 3.87% at 2, 4, and 8% *Streptomyces* solubles). *Streptomyces* solubles are a digestible and palatable product that improved lactation performance, particularly when included at 4% of dietary dry matter.

Key Words: Digestibility, Dairy cows, *Streptomyces* Solubles

M222 Effect of replacing concentrates with wormwood on nitrogen balance and ruminal fermentation characteristics in sheep. Y. D. Ko*[1], J. H. Kim[1], M. D. Lee[1], A. T. Adesogan[2], and S. C. Kim[2], [1]*Division of Applied Life Science, Gyeongsang National University, Jinju, Korea,* [2]*Department of Animal Sciences, University of Florida, Gainesville*.

This study investigated the effect of replacing concentrates with air-dried wormwood (*Artemisia montana* Pampan) on the performance of sheep. Four Corriedale x Polwarth sheep weighing 41.3 kg (± 1.3 kg) were fed a diet of rice straw (80%) and pelleted supplements (20%) at 2% of body weight, for four, consecutive 15 d periods. The supplements were made by substituting the concentrate with no wormwood (0%; CT), or low (3%; LW), medium (5%; MW) or high (10%; HW) levels of wormwood on a DM basis (4 x 4 Latin square design). The concentrate (15.58 % CP, 72.1% TDN) contained corn, ground wheat, wheat bran and rapeseed. In each period, sheep were individually housed in metabolism cages for 10 days of dietary adaptation and 5 days of total collection of feces and urine. Rumen fluid was collected from a stomach tube at 0, 0.5, 1, 2, 4 and 8 hr after the morning feed, on day 5 of the measurement period, and analyzed for volatile fatty acids, ammonia and pH. CP digestibility was greater (p<0.05) in LW, MW and HW (56.6, 55.4 and 55.4%) than CT (52.1%). Digestibility of crude fat was greater (p<0.05) in LW (77.2%) than other treatments (72.1-74.5%). N intake did not differ among treatments, but N retention was greater (p<0.05) in LW, MW and HW (2.2, 2.6 and 2.8 g/d) than CT (0.8 g/d). Microbial nitrogen yield was also greater (p<0.05) in HW (17.3 g N/d) than CT (13.6 g N/d). Ruminal pH, was unaffected by treatment, but from 0.5 to 2 hr after feeding, ruminal ammonia N was greater (p<0.05) in sheep fed wormwood diets (8.2-9.7 mg/100ml) than in those fed CT (6.9-7.2 mg/100ml). Total-VFA concentration at 1 and 2 hr after feeding was greater (p<0.05) in sheep fed LW (9.5 and 10.4 mmol/100ml) or MW (10.6 and 10.2 mmol/100ml) than CT (9.1 and 8.8 mmol/100ml). In conclusion, this study suggests that replacing concentrate with 3-5 % wormwood improved N balance and the efficiency of N retention in the sheep.

Key Words: Wormwood, Digestibility, Ruminal Fermentation

M223 Effects of nonstructural carbohydrate and protein sources on performance, ruminal fermentation, total tract digestibility and feeding behavior in growing calves. A. Rotger, A. Ferret, S. Calsamiglia*, and X. Manteca, *Universitat Autònoma de Barcelona Edifici V, Campus UAB, Bellaterra 08193, Barcelona, Spain*.

Four rumen fistulated Holstein calves (BW 132.3 ± 1.61 kg) fed high concentrate diets (10 to 90, forage to concentrate ratio) were assigned to a 4 x 4 Latin square design to investigate the effects of nonstructural carbohydrate (barley or corn) and protein (soybean meal or sunflower meal) sources on ruminal fermentation and animal performance. The following 2 x 2 factorial arrangement of treatments (13.7% CP, 2.8 Mcal ME/kg DM) was used: 1) Barley-Soybean meal; 2) Barley-Sunflower meal; 3) Corn-Soybean meal and 4) Corn-Sunflower meal. Data were analyzed using the PROC MIXED procedure of SAS, main factors being nonstructural carbohydrate source, protein source and their interaction. Calf and period were considered random effects. Intake of DM was higher in the corn vs. barley based diets ($P < 0.05$), without affecting ADG (1.2 ± 0.12 kg/d). Consequently, feed efficiency was higher for the barley based diets. Average ruminal pH, total VFA and NH_3N concentration were not affected by main factors (6.6 ± 0.14, 116.4 ± 5.27 mM and 5.9 ± 2.17 mg/dL, respectively). Total VFA per kg of DM intake was lower in the corn vs. barley based diets (20.07 vs. 25.42 mM/kg DMI, $P = 0.02$) and no significant effects were observed for the proportions of individual VFA. Nonstructural carbohydrate and protein sources did not affect total tract digestibility of DM and OM, estimated with chromium oxide (64.5 ± 2.67 and 65.1 ± 2.74 %, respectively). Feeding behavior, measured by scan sampling at 5 minute intervals, did not vary significantly among treatments. Calves spent 9.97, 2.11, 25.13 and 62.79% of the time eating, drinking, ruminating and resting, respectively. In conclusion, while nonstructural carbohydrate source affected intake, feed efficiency and total VFA per kg of DM intake, protein source did not affect these measurements.

Rabbit Species

M224 Effects of dietary mannan oligosaccharide in comparison to oxytetracyclin on cecal fermentation and performance of rabbits. A.P. Fonseca[1], L. Falcäo[1], P. Spring*[2], and A. Kocher[3], [1]*Universidade Técnica de Lisboa Instituto Superior de Agronomia, Lisboa, Portugal,* [2]*Swiss College of Agriculture, Zollikofen, Switzerland,* [3]*Alltech Biotechnology Center, Dunboyne, Co. Meath, Ireland*.

Digestive disorders in rabbits are quite frequent. Feed additives, which can lower the risk of digestive disorders and enhance performance are useful tools to the rabbit nutritionist. The aims of the present trials were to compare the effects of mannan oligosaccharide (MOS) and oxytetracycline (OTC) on rabbit performance and intestinal fermentation. Two trials were set up as complete randomized designs with Hybrid Hyla rabbits (31 to 70 days). Rabbits were housed individually in metabolic cages. Grower feed was offered through day 46 and finisher feed from day 47 to the end of the trial. The diets did either contain 2000ppm of MOS (Bio-Mos®, Alltech Inc.) or OTC (20%) in the grower and 1000ppm of MOS or OTC in the finisher diet, respectively. Trial 1 was performed with 48 rabbits. Performance as well as purine derivates excreted in the urine and caecotrophes (soft feces) composition was determined. Trial 2 involved 24 rabbit. Performance, diet digestibility and cecal pH and VFA concentrations were determined. All data were subjected to ANOVA. Average daily gain and FCR did not differ between treatments. ADG was 41.7g and 44.1g for the MOS treatment vs. 42.7g and 43.9g for the OTC treatment in trial 1 and 2, respectively (RSD 4.2 and 2.9). Average feed conversion was 3.05 in trial 1 and 3.50 in trial 2 and was not affected by treatment. Composition of the soft feces did not differ among treatments. Diets did affect purine derivatives excretion. Allantoin and uric acid excretion did not differ between treatments; however, rabbits fed MOS did excrete significantly less hipoxantin and xantin. Diet digestibility in trial 2 was modestly affected by treatment, with a significant improvement in ADL digestibility for MOS compared to OTC. Average cecal pH was 6.2 for both treatments. Total VFA concentrations averaged 36 mmol/l and did not differ between treatments. Under the present trial conditions performance with MOS was similar to performance with OTC. MOS did show a reduction in mortality. Differences in cecal fermentation patterns and diet digestibility were modest between the two additives.

Key Words: Rabbits, Mannan Oligosaccharides, Performance

Production, Management and the Environment: Systems, Economics, and Miscellaneous

M225 Minimum dry period length to maximize performance. M. T. Kuhn*, J. L. Hutchison, and H. D. Norman, *Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD*.

The objective of this research was to find the minimum dry period length while maintaining performance in the subsequent lactation. The number of days dry, month of calving in the subsequent lactation, linear and quadratic effects of the last somatic cell score in the previous lactation, linear and quadratic effects of previous days open, and linear and quadratic effects of age at subsequent lactation were included in the model to look at the effect of dry period length on actual milk yield in the subsequent lactation, adjusted for producing ability. Data included Holstein cows first calving from 1997 to 1999. There were 64,100 records with a second lactation, 28,376 with a third lactation, and 11,997 with a fourth lactation. Peak yield during the following lactation occurred at a dry period length of 45 to 60 days for parities 2, 3, and 4. A difference in milk production of +33, +50, and -16 kg between 56 to 60 and 61 to 70 days dry was not significant for lactations 2, 3, and 4, respectively. A dry period length over 70 days resulted in a 250, 622, and 727 kg decrease in milk production for lactations 2, 3, and 4, respectively. Although peak yield in subsequent lactation occurred between 45 and 60 days, the rate of increase from zero to 45 days was not linear. Cows that were dry from zero to 35 days following first, second, and third lactations showed an average decrease of 1111, 491, and 1802 kg in second, third, and fourth lactations, respectively. In contrast, cows that were dry from 35 to 45 days had an average loss of only 280, 172, and 182 kg in lactations two, three, and four, respectively. Further research will determine optimum dry period length for lifetime yield, somatic cell score, female fertility, fat and protein percentages, and productive life.

Key Words: Dry Period Length, Milk Production, Performance

M226 Effect of photoperiod on milk production in lactating dairy cows. M. J. VanBaale*[1], D. V. Armstrong[1], R. M. Mattingly[2], and J. B. Fiscalini[2], [1]*The University of Arizona, Tucson,* [2]*Fiscalini Dairy Farm, Modesto, CA*.

Ninety-eight multiparous and 60 primiparous Holstein animals were utilized in an extended lighting trial to investigate photoperiods impact on milk yield. After parturition all animals were housed in one pen until 20 DIM under normal daylight/nightlight conditions. On d 21, animals were randomly assigned into two treatment groups receiving supplemental light (SL) or normal daylight and darkness (NL). There were four groups of multiparous cows; two were assigned to SL and two to NL. There were only two groups of primiparous animals that were assigned to SL or NL. While in freestalls both multiparous and primiparous cows in the SL groups were exposed to 17h of natural light and SL above 15 foot candle (FC) and 7h of light below 5 FC in the freestall area. The light exposure for the NL groups followed the normal sunrise-sunset pattern common for the north 40th parallel of sunrise 0530 to 0730 and sunset 1700 to 1900, an average of 12h of light and darkness. Light intensity was measured every two wks at 2200 to 2300 at two points in the freestall barn (feed manger and outside lane at animal head level) and in the milking parlor holding pen (front, middle, and back). Diets for both treatments were balanced for 52 kg milk/d. There was no difference ($P = 0.48$) observed between primiparous animals assigned to SL (32.9 kg/d) or NL (32.7 kg/d) treatments. Multiparous cows in