

1322 In vitro and in vivo inhibition of vaginal Group B *Streptococcus* (GBS) by bifidobacterial strain of human origin. Josee Beaulieu^{*1}, Naceur Naimi², Denis Richard², Yvan Boutin³, and Ismail Fliss¹, ¹Dairy Research Centre STELA, Université Laval, Quebec, Canada, ²Centre for Research on Energy Metabolism, School of Medicine, Université Laval, Quebec, Canada, ³Transbiotech, Cegep de Lévis-Lauzon, Lévis, Canada.

Group B *Streptococcus* (GBS), *Streptococcus agalactiae*, is considered to be problematic in countries all over the world. In fact, 2 or 3 out of every thousand newborns are infected with this bacterium and in 15 to 20% the infection leads to death due to severe meningitis. GBS is mostly found in the genital tracts of pregnant women and can be transmitted to newborns during labour.

In this work, the inhibition of GBS by strains of bifidobacteria was investigated *in vitro* as well as *in vivo* in an animal model. Different strains of bifidobacteria of human origin were screened for their potential to inhibit GBS. An exopolysaccharide-producing isolate (UL-2), exhibiting a high inhibitory effect against GBS and showing a good adherence to HeLa cells was selected. At pH 5.0, this isolate adhered to HeLa cells 25-fold higher than at pH 7.4. This adherence capacity was 1.6 and 3.8 times higher than that of GBS at pH 7.4 and 5.0 respectively. When UL-2 was added at a concentration of 1×10^7 CFU/mL, GBS adhesion to HeLa cells was inhibited by 61% and 69.5% at pH 5.0 and pH 7.4 respectively. However, a complete inhibition was obtained when UL-2 was added at a concentration of 1×10^9 CFU/mL. Finally, the *in vitro* inhibition of GBS by UL-2 was validated *in vivo* by using an animal model simulating GBS vaginal infection. The efficiency of UL-2 was evaluated by microbiological, immunological, histological and metabolic analysis.

Key Words: Human bifidobacterial strain, Group B *Streptococcus* inhibition, Animal model

1323 Effectiveness of cleaning and sanitizing agents against a biofilm of lactobacilli isolated from slit-defected Cheddar cheese. Cecilia Golanarian* and Catherine Donnelly, University of Vermont, Burlington, VT.

Slit-defect in long-hold Cheddar cheese results in loss of salable product. Strains of lactobacilli with the ability to slit cheese have been identified and characterized for the purpose of developing a procedure for the elimination of this problem. The objectives of this research were to study the ability of the strains to form biofilm on stainless steel, and determine if commonly used cleaning and sanitizing agents would eliminate the biofilm.

Selected lactobacillus strains were inoculated, as a cocktail and individually, into containers of sterile milk with stainless steel coupons in each, then held at 31°C for 20 days. The containers were drained, and sterile

Forages and Pastures Grasses and Legumes

1325 Effects of camphene, myrcene, caryophyllene oxide, and β -pinene on consumption of alfalfa pellets by sheep. R. E. Estell^{*1}, E. L. Fredrickson¹, D. M. Anderson¹, K. M. Havstad¹, and M. D. Remmenga², ¹USDA/ARS Jornada Experimental Range, ²New Mexico State University Statistics Center.

Four experiments were conducted to examine effects of individual terpenes on alfalfa pellet intake by lambs. Forty-five lambs (9 lambs/treatment) were individually fed alfalfa pellets sprayed with either camphene, myrcene, caryophyllene oxide, or β -pinene at one of five concentrations in an ethanol carrier. Treatments (0, .5, 1, 2, and 10X) were multiples of the concentration (X) of a specific terpene on the leaf surface of *Flourensia cernua*. Terpenes were applied to alfalfa pellets (.64 kg.lamb⁻¹.d⁻¹, DM basis), and consumption was measured during a 20-min interval for 5 d. Lambs were adapted to handling and individual pen feeding for 10 d and were maintained and fed alfalfa pellets in one group (except during 20-min tests) at a mean total daily intake of 4.7% of BW (DM basis). Camphene and caryophyllene oxide tended to decrease intake (linear contrasts were $P = .0651$ and $P = .0504$, respectively), while myrcene and β -pinene exerted no effect on consumption of alfalfa pellets by lambs during the 20-min interval. Camphene and

milk was added on day 5, 10 and 15. On day 20, the coupons were rinsed, cleaned and/or sanitized as follows: 1) rinsed with vortexing five times in sterile phosphate buffered saline (PBS); 2) rinsed then washed in cleaning agent using agitation; 3) rinsed, cleaned, then soaked in 25°C sanitizer; 4) rinsed, cleaned, then soaked in 72°C sanitizer. Treatments were followed by three rinses in buffer, and a fourth rinse with agitation in Lactobacillus MRS broth. The final rinse was plated for bacterial counts and the tubes incubated for 24 hours. One coupon from each treatment was examined by scanning electron microscopy.

Growth plates for treatment one were too numerous to count (TNTC). Bacterial counts for treatments two averaged between $1.50 \# 2.25 \log$ CFU/ml, depending on agents applied. Bacterial counts for treatment 3 and 4 were <100 CFU est/ml. However, the final rinses in MRS (used to inoculate the growth plates) were turbid with growth within 24 hours. The scanning electron micrographs illustrated the presence of biofilm, as well as an apparent injury effect of cleaning and sanitizing agents on the formation of the films. Although none of the tested agents were able to eliminate the presence of the biofilm, there were noticeable differences in their effect.

Key Words: lactobacilli, Cheddar cheese, biofilm

1324 Incidence of *B. cereus* spore in raw milk by membrane filtration. Yoosung Shin* and Heidi Schraft, ¹University of Guelph.

In order to determine the incidence of *B. cereus* spore in raw milk, a total of 78 raw milk samples from various sampling sites, 12 environmental swabs and finished pasteurized milk were collected.

Spores of *B. cereus* in bulk tank milk of dairy farms were enumerated to be 1-37/60 ml. The incidence of *B. cereus* spores was varied with 1-222 spores and 6-263 spores/60 ml for raw milk of delivery truck and silo tank, respectively. By enrichment of heat-treated milk, *B. cereus* spores were enumerated to be 1.0×10^1 - 7.4×10^7 ml⁻¹ for bulk tank milk samples, 1.1×10^2 - 2.1×10^7 ml⁻¹ for truck samples, and 1.0×10^1 - 4.6×10^7 ml⁻¹ for silo samples, respectively. Finished pasteurized milks were contaminated with *B. cereus* by numbers of 0.5×10^1 - 6.3×10^4 , 1.0×10^4 - 3.2×10^7 , and 1.9×10^6 - 3.4×10^7 cfu ml⁻¹ for enrichment at 7°C for 14 days, 10°C for 7 days, and 40°C for 2 days, respectively. Environmental swab samples contained *B. cereus* with range 0.5×10^1 - 8.2×10^8 cfu ml⁻¹ by up to 24 hours enrichment at 30°C.

Overall, the incidence of *B. cereus* spore was found to be higher in silo and delivery truck than bulk tank in dairy farms. There is a tendency to find higher numbers of psychrotrophic *B. cereus* in raw milks of delivery truck and silo than in bulk tank on the farms. The result suggests the possibility of *B. cereus* residue on the surface of raw milk handling equipment after C.I.P.

Key Words: *B. cereus*, Raw milk, Membrane filtration

caryophyllene oxide may be involved in the differential herbivory of individual tarbush plants by livestock.

Key Words: Herbivory, Intake, Terpenes

1326 Influence of sward height, daily timing of concentrate supplementation and grazing time management on intake, digestibility and grazing efficiency of lactating beef cows. O.J. Gekara*, E. C. Prigge, W. B. Bryan, E. L. Nestor, and W. V. Thayne, West Virginia University, Morgantown, WV.

Thirty-two crossbred lactating beef cows were randomly assigned to two Kentucky bluegrass/white clover sward height (SH) treatments, either 4 to 8 cm or 10 to 12 cm, replicated four times. They were fed a concentrate supplement (T) (4.1 kg DM animal⁻¹.d⁻¹) at 0700 (AM) or 1800 (PM), and either restricted (R) to 12 hrd⁻¹ (0700 to 1900) grazing or allowed (U) to graze 24 hrd⁻¹ (MGT). The experiment was repeated over three 15-d periods in May, July and August 2000. Mean SH of continuously stocked pasture throughout the experiment was 6.0 and 9.9 cm for low and high SH, respectively. The high SH treatment herbage was higher ($P < 0.05$) in fiber components and lower in CP compared to low SH pasture. An interaction, T x MGT ($P < 0.05$), on forage DM

intake (FDMI) was evident. For R cows, supplementing in the AM as opposed to PM resulted in greater FDMI (8.6 vs 8.2 kgd⁻¹). The U cows had greater FDMI (8.4 vs 8.1 kgd⁻¹) when supplemented in the PM as opposed to AM. An interaction between SH and T ($P < 0.05$) on herbage DMD was apparent. Supplementing in the PM as opposed to AM resulted in greater herbage DMD (67.7 vs 65.4%) for cows on high SH while cows on low SH had greater herbage DMD (66.3 vs 64.5%) when supplemented in the AM. An interaction, T x MGT ($P < 0.10$) on grazing time (GT) was apparent. Supplementing in the PM as opposed to AM increased the actual time spent grazing more for R than U cows. An interaction, T x MGT ($P < 0.01$), on grazing efficiency (forage intake/hr of GT) was evident. Supplementing in the AM as opposed to PM increased grazing efficiency of R cows (1.3 vs 1.2 kg DM/hr). When forage intake is restricted as a result of either a limitation in GT or forage availability, supplementing in the AM may result in higher animal performance. When forage or GT is not limiting, feeding concentrate supplements in the PM can result in increased performance.

Key Words: Sward Height, Supplementation, Cows, Intake, Digestibility

1327 Assessment of gamagrass based diets without and with corn supplementation on ruminal fermentation in continuous cultures. J-S. Eun*¹, V. Fellner¹, J. C. Burns², and M. L. Gumpertz¹, ¹North Carolina State University, Raleigh, NC, USA, ²USDA-ARS, Raleigh, NC, USA.

This study was designed to determine the effects of gamagrass diets similar to those fed in a previous lactating cow trial on microbial metabolism in rumen cultures. Artificial fermentors were incubated with filtered ruminal contents and allowed to adapt for 4 days to diets followed by 3 days of sample collection. Five dietary treatments were tested: gamagrass hay (GH), gamagrass silage (GS), gamagrass silage + low corn (GSLC), gamagrass silage + medium corn (GSMC), and gamagrass silage + high corn (GSHC). A concentrate mix consisting of soybean meal and mineral and vitamin premix was added to all diets to keep CP levels similar across treatments. Daily feed offered, on a DM basis, was 13.9 g for all diets. Data were analyzed as repeated measures according to a randomized block design using the proc mixed procedure of SAS. Feeding GS resulted in a higher ruminal pH compared to GH. Increasing the level of corn supplementation in GS linearly decreased culture pH ($P < 0.04$). Concentration of NH₃-N was similar across treatments (27.9 mg/100 ml) and tended to decrease with increasing levels of corn. All diets resulted in similar methane production with the exception of GSMC which lowered methane output ($P < 0.04$). Total VFA concentrations were not affected by diet. Molar proportions of acetate were higher with GH compared to GS. Corn supplementation at the medium and high level resulted in the lowest proportion of ruminal acetate ($P < 0.01$). In contrast, molar proportion of propionate was reduced in the GSLC diet and remained similar across all other diets. Butyrate was higher in GS compared with GH. Corn supplementation increased molar proportions of butyrate which were highest in cultures receiving the high level of corn. Including corn at the high level with gamagrass silage did not have a detrimental effect on ruminal fermentation. There were no major effects of dietary treatments on microbial fermentation, but gamagrass silage resulted in higher ruminal pH when compared to gamagrass hay. Parameters to determine microbial growth are currently being analyzed.

Key Words: Gamagrass, Continuous culture, Fermentors

1328 Effect of variety and maturity stage on chemical composition and energy content of alfalfa and Timothy hay. P. Yu*¹, D.A. Christensen¹, J.J. McKinnon¹, H Soita¹, and J. Markert¹, ¹Department of Animal and Poultry Science, University of Saskatchewan.

The objective of this study was to investigate changes in chemical composition and energy content of two alfalfa varieties (*Medicago sativa* L. cv. Pioneer, Beaver) and two timothy varieties (*Phleum pratense* L. cv. Climax, Joliette) grown at 3 locations (N=3), and cut at 3 stages of growth. The forages were harvested at the following growth stages: 1=early bud for alfalfa; joint for timothy; 2=late bud for alfalfa; pre-bloom head for timothy; 3=early bloom for alfalfa; full head for timothy. Comparing alfalfa and timothy means, alfalfa contained higher ($P < 0.05$) levels of EE (3.1 vs. 2.5 % DM), CP (18.9 vs. 9.7 % DM), SCP (53.6 vs. 40.1 % CP), NPN (86.0 vs. 40.9 % SCP), ADIP (8.6 vs. 5.2 % CP), NDIP (35.8 vs. 24.5 % CP), NSC (25.7 vs. 13.0 % DM), ADL (10.0 vs. 5.5 % DM), but lower ($P < 0.05$) levels of TP (46.3 vs. 78.3 % CP), CHO

(68.2 vs.81.1 % DM), NDF (49.4 vs. 70.7 % DM), ADF (31.0 vs. 39.7 % DM) and GE (4.3795 vs. 4.4397 Mcal/kg DM). There were no differences between the 2 forage types in estimated energy values (TDN_{1x}: 55.2 vs. 56.4% DM; DE_{1x}: 2.5531 vs. 2.4886; DE_p: 2.3447 vs. 2.2855; ME_p: 1.9193 vs. 1.8584; NE_{Lp}: 1.1602 vs. 1.1165; ME^{beef96}: 2.0936 vs. 2.0407; NE_m^{beef96}: 1.2390 vs. 1.1900; NE_g^{beef96}: 0.6712 vs. 0.6264 Mcal/kg DM). Within a forage species, variety had little effect on chemical composition. With advancing maturity, CP was decreased ($P < 0.05$) (alfalfa: 20.2 to 17; timothy: 11.1 to 7.9 % DM). ADF and NDF were not affected in the alfalfa, but increased ($P < 0.05$) in timothy (ADF: 38.0 to 40.7% DM; NDF: 68.7 to 72.8% DM). Lignin was not affected by maturity in either species, but ADIP was increased ($P < 0.05$) in alfalfa (3.5 to 17.1% CP). NDIP was not affected by stage of growth. The highest energy values for both forages were found at stage 2 (TDN_{1x}, DE_{1x}, DE_p, ME_p, NE_{Lp}: 58.0%, 2.5615, 2.4592, 2.0363, 1.2438 Mcal/kg DM for alfalfa varieties; 57.1%, 2.5273, 2.3210, 1.8943, 1.1418 Mcal/kg DM for timothy varieties). The results indicate that within each species, stage of maturity rather than variety has the greatest impact on chemical composition and energy content of the forage.

Key Words: Forage Quality, Variety and Maturity Stage, Chemical Composition and Energy Value

1329 Effect of variety and maturity stage on in vitro rumen degradability of alfalfa and Timothy hay. P. Yu*¹, D.A. Christensen¹, J.J. McKinnon¹, and J. Markert¹, ¹Department of Animal and Poultry Science, University of Saskatchewan.

The objective of this study was to determine the effects of variety and stage of growth on *in vitro* rumen degradability (IVRD) of alfalfa (*Medicago sativa* L. cv. Pioneer and Beaver) and timothy (*Phleum pratense* L. cv. Climax and Joliette) hay grown at three locations (N=3) and cut at three stages of growth: 1=early bud for alfalfa and joint for timothy; 2=late bud for alfalfa and pre-bloom head for timothy; 3=early bloom for alfalfa and full head for timothy. The results showed that IVRD of alfalfa was higher ($P < 0.05$) than that of timothy for DM (IVRDDM) and NDF (IVRDNDF) after 24 and 48 h of incubation (IVRDDM24: 40.9 vs. 25.2%; IVRDDM48: 48.9 vs. 35.7%; IVRDNDF24: 38.5 vs. 20.3%; IVRDNDF48: 40.9 vs. 34.8%). Species differences decreased markedly with increasing rumen incubation time. There was no effect of alfalfa variety on IVRDDM (averaging 40.9 and 49.0% for 24 and 48 h, respectively). IVRDNDF24 for Pioneer tended to be higher ($P < 0.1$) than that of Beaver (41.2 vs. 36.4%) but not after 48 h of incubation. Similar results were seen for the timothy varieties (IVRDDM24 26.4 vs. 23.9% $P < 0.1$; IVRDDM48 36.9 vs. 34.5%, $P < 0.05$; for Climax vs. Joliette, respectively) with no effect of timothy variety on IVRDNDF24 and IVRDNDF48, averaging 20.4 and 33.9%, respectively. No differences were seen in alfalfa in IVRDDM and IVRDNDF between the early and late bud stages. However, as maturity advanced from stage 2 to 3, IVRDDM and IVRDNDF were reduced ($P < 0.05$) (IVRDDM24: 43.4 to 38.1%; IVRDDM48: 50.5 to 46.0%; IVRDNDF24: 43.9 to 34.4%; IVRDNDF48: 42.8 to 38.4%). In contrast, there was no effect of maturity on timothy. These results indicate IVRD is influenced by factors such as forage variety and maturity, however the magnitude of the impact will be influenced by forage species.

Key Words: In vitro Rumen Degradability, Forage Quality, Variety and Maturity

1330 Yield and composition of milk from cattle grazing various binary mixtures of grass and Kura clover. R. F. Gregoret*, K. A. Albrecht, and D. K. Combs, University of Wisconsin-Madison.

Binary mixtures of kura clover (*Trifolium ambiguum* M. Bieb., cv. Endura) with low alkaloid reed canarygrass (*Phalaris arundinacea* L., cv. Palaton), endophyte free tall fescue (*Festuca arundinacea* Schreb., cv. Select), or Kentucky bluegrass (*Poa pratensis* L., cv. Park), were established at the Arlington Agricultural Research Station in spring, 1999. The pastures (each 1.5 ha) have been grazed by dairy cattle since that time and now contained approximately 37% clover in the reed canarygrass (RCK), 45% clover in the tall fescue (TFK) and 75% clover in the Kentucky bluegrass (KBK) pastures. The three pastures had similar available herbage (2795 363, 2839 464 and 3239 657, kg/ha, for RCK, TFK and KBK, respectively) but differed in height and sward density (14.36 cm, 1.89 kg/m³; 13.65 cm, 2.04 kg/m³; and 13.25 cm, 2.58 kg/m³, respectively). They also differed in NDF and ADF (41.9%,

23.7%; 40.5%, 23.9%; and 33.1%, 21.2%, respectively). Thirty multiparous Holstein cows, managed under an intensive rotational grazing management system were used to compare milk production and milk composition across pastures. Cattle were randomly assigned to one of 10-3 x 3 Latin squares. There were 3 cows and 3 treatments per square. Each period was 14 d. Cows grazed the paddocks 19 h/d and were offered 175% of their calculated maximum forage intake by adjusting paddock size daily. All cows were offered 7.8 kg/d corn-soybean meal supplement after the morning and evening milking. Milk yield, milk protein and MUN were highest ($P < 0.05$) for cattle grazing the KBK pasture. Higher production could be due to higher forage quality because of the higher proportion of legume and/or the greater sward density in the KBK pasture.

	RCK	TFK	KBK
Milk yield, kg/d	27.01 ^b	27.21 ^b	29.07 ^a
Fat, %	3.45	3.49	3.44
Protein, %	2.70 ^b	2.73 ^b	2.77 ^a
SNF, %	8.10 ^b	8.20 ^a	8.26 ^a
MUN, mg/dl	17.73 ^{ab}	17.00 ^b	18.37 ^a
Fat yield, g/d	1132	1147	1131
Protein yield, g/d	827 ^b	819 ^b	839 ^a
SNF yield, g/d	2091 ^b	2116 ^a	2132 ^a
Concentrate intake, kg/d	5.22 ^b	5.22 ^b	3.92 ^a

^{a,b} Least square means with different superscripts differ $P < 0.05$

Key Words: Kura clover, Grazing, Milk

1331 Mineral concentrations in four tropical forages as affected by increasing daylength. D. Arizmendi-Maldonado¹, L.R. McDowell^{*1}, T.R. Sinclair², P. Misleve², F.G. Martin³, and N.S. Wilkinson¹, ¹University of Florida, Departments of Animal Sciences, ²Agronomy, ³Statistics.

Pure stands of the following four grasses Florakirk and Tifton-85 bermudagrass (*Cynodon dactylon*), Florona stargrass (*Cynodon nlemfuensis Vanderyst*) and Pensacola bahiagrass (*Paspalum notatum Fluegge*) were established in central Florida. Individual grass plots contained an artificial light, which extended the daylength. There were two daylength treatments, extended (artificial light used to maintain daylength at 15 h) and normal daylength conducted over a two-year period. Samples were taken at distances of 4.0 m #behind# the light and 1.0 m #in front# of the light. Samples were collected and analyzed for mineral concentrations at six sample dates from the late fall to early spring for two consecutive years. There was no difference ($P > 0.05$) between normal and extended daylength for P, Mg, K, Na, Fe, Zn, and Mn. Forage Ca decreased with extended daylength for Florakirk bermudagrass and Pensacola bahiagrass (from 0.40 to 0.36% and from 0.32 to 0.27%, respectively). Florakirk bermudagrass was highest ($P < 0.05$) in P (0.38%), while Florona stargrass was highest ($P < 0.05$) in Ca (0.44%). Pensacola bahiagrass was highest ($P < 0.05$) in Na (0.027%), while Tifton-85 bermudagrass was highest ($P < 0.05$) in Mg (0.21%). Forage Cu increased ($P < 0.05$) with extended daylength for Florona stargrass from 20.3 to 23.1 ppm. Florona stargrass was highest in Zn (90.7 ppm) with normal daylength and had the highest Fe and Cu concentrations (130.0 and 32.1 ppm, respectively) with extended daylength. Pensacola bahiagrass was highest ($P < 0.05$) in Mn (250.8 ppm) with normal daylength. Forage Se increased ($P < 0.05$) with extended daylength from 0.033 to 0.042 ppm. Forage Se had the greatest increase with extended daylength for Tifton-85 bermudagrass from 0.028 to 0.049 ppm. For the 10 minerals analyzed in the four forages, only Se and Na were severely deficient in relation to cattle requirements. In general, extended daylight did not have a practical effect on forage mineral concentrations.

Key Words: minerals, forages, daylength

1332 Steer performance and clover persistence in Georgia-5 tall fescue pastures. J.A. Parish^{*1}, R.H. Watson¹, M.A. McCann², C.S. Hoveland¹, and J.H. Bouton¹, ¹The University of Georgia, Athens, ²Virginia Polytechnic Institute and State University.

White clover is often overseeded into wild-type endophyte-infected (E+) tall fescue in an attempt to dilute the toxic effects of endophyte-derived ergot alkaloids on grazing livestock. However, clover persistence in tall

fescue stands may not be adequate for alleviating tall fescue toxicosis long-term. To address this problem, GA211-59, a white clover with enhanced stolon production and virus resistance, was developed. The objectives of this study were to determine steer growth performance and assess clover persistence in the following pasture treatments: GA211-59 white clover overseeded into GA-5 E+ tall fescue (GA211-59TF), Regal white clover overseeded into GA-5 E+ tall fescue (RWCTF), and a monoculture of GA-5 E+ tall fescue (TF). Replicated (n=2) .809-ha paddocks were established at the Northwest Georgia Branch Station near Calhoun, GA in October 1999. Cattle were stocked on the paddocks using put-and-take grazing management during four periods from Spring 2000 - Autumn 2001 that averaged 100 d during spring and 69.5 d during autumn. Mean stocking rate averaged 4.7 steers/ha. Mean available forage during grazing was approximately 1870 kg DM/ha. Clover available forage was higher ($P < .01$) in the GA211-59TF pastures than in the RWCTF pastures, 687 kg/ha vs 436 kg/ha (SE=19), respectively. Forage stand clover percentage was higher ($P < .01$) in the GA211-59TF pastures than in the RWCTF pastures, 38.8% vs 25.38% (SE=1.0), respectively. Mean serum prolactin was higher ($P < .05$) in steers grazing GA211-59TF pastures than in steers grazing TF pastures. Steer ADG and gain/ha were higher ($P < .01$) on the GA211-59TF and RWCTF pastures than on the TF pastures. These results suggest that overseeding E+ tall fescue with white clover is an effective alternative for combating fescue toxicosis in stocker cattle. In addition, GA211-59 white clover may exhibit better stand persistence than Regal white clover in competition with tall fescue and may subsequently comprise a greater proportion of the available DM in the pasture.

Key Words: tall fescue, white clover, stocker cattle

1333 Nutrient cycling in cool season grasses. T.W. Downing^{*1} and T.T. Leonnig², ¹Oregon State University, ²Oregon Dairy Farmers Association.

Forage grass production is a major component to profitable dairying along the Oregon coast. Grazing with both milk cows and heifers continues to be a common practice. Increased intensity of grazing management and waste management practices have led to a renewed interest in the nutrient uptake potential in grass systems. A two-year study was conducted to identify the nutrient demands and uptake potential of cool season forages. Seventeen varieties were planted in randomized field plots measuring 6 square meters and each replicated three times. These included several different varieties of perennial ryegrass (*Lolium perenne*), hybrid ryegrass (*Lolium perenne* x *multiflorum*) and orchard grass (*Dactylis glomerata*). The plot area was sprayed, tilled and planted in the fall of 1999. During the next two consecutive growing seasons the plots were mechanically harvested, weighed, and samples were taken for analysis. All samples were tested for dry matter, nitrogen and phosphorus content. Harvesting occurred eight times each season and nutrient uptake per cutting calculated. Fresh scraped manure was applied using a honey wagon. The manure was applied at a rate of approximately 561 kg of nitrogen per hectare annually, with a total of five applications each year. The first year dry matter yields ranged from 14719 to 16897 kg/he and averaged 15801 ± 820 . Nitrogen removal ranged from 611 to 759 kg nitrogen per hectare averaging 690 ± 45.8 . Phosphorus removal ranged from 44 to 60 kg/he averaging 53.3 ± 4.8 kg of phosphorus removed. In year two, dry matter yields ranged from 15433 to 21550 kg/he averaging 18194 ± 1665 . Nitrogen removal rates ranged from 578 to 842 kg/he averaging 725 ± 73 . Phosphorus removal ranged from 53 to 78 kg/he averaging 64 ± 6.9 in the second year. The percent of nutrients removed per cutting was determined. Approximately 65 percent of the total nutrients removed occurred in the first half of the season. These data suggest the timing of manure nutrient applications may be real important in determining annual utilization. These data also indicate dry matter yields and nutrient uptake potential of modern forage grasses can be 50 to 100% higher than previously reported having significant implications on nutrient management strategies.

Key Words: Nutrient cycling, Cool season grasses, Nutrient Management

1334 Forage quality management of Kura clover in binary mixtures with selected cool-season grasses. B. W. Kim*¹ and K. A. Albrecht², ¹Kangwon National University, Korea, ²University of Wisconsin-Madison, USA.

Kura clover (*Trifolium ambiguum* M. Bieb.) is a potentially useful perennial legume because of its excellent nutritive value and persistence under environmental extremes. However kura clover has not been evaluated in mixtures with grass species used widely in the North-Central USA. Objectives of this research were to determine forage nutritional value of kura clover-grass mixtures under varying harvest frequency and cutting height regimes. 'Rhizo' kura clover was grown alone and in binary mixtures with #Park# Kentucky bluegrass (*Poa pratensis* L.), #Comet# orchardgrass (*Dactylis glomerata* L.), and #Badger# smooth bromegrass (*Bromus inermis* Leyss.) at the Arlington Agricultural Research Station located near Madison, WI. Three harvest frequencies (3 X, 4 X, or 5 X annually) and two cutting heights (4 or 10 cm) were imposed on each binary mixture and solo kura clover. Averaged over 3 years and all harvest frequency and cutting height treatments, the nutritive value of the Kentucky bluegrass and smooth bromegrass mixtures was superior to that of the orchardgrass mixture (410 g kg⁻¹ NDF and 194 g kg⁻¹ CP in the Kentucky bluegrass mixture; 405 g kg⁻¹ NDF and 188 g kg⁻¹ CP in the smooth bromegrass mixture; 435 g kg⁻¹ NDF and 175 g kg⁻¹ CP in the orchardgrass mixture). Higher nutritive value was observed in the binary mixtures from more frequent harvest frequencies and lower cutting height. All of the mixtures evaluated in this study produced forage with quality equivalent to grade one alfalfa hay and suitable for high producing livestock.

Key Words: KURA CLOVER

1335 Digestion and fermentation of fresh alfalfa as affected by season and level of intake in steers fed indoors. P. Pavan*¹, F.S. Santini^{1,2}, and J.C. Elizalde^{2,3}, ¹Instituto Naciona de Tecnología Agropecuaria (INTA), ²Facultad de Ciencias Agrarias, UNMdP, ³Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET).

We studied the effect of two seasons (S, spring and F, fall) and three levels of intake (AL= ad libitum, 1.8 and 1% of BW) on dry matter intake (DMI) and in vivo OM (OMD) and NDF (NDFD) digestibility of fresh alfalfa fed indoors. Six Holstein steers fitted with ruminal and duodenal cannulas (379 ± 60 kg) were used in a factorial design with a Latin Square arrangement of the treatments. Alfalfa was cut daily and offered in three meals. Chromic oxide (Cr₂O₅) was used as external marker for digesta flow estimation. The S alfalfa had more % DM (23.0 vs 19.6), non starch carbohydrates (6.9 vs 5.8) than F, less CP and soluble CP (21.2 and 8.1, and 29.4 and 10.8% for S and F, respectively) and similar OM, in vitro OMD and NDF (89.2, 63.5, AND 54.5 %DM, respectively). Total DMI (kg) between seasons tend to be higher (P=.06) in S than in F for AL (8.61 and 7.76 kg, respectively), but for 1 and 1.8% total DMI was not affected (P>.05) by season (3.5 and 6.3 kg for 1 and 1.8%, respectively). When expressed as % of BW, AL DMI was higher (P<.05) in S than F (2.5 vs 2.0 for S and F respectively). Ruminal NH₃-N, total VFA concentrations, and pH, were affected (P<.05) by levels of intake (NH₃: 24.1, 28.8 and 27.7 mg/dl, VFA: 88, 100 and 117 mM; pH: 6.6, 6.4 and 6.4 for 1, 1.8 and AL, respectively) and by the season (NH₃: 31.1 vs 22.6 mg/dl; pH: 6.35 vs 6.56; VFA: 111 vs 98 mM for F and S respectively). For pH and total VFA concentration interaction effect was significant (p≤0.05). Neither intake level nor season affected the OMD (63.1%). Although NDFD was not affected by intake level or season (p>.10), NDFD increased (P<.02) as intake increased in F (45.4, 50.6 and 54.2%, respectively) but not in S (48%). It is concluded that higher intakes of high quality fresh forage did not decrease OMD or NDFD. Because there was no season effect on OMD, other factors would depress intake of fresh alfalfa in F respect to S. High VFA and NH₃-N concentration would indicate higher rumen fermentation in S compared to F.

Key Words: Digestibility, Intake, Alfalfa

1336 Prediction of the energy content of Canadian grown forages for growing cattle. B. Gosselin¹, J.F. Bernier¹, G. Allard¹, H. Lapierre², and D. Pellerin*¹, ¹Université Laval, QC, Canada, ²AAC, Lennoxville, Qc, Canada.

Climatic conditions influence the chemical composition and digestibility of forages. Equations developed with Canadian forages could improve the prediction of their energy content. A data set of 46 diets from 11 Canadian experiments published over the last 10 years in growing cattle was used to compare four equations predicting their forage DE content (Mcal/kg DM). Two equations were determined using in vivo forage digestibility trials conducted with sheep and cattle over the last 20 years in Canada: Laval_ADF, DE=3.245+0.035xCP%-0.024xADF%-0.003LEGUME% (R²=0.52;n=202); Laval_ADL, DE=4.139+0.025xCP%-0.02xADF%-0.870xLOG10(ADL%/ADF%x100) (R²=0.57;n=202). The other two models were developed in the 1980's and are currently used in Eastern Canada: McQueen, DE(grasses)=4,681-0.0573xADF% (R²=0.68;n=69); DE(legumes)=4.079-0.0428xADF% (R²=0.83;n=20); Seoane, DE=4.96-0.0585xADF% (R²=0.83;n=20). Average BW, BW gain, DM intake and the forage proportion in diets were used to estimate NE_M and NE_G concentrations of the diet and the forage based on the requirements published in the NRC (1996) beef cattle model. Table values (NRC, 1996) of NE_M and NE_G were used for concentrates and corn silage. NE_M and NE_G in diets as well as BW gain were predicted using the four different equations and the results were plotted against their respective estimated NE_M and NE_G from the NRC model or the observed values for BW gain. Energy predicted from the four equations were lower than estimated values. Determination coefficients (R²) for the regression of forage NE_M and NE_G were low (ranging from 0.14 to 0.24), but increased when whole diets were considered (ranging from 0.29 to 0.55). Higher R² were obtained for BW gain (R² = 0.73, Laval ADF; R² = 0.74, Laval ADL; R² = 0.70; McQueen; R² = 0.63, Seoane). For the present data set, the energy value of Canadian forages was poorly predicted by the four equations. However, prediction of BW gain was adequate. Such a discrepancy could be related to concentrate-rich diets in some experiments.

Key Words: Digestible Energy, Forage, Equations

1337 Effect of sainfoin incorporated into alfalfa pasture on ruminal fluid characteristics and development of bloat in grazing steers. Y. Wang*¹, T.A. McAllister¹, L.R. Barbieri¹, and B.P. Berg², ¹Agriculture and Agri-Food Canada, Lethbridge, AB, ²Alberta Agriculture, Food and Rural Development, Lethbridge, AB.

Ruminal fluid characteristics and development of bloat were assessed in five grazing periods over 2 yr, in a study involving 12 ruminally cannulated Jersey steers and three alfalfa pastures containing 0 (control) to 36% (w/w) sainfoin. The steers (n = 4) were allowed to graze fresh paddocks (without access to water) each day from 0830 to 1430, then were penned without feed (but with water) until 0830 the next day. Grazing behavior and bloat status were recorded hourly while the steers were grazing. Ruminal fluid was collected immediately upon removal of the steers from pasture and analyzed for volatile fatty acids (VFA), ammonia, protozoa, reducing sugars (RS), soluble protein, proteolytic activity, polysaccharide-degrading enzymes (PDE) activity and viscosity. In both years, bloat rates were reduced markedly (by up to 88%, P < 0.05) by sainfoin present at levels as low as 11% (DM basis). However, when sainfoin fell below 5% of pasture DM, its efficacy for bloat prevention dropped substantially, especially when the pasture was in the vegetative stage of growth. Ruminal NH₃ was reduced (P < 0.05) when steers grazed pastures in which sainfoin contributed condensed tannins (CT) at 4.0 to 8.5 g/kg forage DM. This was consistent with observed reductions in intracellular and extracellular proteolytic activity, which likely arose from the effects of the CT on both plant protein and rumen microbes. Sainfoin in the alfalfa pastures increased (P < 0.05) ruminal extracellular PDE activity and tended (P < 0.10) to reduce acetate:propionate ratios, but did not affect protozoal numbers, viscosity, total VFA or RS concentrations. Sainfoin in alfalfa pastures in quantities sufficient to provide 2 to 10 g CT/kg forage DM reduced but did not eliminate pasture bloat; CT at 5 to 10 g/kg DM improved protein metabolism by steers grazing pasture at or beyond full bud maturity.

Key Words: Rumen Metabolism, Condensed Tannins, Bloat

1338 Ca and P endogenous losses and true absorption of alfalfa and fescue diets when fed to dairy cows. M. F. Weiss*, F. A. Martz, R. L. Belyea, and A. T. Belo, *University of Missouri, Columbia MO.*

Eight holstein cows of high milk potential were paired by production and parity, then assigned to a fescue(F) or an alfalfa(A) diet in order to study dietary Ca and P use. Dry cow diets were 50% forage, plus corn silage with 0.91% Ca and 0.42% P for A and 0.50% Ca and 0.27% P for F. Diets fed during lactation were 24% forage, plus corn silage and grain mix resulting in 0.55 and 0.57% Ca, while 0.37 and 0.45% P for A and F respectively. Endogenous fecal loss(EFL) and diet true absorption(TA) were measured using isotope dilution of 45-Ca and 32-P single injection tracers iv. Plasma and fecal specific activity(SA) of both tracers were measured over 7d during the dry(D) period, early(EL) and post-peak(PP) lactation. Data were analyzed as a split-plot in time. The ratio of integrals of the fecal SA curve to the plasma SA curve is theoretically justified as the first step for precursor-product single injection tracer studies (to find fractional EFL). Alternatively simple fecal SA/plasma SA equilibrium ratios with various time delays are often used for convenience. Calculated EFL and TA varied with the method used, and values from different methods changed rank dependent upon stage of lactation and mineral. For Ca EFL, the differences among methods were greatest for EL period effect, with the integral method value 9.4g/d intermediate to the equilibrium ratio methods with 24 and 48h delays, 11.3 and 6.5 g/d respectively(P<.01). Values for TA reflect this same pattern for EL, with the integral solution value 40% being likewise intermediate. The Ca EFL for main effect of D was 6.7g/d(diff. from EL, P<.05) comparing integral values. Main effects for diet were not significant. For P EFL, the differences among methods were also greatest for EL period effect, with the integral method(Pi based) value 22.4g/d, being greater than the equilibrium ratio methods with 24 and 48h delays, 15.5 and 12.9g/d respectively(P<.01). Corresponding TA values were 70, 62, and 59% respectively. The P EFL for main effect of D was 12.2g/d(diff. from EL, P<.05) comparing integral values. Main effects for diet were not significant(P<.05) for P EFL.

Key Words: Dairy, True absorption, Phosphorus

1339 Continuous vs 8-paddock rotational stocking of rye-ryegrass pastures at three stocking rates. F.M. Rouquette, *Texas Agricultural Experiment Station.*

During two successive years, Simmental crossbreed steers and heifers, and Angus X Brahm (F-1) steers (total n=272) grazed Maton rye and TAM-90 annual ryegrass pastures under grazing methods of either continuous (CNT) or rotational (RTN) stocking, and each at three (LO, ME, HI) stocking rates (SR). All pastures were stocked without interruption each year from early-December to mid-May for 159 d in Year 1 and 156 d in Year 2. A fixed SR for both CNT and RTN were the same within a year for LO, ME, and HI, respectively, and for Year 1 was 4.2, 5.7, and 7.2 hd/ha, and for Year 2 was 3.7, 5.2, and 6.7 hd/ha. At initiation of grazing in December, stocker cattle averaged 275 kg and were weighed at 28-d intervals. Pastures were sampled for nutritive value and DM at about 14-d intervals from both CNT and the 8-paddock RTN pastures. Residence time in each paddock of RTN stocked pastures averaged 2 days with about a 14-day rest period. The overall statistical analyses showed differences for ADG between years (P=.0001), grazing

method (P=.03), stocking rates (P=.0001), and sex (P.0001), but no difference for breeds (P=.25). In Year 1, ADG was similar for grazing methods, CNT vs RTN; different for all three SR with 1.25 kg/d (LO), 1.06 kg/d (ME), and 0.69 kg/d (HI); and different for steers (1.06 kg/da) vs heifers (0.86 kg/da). In Year 2, ADG was highly significant for grazing method, stocking rate, breed, and sex. A significant interaction showed ADG from RTN to be greater than from CNT and was attributable principally to HI (P=.0008) SR (0.39 vs 0.20 kg/d) rather than to ME (P=.09) (0.74 vs 0.65 kg/d) or LO (P=.55) (1.06 vs 1.02 kg/d). The rest period in RTN paddocks enhanced forage DM production in all SR; however, only at HI SR was ADG increased. When forage DM limits intake and SR can not be reduced, then a RTN grazing method will likely increase gains per animal and per ha via increased forage production. Selection of CNT vs RTN for cool-season annual grass pastures was not as important as selection of SR for expected animal performance. "

Key Words: Grazing, Stocking Rate, Ryegrass

1340 Use of dosed and endogenous herbage alkanes as markers for estimating intake of alfalfa and alfalfa:sainfoin pastures by grazing steers. Y. Wang*¹, T.A. McAllister¹, L.R. Barbieri¹, B.P. Berg², and D.M. Veira³, ¹*Agriculture and Agri-Food Canada, Lethbridge, AB,* ²*Alberta Agriculture, Food and Rural Development, Lethbridge, AB,* ³*Agriculture and Agri-Food Canada, Kamloops, BC.*

Externally dosed (C₃₂) and naturally occurring (C₃₁) alkanes were used to estimate intake of three alfalfa:sainfoin pastures (0 to 36% sainfoin) by 12 ruminally cannulated steers (n = 4) to determine the effects of sainfoin in the pasture on intake. The study comprised three 12-d periods during which the steers grazed continuously for 6 h/d (0830 to 1430 h). Samples of pasture herbage and pure swards of component species were collected every 48 h for alkane analysis by gas chromatography. The majority (95%) of the alkanes in herbage were odd-numbered from C₂₅ to C₃₃, predominantly C₂₉ and C₃₁, and these findings were consistent between pastures and between grazing periods. Alkane composition profiles of pure alfalfa and sainfoin were also similar. Each day, the steers were dosed intraruminally with 10 g of ground, extracted alfalfa hay coated with 1 g exogenous alkane (dotriacontane, C₃₂H₆₆) immediately prior to entering the pastures. Fecal samples were collected by rectal grab on d 8 to d 12, immediately prior to and following grazing. Intake was estimated as excretion of marker/indigestibility of forage. Average intake of organic matter (OMI) by steers, as estimated by the combination of C₃₁ and C₃₂ methods, was 4 to 5 kg per 6-h grazing bout. Within periods, OMI did not differ (P > 0.05) among pastures; further, OMI estimates were numerically similar in each of the three periods. In all pastures and all periods, estimates of OMI derived from afternoon fecal samples were numerically higher than those derived from samples collected in the morning; this was closely associated with the lower fecal concentration of external marker alkane (C₃₂) in the afternoon as compared to morning samples. It is concluded that sainfoin incorporated into alfalfa pastures at up to 36% (DM basis) did not affect feed intake of grazing beef cattle.

Key Words: n-Alkanes, Grazing, Feed Intake

1341 Withdrawn. . .

Growth and Development Dairy Calf and Heifer Growth

1342 Development of a repeatable procedure for rumen tissue sampling. K. E. Lesmeister*, A. J. Heinrichs, and P. R. Tozer, *The Pennsylvania State University, University Park, Pennsylvania.*

To aid the understanding of rumen development and papillae growth in young calves and to increase repeatability in rumen tissue sampling techniques, a procedure for rumen sampling and measuring was developed. An extensive statistical analysis of the procedure's results was conducted to determine its efficacy. With the reticulo-rumen lying upon its left side, the esophageal groove facing away, an incision was made around the circumference of the organ in line with the esophageal groove. A 6 cm section of the caudal portion of the caudal ventral blind sac was

maintained intact. The rumen pillars were incised in line with the initial incision, and the muscles forming the rumen pillars separated. The reticulo-rumen was then opened and laid flat, creating a right and left side separated by the portion of the rumen maintained intact. The rumen pillars separate the rumen into distinct sampling areas: the caudal portion of the caudal ventral blind sac (CaV), the caudal dorsal blind sac (CaD), the cranial dorsal sac (CrD), the cranial ventral sac (CrV), and the ventral portion of the CaV. Right and left sides of the rumen were sampled. A 1-cm² section was removed from the four corners and center of each area and measured for papillae length (n=20) and width (n=20), rumen wall thickness (n=5), and number of papillae per cm² (n=5). Rumen utilized in the development of this procedure were obtained from 12 calves that were assigned to 1 of 3 treatments. Means