369 Determination of organic acids in the water soluble fraction of Cheddar cheese. Therese Considine*[1] and Nana Farkye[1], [1]*Dairy Products Technology Center, Calpoly State University, San Luis Obispo, CA 93407.*

The objective of this study was to compare the current method of analyzing organic acids in cheese with a modified method using the water soluble fraction (WSF) of cheese. Organic acids play an integral role in cheese quality as they are believed to contribute to the flavor. Depending on their concentrations, organic acids together with sulfur compounds, lactones, methyl ketones, alcohols and phenolic substances can have a negative or positive contribution to cheese flavor. Organic acids appear because of the hydrolysis of fatty acids, bacterial growth, normal bovine metabolic processes or direct addition of acidulants. Quantitative determination of organic acids in dairy products is important to monitor starter culture activity, bacterial growth and to trace quality changes during ripening. Current methods of analyzing organic acids in cheese require lengthy extraction, whereby five grams of cheese is stirred for one hour in 25 ml dilute (0.009N) H_2SO_4, followed by centrifugation, filtration and Aminex HPX-87H® column with detection between 210-214 nm. In many cases of cheese research, especially when monitoring proteolysis, the WSF is already prepared for further research (e.g., for determination of free amino acids, water soluble nitrogen levels). Thus, by adjusting the WSF (50g cheese/100 ml water) with H_2SO_4 to give a final concentration of 0.009 N H_2SO_4, it is possible to monitor organic acids in the WSF. Six cheeses analyzed by both the current and modified WSF yielded almost identical HPLC profiles. The organic acids detected were: orotic, oxalic, pyruvic, propionic, lactic and uric acid. The simplicity of the method allows rapid monitoring of organic acids during ripening of cheese.

Key Words: Water soluble nitrogen, Cheese, Organic acids

Forages and Pastures
Silages and Forage Composition

370 Effect of alfalfa hay and silage on the peformance of dairy cows in early lactation. A. A. Naserian*[1], [1]*Ferdowsi university of Mashhad.*

alfalfa hay is popular crop in dairy cattle feeding but it is not suitable for silage because of, low in solouble carbohydrates and high buffering capacites. Hay, untreated, and treated with 0.5%urea alfalfa silage were studied with nine multiparous Holstein cows. Weighting mean was 594± 42Kg in this trail. The average milk production of the cows was 29.9 ±1.7 Kg/d prior to the experiment. Cows were randomly assigned to 3*3 latin square designed experiment. Diets were A)30% alfalfa hay +12%corn silage +5% cottonseed +53% concentrate B)30%untreated alfalfa silage with similar ingeridents in diet A C)30% treated alfalfa with 0.5% urea with similar ingerdents in diet A. The diets were balanced to supply requirments according to(NRC 1989)and were offered ad libitum in two equal portions. Each experimental period was 21 days. the cows were adapted to their diets for 14 days which was followed by a 7 days collection period for determination of digestibility and milk production. milk and blood samples were taken in the last two days of every collection period. The results indicated that intakes of dry matter were similar in different diets. No significant differences were detected for DM, OM, CP, NAF and ADF digestibilities. Milk production was slighty higher in treatment 3(31.28) versus 1(30.92).Blood metabolites were not affected by treatments expect blood urea nitrogen which was higher in treatment 3 (15.58) versus 1(12.07). Therefore it seems that alfalfa silage can be used up to 30% of rations DM without any advere effects on the milk production and compositions

Key Words: Dairy cattle, Alfalfa silage, Milk production

371 Edible covering reduces spoilage in bunker silos. L.L. Berger*, N.A. Pyatt, and J.R. Sewell, *University of Illinois-Urbana.*

The goal of this research was to develop an edible covering for bunker silos that would simultaneously reduce spoilage and serve as a nutrient source when fed. The criteria used in developing the covering was that it must provide effective protection, be edible, provide essential nutrients, be palatable, cost effective, and easy to apply. Whole plant corn (40.0% DM) was chopped and packed to equal densities (215 kg DM/m3) into six side-by-side 3.66-m long x 1.83-m wide x 1.83-m deep bunker silos. Equal volumes (1570.5 kg DM) of pre-ensiled whole-plant corn were weighed into each bunker, leveled and packed with a small tractor and lawn roller. The three treatments were, uncovered, covered with polyethylene plastic, or covered with a starch-salt matrix. The starch-salt matrix was applied to achieve a surface thickness of 1.5 cm. After curing 3 days, paraffin wax was melted and a thin layer applied to the starch-salt matrix with a paint roller. The forage was ensiled for 92-days. Spoiled silage was separated prior to feeding. A wooden frame 148.6 x 30.5-cm was utilized to measure the spoilage under a fixed area. This measurement was made at 3 locations on each silo. Surface spoilage under the frame was 14.3, 16.4 and 1.2 kg DM ($P < 0.05$) for the uncovered, plastic and starch-salt coverings, respectively. Forty-eight Angus heifers were allotted by weight to 12 pens. Two pens of heifers were randomly assigned to each silo. Silage DM fed was 704, 887, and 1220 kg ($P < 0.05$) for the uncovered, plastic and starch-salt covered silos, respectively. Animal days per bunker were 140, 152, and 212 ($P < 0.05$) for the three treatments, respectively. For the last 6-days, heifers fed silage protected with the starch-salt covering were fed 0.91 kg (as-fed) of the covering daily. Heifers consumed 91% of the covering. The ash content of the pre-ensiled forage and spoilage from uncovered, plastic, and starch-salt treatments averaged, 5.8, 11.4, 8.7, and 18.3%, ($P < 0.05$) respectively. These data suggests that a portion of the salt leached into the silage immediately under the covering.

Key Words: Bunker Silo, Edible Covering, Spoilage

372 Effects of substituting sunflower silage for corn silage in diets for lactating cows. L. A. Leite[1], B. O. Silva[1], R. B. Reis*[1], L. M. Fonseca[1], and D. K. Combs[2], [1]*Escola de Veterinária UFMG, Brasil,* [2]*University of Wisconsin, Madison.*

Objectives of this study were to compare dry matter intake, apparent dry matter digestibility, milk yield and milk composition of Holstein cows fed diets in which sunflower silage (SS) replaced corn silage (CS) as the forage component. Five ruminally- cannulated cows, 60 to 82 DIM, were arranged in a 5X5 Latin Square design. Periods were 21 days and treatments were dietary forage from: 100% corn silage (100CS); 34% sunflower silage plus 66% corn silage (34SS); 66% sunflower silage plus 34% corn silage (66SS); 100% sunflower silage (100SS); or 100% corn silage plus whole cotton seed (CS-WCS). The diets were formulated according NRC 2001, to be iso-nitrogenous and iso-energetic. Dry matter intake, milk yield and milk protein yield were lower for 100SS compared to 100CS ($P<0.05$). However, partial replacement of CS with SS did not affect milk and protein yield. Cows on diets with 34 or 66% of the forage as SS produced more milk per unit of dry matter intake compared to those on CS-WCS diet. Partial replacement of corn silage with sunflower silage could be a viable option for lactating cows in this range of milk production.

	100CS	34CS	66CS	100SS	CS-WCS	SEM	P value
DMI, kg/d	21.3^{a}	19.7^{ab}	19.1^{ab}	17.6^{b}	20.3^{a}	1.39	0.02
DM Dig, %	69.2	64.6	63.9	57.8	68.1	6.34	0.10
Milk Yield, kg/d	27.4^{a}	27.5^{a}	27.3^{a}	24.0^{b}	25.5^{ab}	1.57	0.02
FCM, kg/d	26.2	25.0	25.2	22.6	25.5	1.93	0.10
Fat, %	3.7^{ab}	3.4^{a}	3.5^{ab}	3.6^{ab}	4.0^{a}	0.26	0.03
Protein, %	3.1^{a}	2.8^{ab}	2.7^{b}	2.9^{ab}	3.0^{a}	0.14	0.02
Fat Yield, kg/d	1.02	0.94	0.96	0.87	1.02	0.10	0.14
Protein Yield, kg/d	0.84^{a}	0.78^{ab}	0.74^{ab}	0.70^{b}	0.77^{ab}	0.06	0.04
MUN, %	0.229	0.233	0.240	0.237	0.226	0.02	0.87
Milk Yield, kg/kg DMI	1.29^{bc}	1.40^{ab}	1.46^{a}	1.39^{ab}	1.26^{b}	0.09	0.04

^{a,b,c} Means within the same row with different superscript differ according to the P value in the table.

Key Words: corn silage, sunflower silage, dairy

373 Effect of variety on chemical composition and ruminal nutrient degradability of pea silage. A. F. Mustafa*[1], P. Seguin[1], I. Adeleye[1], and D. Ouellet[2], [1]*McGill University, Ste-Anne-De-Bellevue, QC, Canada*, [2]*Agriculture and Agri-Food Canada, Lennoxville , QC, Canada*.

A study was conducted to determine the effects of pea (Pisum sativum L.) variety on chemical composition and ruminal nutrient degradabilities of pea silage. The varieties were Lenca (L), Carneval (C), and Delta (D). The pea varieties were sown in field plots in May 2001 and were harvested in July 2001. Harvested forage was then ensiled in mini- silos for 70 d. Chemical analysis showed that variety L contained higher ($P < 0.05$) NDF (42.7 vs 32.5% DM) and ADF (31.8 vs 25.3% DM) and lower ($P < 0.05$)starch (6.8 vs 9.8% DM) levels than C and D. Crude protein was highest ($P < 0.05$) for C (20.5% DM), intermediate ($P < 0.05$) for D (19.0% DM) and lowest ($P < 0.05$) for L (17.9% DM). Distribution of protein fractions showed that L contains lower ($P < 0.05$) soluble protein and higher ($P < 0.05$)neutral detergent insoluble protein levels than the other two pea varieties. However, no difference ($P > 0.05$)in acid detergent insoluble protein level was observed between the three silage treatments. Estimated net energy of lactation was highest ($P < 0.05$)for C (1.64 Mcal/kg), intermediate ($P < 0.05$)for D (1.55 Mcal/kg) and lowest ($P < 0.05$)for L (1.46 Mcal/kg) . Results of the in situ experiment indicated that L had lower ($P < 0.05$)ruminal DM (69.2 vs 74%) and CP (84.1 vs 90.6%) degradabilities than C or D. However, ruminal degradability of NDF was similar among the three varieties (average 32.9%). It was concluded that chemical composition and ruminal nutrient degradabilities of pea silage are significantly influenced by variety.

Key Words: Pea silage, Chemical composition, Ruminal nutrient degradability

374 Effect of corn silage maturity and crop processing on performance of dairy cows. G. Ferreira*[1], D.R. Mertens[2], P. Berzaghi[2,3], and R.D. Shaver[1], [1]*University of Wisconsin, Madison, WI*, [2]*ARS-US Dairy Forage Research Center, Madison, WI*, [3]*University of Padova, Italy*.

The objective of this experiment was to evaluate the effects of maturity and processing of corn silage on the performance of cows differing in production level. Forty-eight lactating dairy cows were blocked by stage of lactation (mid or late) and parity (1, 2 or $\geq$3) and assigned to replicated 4 × 4 Latin squares (28-d periods) with a 2 × 2 factorial arrangement of treatments: early or late maturity (E or L) and processed or unprocessed (P or U). Crop DM contents at harvest time were 30.7% for E and 41.5% for L. Diets were composed by 70% of corn silage and 30% of concentrate and averaged 17% CP and 28% aNDF (DM basis). Daily DMI was higher for L compared to E (22.5 vs. 21.0 kg/d) and for P compared to U (22.2 vs. 21.2 kg/d). Fiber intake was higher for P than for U (6.34 vs. 5.51 kg/d), but no difference was observed between E and L (5.95 vs. 5.90). Interactions between maturity and processing were observed for both DM and aNDF intake. No differences were observed on DM and aNDF intake between cows of mid and late stages of lactation. A higher milk yield was found for P compared to U (24.4 vs. 23.3 kg/d), but no difference was obtained between E and L (24.0 vs. 23.8 kg/d). Milk fat content was higher for E than for L (3.93 vs. 3.70%), but did not differ between U and P (3.88 vs. 3.76%). No differences were obtained among treatments for milk protein content. Cows in late lactation had higher milk fat (4.13 vs. 3.51%) and milk protein (3.81 vs. 3.10%) contents compared to cows in mid lactation. Body weight gain was higher for P than for U (0.69 vs. 0.45 kg/d), but no difference was found E and L (0.57 vs. 0.57 kg/d). Cows in late lactation gained more weight than cows in mid lactation (0.74 vs. 0.40 kg/d). In this experiment, processing resulted in greater DM and aNDF intakes, MY and BWG. The interactions for DM and aNDF intakes suggest that processing had a greater effect on intake when corn silage was in an early stage of maturity.

Key Words: Corn Silage, Maturity, Processing

375 Variability in relationships among forage intake, digestibility, NDF and ADF. S. W. Coleman*[1] and J. E. Moore[2], [1]*USDA, ARS Subtropical Agricultural Research Station, Brooksville, FL*, [2]*University of Florida, Gainesville, FL*.

Confusion exists about forage quality and in methods to measure or predict forage quality. The conventional wisdom is that there are close relationships between voluntary forage dry matter intake (DMI) and digestible dry matter (DDM) concentration, DMI and NDF, and DDM and ADF. Correlation coefficients were obtained from several publications on grasses and legumes, and from a test database of 75 grass hays fed to cattle for voluntary intake measurement and to cattle or sheep for digestibility. Published correlations (r) between DMI and DDM range from -0.32 to 0.86. In the test database, the correlation between DMI and DDM was 0.75. The conventional wisdom is that intake of NDF is a constant 1.2% of BW, a concept based on work with mixed diets balanced for high producing dairy cows. Several publications, however, have not confirmed this concept, particularly for forages fed alone. In the test database, NDF intake ranged from 0.4 to 2.4% of BW. When DMI was estimated from the equation: DMI (% BW) = 120/NDF, DMI was underestimated in most cases except for protein-deficient native grasses where DMI was overestimated. Many forage testing programs use simple regression equations to predict DMI from NDF and DDM from ADF. In the early research that serves as the basis for some of these programs, Van Soest (J. Anim. Sci. 24: 834,1965) reported r = -0.65 between DMI and NDF, and r = -0.74 between DDM and ADF (n=83, grasses and legumes), similar to that found in the test database (-0.55 and -0.71, respectively). Published r values have ranged from 0.03 to -0.90 between DMI and NDF, and from -0.39 to -0.93 between DDM and ADF. We conclude 1) that voluntary intake and digestibility are related but often independent components of forage quality; 2) that when grasses and legumes are fed alone for measurement of forage quality, NDF intake will not be constant across all forages; and 3) that conventional wisdom about the relationships between DMI and NDF, and DDM and ADF cannot be justified. Routine forage testing programs using only NDF and ADF may often provide unacceptable estimates of DMI and DDM, for both grasses and legumes.

Key Words: Forage intake, Digestibility, Prediction

376 Divergent phenotypic selection for concentrations and ratios of fiber components in timothy. A. Claessens*[1], D. Mather[2], G. Belanger[1], G. F. Tremblay[1], and R. Michaud[1], [1]*Agriculture and Agri-Food Canada, Ste-Foy, QC, Canada*, [2]*McGill University, Macdonald Campus, Sainte-Anne-de-Bellevue, QC, Canada*.

Animal performance has been shown to improve when using forages bred for increased digestibility, which can be achieved by selecting for reduced fiber concentration. Our objective was to evaluate the effects of divergent phenotypic selection for concentrations and ratios of fiber components on the improvement of *in vitro* true digestibility (IVTD) of timothy (*Phleum pratense* L.). Divergent phenotypic selection was conducted in a population of 495 high yielding timothy plants for neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), hemicellulose (HEM), cellulose (CEL), ADL/HEM, ADL/CEL, ADL/HEM+CEL, and HEM/CEL. For each selection criterion, the eight highest and eight lowest plants were selected and intercrossed separately. The populations derived from selection were evaluated on the spring growth of a two-year field experiment. Direct divergent selection responses were significant ($P < 0.01$) in both years for NDF, CEL, ADL/HEM, ADL/CEL, ADL/HEM+CEL, and HEM/CEL. The ADL/CEL selection criterion produced the most divergent populations for IVTD. In 1999 and 2000, the low ADL/CEL population showed a decrease of 4.6 and 5.0 g kg^{-1} in lignin and an increase of 22 and 32 g kg^{-1} in IVTD compared to the high ADL/CEL population. In both years, the low and high ADL/CEL populations had similar hemicellulose and cellulose concentrations, as well as similar DM yield. Selection for low ADL/CEL on high yielding genotypes seems to be a promising approach to increase timothy digestibility without adversely affecting DM yield.

Key Words: in vitro true digestibility, fibers, timothy

377 Seasonal fluctuations in kikuyu grass (Pennisetum clandestinum) yield and nutrient composition, and impact on growth rate of nursing calves. J.R. Carpenter*[1], B.W. Mathews[2], R.Y. Niino-DuPonte[1], and M. Kaheki, [1]*CTAHR, Univ. of Hawaii at Manoa*, [2]*CAFNRM, Univ. of Hawaii at Hilo*.

Forage-livestock systems on improved tropical grass pastures are an integral part of agriculture and the economy in the tropics. Key limitations include the available pastures' ability to support growth, reproduction, and lactation due to their high moisture and fiber, and low protein and

energy content. The objectives of this study were to retrospectively determine the seasonal fluctuations in improved kikuyu grass (Pennisetum clandestinum) pasture yield and nutrient composition, and impact on growth rate of nursing calves. Data from fourteen grazing cycles over a 7-year period, seven in the spring and seven in the fall, was combined into a single data base. For each grazing cycle groups of cow/calf pairs from mixed breed beef cattle (assigned to groups by age and body weight) were grazed on three 1.2-ha paddocks per group, each having a 4 to 6-wk rest and 2 to 3-wk grazing cycle. Pasture swards were clipped during each cycle to determine yield, nutrient (NIRs) and mineral (ICPE) composition. Stocking rates (hd/ha) were highest (P<.01) for Spring/Summer grazing cycles. Total live weight gain (kg/ha) and average daily gain (kg/d) for calves were lower (P<.05) during the fall (287.7 and .69, respectively) than the spring (517.8 and .91, respectively). Forage DM production during the fall was only 65% that of the spring. Data shows that the production potential of both forage and animals is significantly impacted by the climate during the growing period. The mean % ash, CP, NDF, ADF and IVDMD for the 289 samples (DM basis) was 8.1, 17.4, 52.2, 34.4, and 76.6, respectively. Climate, forage yield, pasture nutrient composition, grazing options and fluctuations in calf prices must all be considered in comparing the economics of a fall versus spring calving cycle in the tropics.

Key Words: Grazing cow/calves, Tropical kikuyu grass, Yield and nutrient composition

378 Fatty acid and nutrient composition of annual rye and ryegrass forage. S. J. Freeman*, J. A. Bertrand, T. C. Jenkins, and B. W. Pinkerton, *Clemson University, Clemson, SC / USA*.

The objective of this study was to document the changes in fatty acid and nutrient content of two forages over time. Weekly samples of rye (*Secale cereale*) and ryegrass (*Lolium multiflorum*) pastures were collected during their growth phase. One aliquot was analyzed for DM. The remaining sample was immersed in liquid nitrogen at the time of cutting to cease cellular metabolism. These samples were then freeze-dried and ground through a 2-mm screen. Samples were analyzed for CP, NDF, ADF, lignin, fat, ash, sugar, starch and fatty acids. The percent CP, NDF, fat and ash significantly changed across time ($P < 0.05$) for rye. The percent CP, NDF and ADF significantly changed across time ($P < 0.05$) for ryegrass. The average DM, CP, NDF, ADF, lignin, fat, ash, sugar, starch and total fatty acids percents for rye and ryegrass were 33.87, 29.45, 26.56, 17.05, 29.84, 44.60, 15.23, 24.19, 0.29, 0.27, 10.86, 7.69, 4.81, 2.68, 19.40, 14.21, 5.37, 7.14, 5.67 and 3.75, respectively. For both forages, C18:3 was the fatty acid of highest quantity for all sampling times and averaged 50.86% and 43.86% of all fatty acids present for rye and ryegrass, respectively. Other fatty acids of high quantity were C18:2 and C16:0 which were 8.89% and 11.98% for rye and 8.53% and 11.27% for ryegrass. For rye, the total fatty acid content peaked at 6.79% at week 2 of sampling and was lowest at 4.65% at week 17 of sampling. For ryegrass, the total fatty acid content peaked at 4.87% at week 5 of sampling and was lowest at 1.75% at week 9 of sampling. The content of C16:0, C16:1, C18:3 and C24:0 fatty acids and total fatty acids significantly changed ($P < 0.05$) over time for rye. The content of C16:0, C16:1, C18:0, C18:1, C18:2, C18:3, C20:0, C22:0 and C24:0 fatty acids and total fatty acids significantly changed over time ($P < 0.05$) for ryegrass. In conclusion, the fatty acid content of rye and ryegrass ranged from 4.65% to 6.79%, and from 1.75% to 4.87% of total DM, respectively.

Key Words: Pasture, Fatty Acids

379 How relevant are meals in the short-term regulation of diet choice? M.P. Yeates*, B.J. Tolkamp, and I. Kyriazakis, *Scottish Agricultural College, Edinburgh, UK*.

When cows are offered a choice of foods, which are nutritionally complementary, they are able to select a consistent combination of these foods over long periods of time. Analysis of how such consistent diet choice is achieved, in terms of short-term feeding behavior, may further our knowledge of how cows regulate nutrient intake. Previous work, on meal pattern analysis and on nutrient synchronisation, led us to hypothesise that animals may select a consistent diet within a meal. In three experiments cows were offered a choice between high (H) and low (L) protein foods and short-term feeding behavior data were collected using computerised feeders. Feeding behavior was first analysed in terms of visit characteristics. The greater intake of H, relative to L in the experiments, was more closely related to the ratio of H visits to L visits, than to differences in the intake per visit to H and L. Individual meal criteria were estimated and visits were clustered into meals. Cows typically had six meals per day. The observed frequency distribution of meal composition, in terms of the proportion of visits to H feeders, was determined. Subsequently, the observed visits were randomly re-clustered into bouts, consisting of the same number of visits as were observed in meals, and the frequency distribution of random bout composition was calculated. Comparison of the frequency distributions of meals and random bouts provided no evidence that cows attempted to achieve their long-term average diet composition within a meal. We also investigated if cows attempted to regulate diet choice within a meal by adjusting their intake per visit depending on the food type visited, such that they achieved a consistent diet choice within a meal. There was no evidence that this occurred. In conclusion, our analyses have shown that cows did not attempt to select a consistent diet within a meal. Indeed, the data suggest that the timeframe of diet choice regulation must be considerably greater than a meal. Therefore, within a meal, a diet that was synchronous for energy and protein was not selected.

Key Words: Diet choice, Cow, Feeding behavior

380 Effect of barley or soybean supplementation on growth, and carcass and meat characteristics of steers finished on pasture. J.L. Duynisveld*[1], E. Charmley[1], P. Mir[2], and Z. Mir[2], [1]*AAFC Crops and Livestock Research Centre, Canada,* [2]*AAFC Lethbridge Research Centre, Canada*.

The effect of supplementing pasture-finished cattle on their performance, carcass characteristics, meat quality, and fatty acid composition of beef was studied. Thirty-two British cross steers (initial BW 360 kg) were assigned by weight to one of 4 treatments; TMR (finished indoors on a totally mixed ration comprising 60 % silage and 40 % barley (DM basis); P (grazed on permanent grass/legume pasture); PB (grazed on pasture supplemented with 5 kg barley hd^{-1} d^{-1}; PS (grazed on pasture supplemented with 2 kg hd^{-1} d^{-1} whole roasted soybeans. Cattle were slaughtered in September after 105 d on test at between 500 and 600 kg BW. At slaughter, carcass data and tissue samples were collected for analysis of carcass and meat characteristics and fatty acid composition. Gains of BW were higher (P<0.01) for TMR-fed cattle (1.43 kg d^{-1}) than for cattle on other treatments which averaged 1.02 kg d^{-1}. Steers grazing pasture alone had the lowest backfat (P<0.05), highest drip (P<0.05) and volatile losses cooking losses (P<0.05). The beef from P was more tender (P<0.05) than from other treatments when measured using both Instron Kramer techniques and trained sensory panel analysis. When expressed as % total fatty acids, beef from all pasture-based treatments had 66% higher levels of CLA (c9 t11) (P<0.001) than TMR-fed cattle, however there was no difference among the three pasture-based treatments. The t10 c12 CLA concentration was higher for P and PS than for other treatments (P <0.0001). CLA levels in wet meat were higher in PS than in the TMR treatment. Levels of polyunsaturated fatty acids (PUFA) were highest in P and PS (P<0.05) and lowest in TMR. The proportion of CLA in PUFA (9%) did not change among treatments. Pasture increased PUFA and CLA in beef compared to a TMR-based diet. However feeding soybeans, a source of linoleic acid, did not further increase CLA levels.

Key Words: Pasture, Beef, CLA

381 An evaluation of the use of alkanes for estimating intake and digestibility of forages from fecal grab samples. E. Charmley*[1], H.V. Petit[2], D.R. Ouellet[2], D.M. Veira[3], and R. Michaud[4], [1]*AAFC, Crops and Livestock Research centre,* [2]*AAFC, Dairy and Swine Research and Development Centre,* [3]*AAFC, Kamloops Range Research Unit,* [4]*AAFC, Soils and Crops Research and Development Centre*.

Ratios of endogenous (odd chain length) and exogenous (even chain length) n-alkanes can be used to determine intake and digestibility of pasture by cattle. However, the accuracy and precision of this method has to be validated. In a trial with 12 growing beef steers, grass/legume silage was either fed ad libitum or at 70% of ad libitum(Restricted) for 29 d. After 7 d on feed, a controlled release capsule (CRC) (Captec, New Zealand), containing C_{32} and C_{36}, was inserted into the rumen of each steer. Fecal grab samples were taken daily thereafter and total collection of feces was conducted from 12 to 18 d after CRC insertion. Observed

and predicted dry matter (DM) digestibility was not influenced by level of feeding, with observed digestibility averaging 66.9 % (SEM=1.84). Predicted digestibility values, estimated without correction for alkane recovery were 86, 96, 93 and 100 % of observed, using C_{27}, C_{29}, C_{31}, and C_{33} alkanes, respectively, with C_{27} and C_{31} being different ($P<0.05$) to the observed value. When adjustments were made for alkane recovery, corresponding values were 118, 104, 108, and 100 %, with only the C_{27} value being different ($P<0.05$) from the observed value. Predicted DM intake using the C_{31}:C_{32} ratio was underestimated at the restricted ($P<0.05$) and ad libitum ($P<0.10$) levels of feeding, when calculated using the manufacturers release rate (190 mg d^{-1}). However, when actual release rates of 239 (restricted) and 211 (ad libitum) mg d^{-1} were used, estimates agreed with observed values. Although the accuracy of prediction for DM intake was high, the precision was low, with significant ($P<0.05$) discrepancies for both treatments and all methods of measurement. Discrepancies of up to 2.9 kg d^{-1}, when average DM intake was only 7 kg d^{-1} was a concern. Endogenous alkanes can be used to accurately predict digestibility. However daily fecal grab samples did not give precise measurements of intake, based on the ratio of endogenous to exogenous alkane markers.

Key Words: Alkane, Marker, Forage

Nonruminant Nutrition
Ractopamine and Somatotropin on Nutrient Metabolism and Pork Quality

382 Effect of ractopamine on optimum dietary phosphorus regimen for growth in pigs.

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Ten replications of individually-penned gilts from a high-lean strain were utilized to determine the effect of ractopamine (RAC) on the optimum dietary available phosphorus (AP) regimen. At 70 kg BW, pigs were randomly allotted to a corn-soybean meal basal diet (.08% AP) adequate in all nutrients except AP. The basal diet was supplemented with mono-dicalcium phosphate to create six AP concentrations (.08, .13, .18, .23, .28, .33%) and ractopamine HCL to create two RAC concentrations (0 vs. 20 ppm). A constant Ca/AP ratio of 2.5:1 was maintained in each diet. BW gain and feed intake were recorded weekly until each pig individually reached 114 kg BW. Pigs were then slaughtered keeping the ham and loin for subsequent dissection and bone removal. Dietary AP additions resulted in improved ($P<.01$) daily BW gain, but did not alter carcass or ham-loin muscle content. Dietary AP additions also linearly improved ($P<.01$) bone integrity as observed by ham-loin bone content and femur weight and mineral content. RAC improved ($P<.01$) BW gain (+125 g), gain/feed ratio (+64 g/kg), and carcass and ham-loin muscle (+3.4%, +5.6%) content. RAC reduced ($P<.01$) the ham-loin bone content and femur weight and mineral content, but the amount of additional bone or bone mineral accrued per unit of added dietary AP was linear and independent of RAC. Based on breakpoint analysis, BW gain and femur mineral content in non-RAC pigs were optimized at dietary AP concentrations of .20% and .31%, respectively. Because of their greater muscle accretion capacity, thus P demand, pigs fed RAC from 70 to 114 kg BW needed an additional .02 to .03% AP to maintain the same ham-loin bone and femur mineral contents as the non-RAC pig.

Key Words: Ractopamine, Phosphorus, Pig

383 Effects of vitamin and mineral concentrations and ractopamine hydrochloride in diets for growing-finishing pigs.

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A total of 160 pigs (two pigs/pen and 10 pens/treatment) were used to determine the effects of added vitamins and minerals (VM) and ractopamine hydrochloride (RAC) on growth and carcass characteristics. Treatments for 32 to 96 kg were corn-soy diets formulated to 70 and 130% of NRC recommendations for vitamins (A, D, E, K, niacin, pantothenic acid, riboflavin, thiamin, B_6, and B_{12}) and minerals (I, Fe, Se, and Zn). For 96 kg to 123 kg, treatments of with or without VM additions and without or with RAC (20 mg/kg) were imposed. No differences in ADG or gain/feed were observed from 32 to 96 kg among pigs fed diets with the 70 and 130% treatments ($P > 0.2$). For 96 to 123 kg, there were no differences in ADG or gain/feed among pigs fed the diets with or without VM ($P > 0.7$), but RAC increased ADG and gain/feed ($P < 0.001$). These effects were consistent regardless of prior vitamin and mineral fortification, i.e., no interactions ($P > 0.15$) with the 70 and 130% treatments from 32 to 96 kg BW. Carcass measurements were not affected by the 70 vs 130% or the with vs without VM treatments ($P > 0.06$). Pigs fed RAC had heavier ($P < 0.01$) carcasses, less ($P < 0.05$) last-rib backfat thickness, and greater ($P < 0.01$) dressing percentage, longissimus area, and percentage carcass lean. In conclusion, low inclusions of VM from 32 to 96 kg BW and withdrawal of VM from 96 kg to market had no effects on growth or carcass characteristics. Also, RAC did not increase the need for VM supplementation.

	ADG, kg	Gain/feed kg	HCW, backfat, mm	Item[a] 10th rib simus area, cm^2	Longis-lean, %	Carcass
70% +VM -RAC	1.01	0.377	88.8	20	35	51.6
+VM +RAC	1.01	0.380	92.9	17	38	53.5
-VM -RAC	1.03	0.377	89.9	19	34	52.1
-VM +RAC	1.05	0.383	92.7	17	38	53.5
130% +VM -RAC	0.98	0.369	88.3	18	36	52.8
+VC +RAC	1.05	0.393	93.8	17	38	53.4
-VM -RAC	1.03	0.382	89.9	19	36	52.4
-VM +RAC	1.07	0.385	93.1	16	39	54.1
SE	0.02	0.007	2.0	1	1	.05

[a]Overall data (32 to 123 kg).

Key Words: Pig, Vitamins and minerals, Ractopamine

384 Effects of vitamin and mineral concentrations and ractopamine hydrochloride on pork quality.

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A total of 160 pigs (two pigs/pen and 10 pens/treatment) were used to determine the effects of added vitamins and minerals (VM) and ractopamine hydrochloride (RAC) on pork quality. Treatments for 32 to 96 kg BW were corn-soy diets formulated to 70 and 130% of NRC recommendations for vitamins (A, D, E, K, niacin, pantothenic acid, riboflavin, thiamin, B6, and B12) and minerals (I, Fe, Se, and Zn). For 96 kg to 123 kg, treatments of with or without VM additions and without or with RAC (20 mg/kg) were imposed. No differences ($P > 0.05$) among pigs fed the VM and RAC treatments were observed for initial color score, expressible moisture, water-soluble protein, and pH of the longissimus 24 h after slaughter. However, RAC increased shear force ($P < 0.001$) and deletion of VM from 96 to 123 kg increased thiobarbituric acid values (TBA) slightly at d 6 ($P < 0.01$). An interaction among the VM and RAC treatments indicated that marbling increased when RAC was added to diets with VM and decreased when RAC was added to diets without VM ($P < 0.04$). Also, thaw loss and cooking loss decreased when RAC was added to diets with VM and increased when RAC was added to diets without VM ($P < 0.05$). In conclusion, the VM treatments had few affects on measurements of pork quality, but RAC did increase shear force. Also, there were VM by RAC interactions that suggested slight decreases in pork quality when RAC is used in diets without VM from 96 kg to slaughter.