

Abstracts

Abstracts of papers presented at the Halifax 2006 joint meeting of the Canadian Society of Agronomy, the Canadian Society for Horticultural Science and the Canadian Society of Animal Science.

CANADIAN SOCIETY OF ANIMAL SCIENCE

Oral Presentations

Effect of protein supplementation on growth performance of sheep under grazing conditions. A. Sepehri¹*, M. Aghazadeh¹, and A. Ahmadzadeh¹. ¹Shabestar Azad University Department of Animal Science, Shabestar, Iran.

This study was conducted on Mogani male lambs maintained on varying levels of protein supplementation in addition to free grazing to assess their performance. Lambs, (20) 7 to 8 mo old (36.2 kg), were divided into four groups of five each and were grazed for 75 d. The first group of five lambs was solely maintained on grazing (conventional method of fattening in the region), whereas the other three groups were supplemented with 12, 14 and 16% protein diet, respectively. The concentrate mixture was supplemented in the evening after grazing for 8 h daily and confined overnight individually. Average daily gain (gr), slaughter weight (kg), warm dressing percentage, loin eye area (cm²), kidney fat (gr), pelvic fat (gr), abdominal fat (gr) were significantly ($P < 0.05$) increased by increasing levels of crude protein from 12 to 16% in supplementary diets. The protein-supplemented groups were significantly ($P < 0.05$) superior to the control group in all of these traits. These results indicate that supplementary feeding of high protein diet significantly increased growth performance under grazing conditions.

Influence of grain induced sub-acute ruminal acidosis (SARA) on lipopolysaccharide endotoxin (LPS), and acute phase proteins. E. Khafipour*, J. C. Plaizier, and D. O. Krause. Department of Animal Science, University of Manitoba, Winnipeg, MB.

Subacute ruminal acidosis (SARA) was induced in Holstein dairy cows to evaluate the relationship between rumen fermentation and immune response. Serum amyloid-A (SAA), haptoglobin (HP) and bacterial lipopolysaccharide endotoxin (LPS) were measured during two consecutive 6 wk experimental periods in four ruminally fistulated cows. During week 1 to week 5 of each period, cows received total mixed ration (TMR) containing 52.4% dry matter, 17.3% DM crude protein, and 39.9% DM NDF, ad-libitum. During week 6 of each period, SARA was induced by replacing, on average, 18% of DM of the TMR with pellets containing 50% wheat and 50% barley. Rumen fluid and blood samples were collected during wk 5 (control) and 6 (SARA). Continuous rumen pH monitoring during weeks 5 and 6 indicated that SARA reduced average daily pH from 6.17 to 5.97 and increased period of less than pH 5.6 from 118 to 278 min d⁻¹. Induction of SARA also increased the concentration of bacterial endotoxin (lipopolysaccharide, LPS) from 28 400 to 107 700 EU mL⁻¹ SAA from 77.6 to 218.6 µg mL⁻¹ and HP from 0 to 0.47 mg mL⁻¹. These data suggest that lysis of gram negative bacteria triggers an inflammatory response during SARA.

Nutritional evaluation of a low-lignin hull, high-oil groat oat grain for feedlot cattle. G.R. Zalinko*, J.J. McKinnon, V.J. Racz, D.A. Christensen, and B.G. Rossnagel. University of Saskatchewan, Saskatoon, SK.

A study was conducted to evaluate the performance and carcass traits of steers fed an oat cultivar selected for a low-lignin hull and

high-oil groat. In trial 1, 400 steers (275.4 ± 68.1 kg) were fed one of two diets for 98 days consisting of 25% (as fed) barley or oat grain. Dry matter intake (DMI) was lower ($P < 0.05$) and feed efficiency improved ($P < 0.05$) for steers fed the oat diet. In trial 2, 240 steers (341.6 ± 62.6 kg) were backgrounded (30% grain, as fed) and finished (79% grain, as fed) on one of three diets containing either barley, corn or oat grain. Overall, DMI and average daily gain (ADG) for cattle fed the corn diet was higher ($P < 0.05$) than those fed the oat and barley diets and higher ($P < 0.05$) for barley relative to oat fed cattle. Cattle fed the oat diet had lower ($P < 0.05$) carcass weight and marbling scores and a smaller ($P < 0.05$) longissimus dorsi muscle. The results indicate that the feed value of this oat cultivar equals barley in backgrounding rations but additional research identifying factors limiting feed intake is required before use in finishing programs is recommended.

Effects of feeding sugar to mid-lactation Holstein cows grazing intensively or extensively managed pasture on productivity and methane emission. R.P. Riordon*, M. Main, and A.H. Fredeen. Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS B2N 5E3 Canada.

Sixteen Holstein dairy cows were blocked into groups of 4 averaging 610.9 ± 29.4 kg BW, a parity of 3 ± 0.44 and 50.7 ± 8.4 days in milk. Within block cows were allocated randomly to four treatments: intensively or extensively managed pasture and either a grain-based supplement or one with sugar replacing 20% (wt/wt, DM basis) of the grain. Supplement was fed at the rate of 1 kg 4 kg⁻¹ milk, up to 8 kg cow⁻¹ d⁻¹. Rumen fluid was sampled from one cannulated cow per group every 14 d at 1, 2 and 3 h following the evening supplementation. Five days of breath sampling ensued for determination of methane emission using the S hexafluoride (SF6) method. Four percent fat-corrected milk (FCM) production averaged 32.07 kg d⁻¹ and was not affected by treatment. Sugar did not affect rumen fluid pH or concentration of even-chain fatty acids. Methane production was not statistically different among treatments ($P < 0.05$), averaging 9.66 g L⁻¹ FCM. In conclusion increasing intensity of clipping and harrowing pasture and feeding sugar at 20% of concentrate DM may not mitigate methane production of grazing dairy cattle.

Effect of pelleted barley on rumen function and eating behaviour in beef steers. L.M. Williams¹*, J.J. McKinnon¹, V.R. Racz¹, D.A. Christensen¹, and K. Ataku². ¹Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, ²Rakuno Gakuen University, Ebetsu, Hokkaido, Japan.

High-density processed feed products fed at high levels can lead to problems such as rumen acidosis. A trial was conducted to evaluate whether a high-density processed barley product supplemented with a high-fibre protein source such as canola meal could produce satisfactory rumen function. Weaned beef steers fitted with ruminal cannulas were fed 86% concentrate diets in a 4 × 4 Latin square design with 23-d periods. The concentrate was 6% canola meal plus 94% either rolled barley (RB), pelleted barley (PB), rolled corn (RC), or pelleted corn (PC). Time spent chewing, defined as

time spent eating plus time spent ruminating, was monitored for 24h beginning on day 19. Rumen fluid was sampled every 2 h for a 24 h period beginning on day 22 and assayed for pH, osmolality, VFA concentration, and ammonia concentration. Minutes spent chewing did not differ ($P > 0.05$) between the groups. Rumen pH, osmolality, VFA concentration, and acetate:propionate ratios were similar ($P > 0.05$) for all four diets. Results from this study indicate that high-density grain products fed with a high-fibre protein source can result in rumen function and eating behaviour comparable to animals fed traditional feedlot diets.

Adaptation of ruminal papillae in transition dairy cows as affected by diet. G.B. Penner^{1,2*}, K.A. Beauchemin², T. Mutsvangwa¹, and A.G. Van Kessel¹. ¹University of Saskatchewan, Saskatoon, SK; ²Agriculture and Agri-Food Canada, Lethbridge, AB.

A study was conducted to characterize changes in ruminal papillae growth during late gestation and early lactation in primiparous cows. We hypothesized that papillae growth would be enhanced by providing additional concentrate to cows pre-partum. Ruminally cannulated Holstein cows (18) were assigned to 1 of 2 pre-partum dietary regimes: 1) a control regime that followed NRC recommendations, and 2) an intensive regime of several diet steps of increasing concentrate proportion. All cows received the same diet post-partum. The ruminal epithelium was sampled on d -48, -14, +19, and +61 relative to parturition. Samples were from the dorsal sac, caudal-dorsal blind sac, and ventral sac, representing locations exposed to low, medium, and high concentrations of volatile fatty acids in ruminal fluid, respectively. Dietary treatment did not affect papillae growth. Papillae on the ventral sac were longer, wider, and had more surface area than the other locations ($P < 0.001$). Over the course of the study, papillae density decreased ($P = 0.003$) but papillae length ($P = 0.036$), width ($P = 0.005$), and surface area ($P = 0.002$) increased. This study indicates that papillae increase in surface area as cows progress through late gestation and early lactation, but papillae growth is not stimulated by supplying additional grain pre-partum.

Comparing predictions of feed intake in performance tested beef bulls, for use in determining residual feed intake. M.W. Lowerison^{1*}, S.P. Miller¹, J.W. Wilton¹, R.A. Kemp², C.B. Williams³, ¹University of Guelph, Center for the Genetic Improvement of Livestock, Guelph Ontario; ²RAK Genetic Consulting, Lethbridge, Alberta; ³USDA, ARS, US Meat Animal Research Center, Clay Center, Nebraska.

Five models were compared for their ability to predict observed feed intake (OI) in performance tested beef bulls ($n = 2697$). Models included the Cornell Value Discovery System (CVDS), Decision Evaluator for the Cattle Industry (DECI) and three multiple regression models. Regression model A (REG_A) included ADG, start of test weight (SOT) metabolic mid-test weight (MMW), and end of test back fat depth (BF). Regression models B and C (REG_B, REG_C) included ADG, MMW and BF, and ADG and MMW, respectively. Correlations between observed and predicted intake were 0.52, 0.51, 0.60, 0.53, and 0.51 for CVDS, DECI, REG_A, REG_B, and REG_C, respectively. Residual Feed Intake (RFI) was calculated as the difference between observed and predicted intake. Correlations between the RFI for each model ranged from 0.80 to 0.98. Low correlations between OI and predicted intake and the differing correlations among the RFI predictions indicate that, not only are these models accounting for a small amount of the variation in OI but they are also accounting for dif-

ferent components of OI. Genetic parameter estimation will help to determine the appropriate use of these prediction models in genetic evaluation programs.

Predicting foot health in beef bulls using an infrared camera to measure foot surface temperature. T.R. Caldwell^{1*}, S.P. Miller¹, K.C. Swanson¹, and K.G. Bateman². ¹Department of Animal and Poultry Science, ²Department of Population Medicine, University of Guelph, Guelph, ON, Canada.

Foot health is a problem for cattle finished in feedlots and for performance tested bulls. A non-invasive indicator of foot health would be a useful tool. An infrared camera was used every 28 days to measure foot surface temperature in 47 performance tested yearling beef bulls fed two diets differing in energy. Bulls were categorized into percentage of British, Continental or Piedmontese. Feet were collected at slaughter to determine foot health, organ weights, liver abscesses and rumen pH were also recorded. Increased foot temperature at end of test was observed in bulls on the higher energy diet ($P < 0.01$), and in British bulls compared with Continental and Piedmontese ($P < 0.05$). British bulls had a higher incidence of sole ulcers than Piedmontese ($P < 0.05$). Positive partial correlations were found between front foot temperature and front sole ulcers (0.49, $P < 0.01$), ulcers found in the front soles and ulcers found in the hind soles (0.44, $P < 0.01$), and between liver abscesses with ulcers found in the front soles (0.50, $P < 0.01$), ulcers found in the hind soles (0.48, $P < 0.01$) and with liver weight (0.52, $P < 0.001$). More research is needed before infrared scanning can be applied to industry programs for predicting foot or liver health. However, relationships between infrared and foot health, and links between foot and liver health shown here indicate that infrared is a promising technology.

Identification of morbidity based on feeding behaviour of newly received calves. R. Silasi^{1,2*}, K.S. Schwartzkopf-Genswein¹, T.A. McAllister¹, B. Genswein¹, T.G. Crowe², R. Bolton², and B. Hill¹. ¹Agriculture and Agri-Food Canada, Lethbridge, AB; ²University of Saskatchewan, Department of Agricultural and Bioresource Engineering, Saskatoon, SK.

Feeding behaviour (FB) in receiving calves is typically irregular and its usefulness as an early indicator of morbidity has not been determined. Data were collected hourly from 384 heifers (228 ± 22.7 kg) to determine relationships between FB and morbidity in the first 4 d after feedlot arrival. FB data included duration and inter-meal interval (INT) (min., max., avg., SD and total; min/d). Health records included occasions treated, days in the hospital and days on feed (DOF). Heifers were defined as sick (S) based on drug treatment and hospital diagnosis and healthy (H) if they were never treated and had no signs of prior sickness at slaughter. Health status was compared by matching individuals by day of pull and pen. No status \times DOF interactions were observed. H cattle had higher ($P < 0.001$) bunk attendance and smaller ($P < 0.05$) INT values than S cattle. A higher ($P < 0.0001$) number of H compared to S calves were present at the bunk/d. FB has potential as an early predictor of morbidity during the first 4 d in the feedlot despite its variability.

Relationship of multilocus homozygosity and inbreeding in Canadian Holstein sires. H. D. Daetwyler^{*}, F. S. Schenkel, and J. A. B. Robinson, Center for Genetic Improvement of Livestock, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario N1G 2W1, Canada.

The challenge of increased inbreeding levels through accelerated genetic improvement is attracting considerable attention. A total of

484 Canadian Holstein sires were genotyped for 9919 SNPs using the Affymetrix GeneChip Bovine Mapping 10K array (www.affymetrix.com) and their inbreeding coefficients were obtained from the Canadian Dairy Network. The average multilocus homozygosity (Hm) over the 9919 SNPs was 0.696 (0.632 to 0.755), while the average inbreeding coefficient (F) was 0.06 (0.00 to 0.19). A correlation of 0.50 was found between Hm and F. A linear regression of F on Hm produced a slope (1.04) close to the expected value (1.0) with an R^2 of 0.25. This result is expected by quantitative genetic theory, which relates increased inbreeding coefficient to increased locus homozygosity. In this study, Hm represents both identical-by-state (IBS) and identical-by-descent (IBD) homozygous locus genotypes. The next step will be to partition the IBS and IBD components of Hm and investigate their relationship to F. It is anticipated that the correlation between IBD and F will be stronger than with a non-partitioned Hm. As the industry moves toward utilizing more genotypic data in genetic improvement programs it will be necessary to develop a measure of relatedness based on IBD genotypic homozygosity.

Structure and sequence variation of the mink interleukin-6 gene. J. Donkor* and A. Farid, Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS.

Interleukin-6 (IL-6) is an immunoregulatory cytokine with a wide variety of biological functions, including stimulation of immune response to tissue damage leading to inflammation and differentiation of B-cells into immunoglobulin-secreting cells. Polymorphisms at the IL-6 gene have been associated with several human diseases. The objective of this study was to identify polymorphisms at the IL-6 locus which can be used to study the potential role of this gene in the immune system response to infections in the mink. Exons 1, 2 and 3 of the gene, whose sequences were not previously known, were PCR amplified using primers based on the sequence of the dog IL-6 gene. The 3981 bp of the gene, consisting of its five exons (764 bp) and four introns (3217 bp), were bi-directionally sequenced in two mink from each of black, pastel and brown, and three wild mink that had been trapped in northern New Brunswick. No single nucleotide polymorphism was observed, but one polymorphic CA repeats was detected in the intron 2. The number of repeats varied between 9 and 17 in the nine individuals. This microsatellite provides a means of rapid genetic screening of this region of the mink genome.

Impact of obesity and dietary polyunsaturated fatty acids on lipid and glucose metabolism in the mink (*Mustela vison*). Jody Muise* and Kirsti Rouvinen-Watt, Nova Scotia Agricultural College, Department of Plant and Animal Sciences and Canadian Centre for Fur Animal Research, Truro, NS, Canada B2N 5E3.

Obesity can alter glucose and lipid metabolism resulting in insulin resistance, while dietary omega-3 fatty acids are known to improve and omega-6 impede glycemic control. The objective of this research was to study the impact of dietary polyunsaturated fatty acid enrichment on glycemic regulation. This study included 48 mink (24 males, 24 females) evenly divided into feeding regimes of 100% or 120% of Recommended Dietary Allowance (RDA) with either dietary omega-3, 6 or 9 (control) fatty acid enrichment. Body weight and blood glucose measurements were taken monthly and examined using Proc Mixed in SAS. Exp 1 (Aug–Oct; control) showed that males weighed more (1973.8 ± 40.2 g) than females (1181.5 ± 40.2) ($P \leq 0.001$) and that the mink fed 120% RDA weighed more (1655.5 ± 40.2 g) than the 100% RDA mink (1499.8 ± 40.2 g) ($P = 0.009$). Blood glucose levels were not affected. In exp 2 (Oct–Dec; omega-3, 6, 9) the BW of the 100%

RDA omega-9 (1627.5 g) and the 120% RDA omega-9 (1838.7 g) groups differed from each other ($P = 0.037$, SEM = 126.3). Both the 100% and 120% RDA treatment group glucose levels differed from August (5.4 mmol L^{-1}) (5.5 mmol L^{-1}) to December (4.6 mmol L^{-1} , $P = 0.035$) (4.5 mmol L^{-1} , $P = 0.021$), respectively.

Marine fatty acid effects on milk composition and prostaglandin production in dairy cattle. J.M. Yuill*, A.H. Fredeen, K.E. Glover, C.T. Enright, and L.A. MacLaren. Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3.

The objectives of the current study were to evaluate the effects of long chain omega-3 (n-3) PUFA supplementation on uterine secretion of prostaglandin F2 α (PGF2 α) and prostaglandin E2 (PGE2) and milk yield. Nineteen postpartum Holstein cows were fed one of three isolipidic TMR-based diets supplemented with either hydrogenated plant oil (HPO; negative control), or one of two sources of n-3 fatty acids, encapsulated fish oil (PFO; positive control) or protected marine micro-algae (PMA) for four months. Monthly milk samples were collected and analyzed for individual milk components. On day 16 of a synchronized estrous cycle, 100 IU of oxytocin (OT) were administered i.v. to induce uterine secretion of PGF2 α and PGE2. Blood samples were obtained before and 30 minutes after OT injection. Enzyme linked immunoassay was used for plasma analysis for the prostaglandin metabolites, PGFM and PGEM. No significant differences were found between treatments for basal PGFM and PGEM concentrations. Post-OT infusion, cows fed PFO had lower plasma levels of PGFM ($P < 0.05$) and tended to have lower PGEM ($P < 0.10$) than cows fed HPO. Cows fed PMA were intermediate. Daily milk fat and protein yields averaged 1.19 kg (± 0.03) and 0.95 kg (± 0.02), respectively, and were not different among treatments. The results indicate that long-term n-3 supplements may inhibit uterine secretion of prostaglandins without impacting overall milk fat or protein yields.

Best practices in the use of animals for agricultural research and teaching: CCAC guidelines on: the care and use of farm animals in research, teaching and testing. Gilly Griffin¹*, Tarjei Tennessen², and Clément Gauthier¹, ¹Canadian Council on Animal Care, 1510-130 Albert St, Ottawa, ON Canada K1P 5G4, ²Department of Plant and Animal Sciences, Nova Scotia Agricultural, College, Truro NS Canada, B2N 5E3.

The Canadian Council on Animal Care (CCAC) is currently developing guidelines on: the care and use of farm animals in research teaching and testing. The guidelines aim to ensure the implementation of best practices within institutions involved in the care and use livestock. This presentation will outline the provisions developed by the CCAC subcommittee on farm animals to address the following: Research and teaching institutions are considered to be in a position to provide a leadership role in the exploration and implementation of best practices for the agricultural industry; For institutions involved in teaching, it is important that both the facilities and procedures used meet the highest standards, so that students graduate fully aware of the current best practices which can be used by the agricultural industry; Research studies and testing studies are expected to be carried out in facilities, and according to procedures, that are recognized as best practices; Where the agricultural research environment must be of direct relevance to the commercial animal production environment, so that the results can be translated to the agricultural industry, it is expected that the best industry standards will be used.

Mapping of quantitative trait loci for economically important traits in Canadian Holstein bulls. D. Kolbehdari^{1,2*}, H. D. Daetwyler¹, J. A. B. Robinson¹, and F. S. Schenkel¹, ¹Center for Genetic Improvement of Livestock, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario N1G 2W1, Canada. ²Department of Animal Science, Aboureihan Campus, University of Tehran, Iran.

A whole genome scan to map quantitative trait loci (QTL) for economic important traits was performed in a granddaughter design in Canadian Holstein dairy cattle. The Affymetrix GeneChip Bovine Mapping 10K SNP array (www.affymetrix.com) was used for high throughput genotyping. A total of 484 Canadian Holstein bulls, 427 originating from 10 core sire families, were genotyped for a total of 9,919 SNP included in the GeneChip. The genome location of about half of these SNP was still unknown, as the bovine genome assembly was not yet finalized. However, the physical map for 4908 SNP was available. The average polymorphism information content of the 9919 SNP was 0.246 (0.0 to 0.375) with 79% of the SNP above the 0.125 level. The average SNP heterozygosity was 0.309 (0 to 0.50). Initial analysis for milk yield by interval mapping using complex pedigree and variance component approach, mapped QTL at regions of the chromosomes known to harbor QTL based on previous reports in the literature. It is anticipated that this study will validate some of the QTL already mapped and new QTL will be discovered, which will aid in the improvement of the Canadian Holstein population.

Identification of QTLs by SSLP and microarray analyses in recombinant congenic strains of mice. Adam Torkamanzahi*, Sarojini S. Sengupta, and Ridha Joobar. University of Sistan and Baluchistan, Zahedan, Iran and Douglas Hospital Research Centre, Montreal, Quebec, Canada.

Amphetamine induced locomotion (AIL) is a quantitative behavioural trait with inter-strain differences in rodents. We used SSLP analysis to map QTLs modulating AIL in two panels of recombinant congenic strains (RCSs) of mice generated from A/J and C57BL/6J mouse strains. The RCSs were informative for 620 SSLPs throughout the genome. Eight to fifteen animals were tested from 36 RCSs from the two panels. Total distance traveled (TDIST) was measured as an indication of AIL for each animal. Mean TDIST of strains were compared for each of the SSLPs by ANOVA within each genetic background. Parental A/J and C57BL/6J were significantly different for TDIST and 4 RCSs deviated significantly from parental strains within the two panels. C57BL/6J genes increased AIL in the A/J background while A/J genes decreased AIL in the C57BL/6J background. SSLPs significantly associated with TDIST in the A and B backgrounds were distributed on chromosomes 1, 2, 3, 5, 6, 8, 9, 10, 17 and 20. Microarrays were used to combine the positional information with cDNA expression data in one promising informative strain (A52) and the parental strains. Microarrays were prepared from brain tissue samples from 3 animals from each strain. A group of 15 ESTs displayed transcript levels that paralleled the level of TDIST phenotype in these strains. Combining positional and cDNA expression information will help to identify candidate genes.

Differential response of black mink to the Aleutian mink disease virus. A. Farid* and B.F. Benkel, Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3.

In each of 2004 and 2005, approximately 750 black mink from a single ranch in Nova Scotia were tested by Counter-immune elec-

trophoresis (CIEP), which detects antibody against the Aleutian mink disease virus (ADV), and Iodine Agglutination Test (IAT), which detects animals with an elevated level of gammaglobulin. The ranch has kept 700 to 800 breeding females, and the herd has been infected with ADV since 1990. Mink were tested by IAT every year, and positive animals have been regularly eliminated from the herd. Percentages of CIEP positive mink were 84.7 and 80.6 in 2004 and 2005, respectively, and the corresponding figures for IAT were 5.3% and 10.4%. ADV infection had little negative effects on reproductive performance or the survival rates of adults and kits. The results suggest that, despite a high level of infection, mink on this ranch do not develop disease symptoms because either the ADV strain(s) on this ranch has low pathogenicity, or continuous selection for IAT negative animals in an environment with a high level of exposure to the virus has favored ADV tolerant (CIEP positive) animals.

Neural networks to predict morbidity in a commercial feedlot. B. D. Hill*, K. Schwartzkopf-Genswein, T. McAllister, B. Genswein, A. Banack, R. Silasi, L. Thompson, and F. Brown. Lethbridge Research Centre, Agriculture and Agri-Food Canada, P.O. Box 3000, Lethbridge, Alberta, Canada T1J 4B1.

Trials were conducted in 1998 and 2002 at a commercial feedlot near Amarillo, TX. Feeding behaviour of newly-received calves was monitored for 107 d using the GrowSafe[®] system, which uses radio frequency to record feedbunk attendance. Thirteen variables were collected including initial BW, days on feed, max. daily temperature, feeding frequency, feeding durations and inter-meal intervals. Neural network (NN) modeling was applied to predict (classify) healthy and morbid animals on different d prior to morbid animals being pulled by a pen checker. Cattle were defined as morbid based on hospital diagnosis and drug treatment; healthy cattle as never pulled/treated. For the 1998 trial, animals ($n = 104$) were classified with 76% accuracy 2 d before pull. The most important variables were min. feeding duration, min. inter-meal interval and d on feed. At 4 d and 6 d before pull, classification accuracies were 74% and 78%, respectively. For the 2002 trial, classification accuracy was 73% at 2 d before pull ($n = 220$) with min. inter-meal interval, min. feeding duration, and total feeding duration as important variables. Accuracies were 75% and 76% at 4 d and 6 d before pull, respectively. We are currently trying to extend predictions out to 10 d before pull.

Monitoring blood glucose levels in female mink during the reproductive cycle: The prevention and reversal of hyperglycemia in nursing dams. Amber M. J. Hynes and Kirsti Rouvinen-Watt*. Nova Scotia Agricultural College, Department of Plant and Animal Sciences, P.O. Box 550, Truro, Nova Scotia, Canada B2N 5E3.

Nursing sickness, the largest cause of mortality in adult mink females, is a metabolic disorder characterized by hyperglycemia. This research investigated the impacts of body condition, anti-diabetic supplements and reproductive status on blood glucose levels in female mink during the reproductive cycle. Firstly, dams from three farms were assigned to either herring oil (HerO), chromium picolinate (CrPic), or a control group for 6 weeks at the onset of lactation. Hyperglycemia was observed throughout reproduction. Females exhibiting hyperglycemia early in the reproductive cycle tended to remain hyperglycemic, have poorer health and fewer kits. CrPic reduced blood glucose levels. Secondly, females having blood glucose values of $<5.5 \text{ mmol L}^{-1}$ (Normoglycemic) and over 5.5 mmol L^{-1} (Hyperglycemic, HG) early in lactation were sup-

plemented daily for 1 wk at day 21 of lactation with various combinations of HerO, CrPic and acetyl-salicylic acid (ASA). In HG females, treatments, excluding CrPic and ASA alone, reduced blood glucose levels. Blood glucose levels in lactating mink may be affected by anti-diabetic supplements; however, as hyperglycemia occurs also prior to nursing, preventative measures are recommended throughout the year.

Days between first service and conception in a multi-breed beef seed-stock herd is heritable but different age classes should be considered as different genetic traits. M.J. Kelly*, S.P. Miller, and J.W. Wilton. Centre for Genetic Improvement of Livestock, University of Guelph, Guelph, ON, Canada.

Cow fertility is an economically important trait in beef production. Days between first service and conception (FSTC) is an indicator of cow fertility. Generally, for analysis of fertility traits such as FSTC a single trait repeatability model has been used for genetic analysis. Breeding season records (7452) from the first four adult parities (with a calf at foot) of a cow herd (3240 multi-breed cows) were analyzed, heritability under the repeatability model was 7% (+1.73%) with a repeatability of 12% (+1.48%). Multiple trait analyses were performed in which FSTC for each parity was treated as a separate trait. Heritability estimates were higher than from the repeatability model being 17%, 10%, 16% and 6% for the 2, 3, 4 and 5th parities, respectively. The genetic correlations differed between parities, generally, decreasing as parity difference and parity increased. Genetic correlations were low comparing 5th parity with 2nd and 4th parities (0.164 and 0.226, respectively). Genetic correlations between remaining parities were greater than 0.5. It would be more correct to consider the FSTC of adult cows as a separate trait per parity, rather than using a repeatability model. Thus a multi-trait analysis considering different parities as separate traits is recommended for routine genetic evaluation.

Cattle shedder type affects the amount of Enterohaemorrhagic *Escherichia coli* 0157:H7 adherence and inflammation in bovine intestine. Danica Baines* and Tim McAllister. Agriculture and Agri-Food 5403 1 Avenue South, Lethbridge, Alberta, Canada T1J 4B1.

Mature cattle are the main reservoir for *Escherichia coli* 0157:H7, a human pathogen that causes haemorrhagic colitis and haemorrhagic uremic syndrome. Little is known about the contribution of cattle factors to the *E. coli* 0157:H7 infection process. We examined intestinal tissue from *E. coli* 0157:H7 challenged cattle for mild symptoms of bacterial infection. We also examined the role of cattle shedder type, intestinal site and *E. coli* 0157:H7 exposure dose to the amount of *E. coli* 0157:H7 adherence to 8 intestinal sites, in vitro. Mature cattle produce an inflammatory response when challenged with *E. coli* 0157:H7 and the proportion of intestinal sites affected is related to shedder type. The amount of *E. coli* 0157:H7 adherence to intestinal sites increased from low to high shedder type but there was no difference in adherence to the 8 intestinal sites in an animal. The greater *E. coli* 0157:H7 adherence, proportion of inflammatory intestinal sites and level of endogenous *E. coli* 0157:H7 for high shedder types compared to low shedder types strongly suggests that colonization of the small and large intestine leads to long-term shedding in feces. The terminal rectum did not support more *E. coli* 0157:H7 adherence than the 7 other intestinal sites in mature cattle and together with the inflammation results suggests that the terminal rectum is not the primary infection site for *E. coli* 0157:H7 in mature cattle, instead it appears to act as a final infection site before pathogen clearance from an animal.

Feeding feather meal, vitamin E or acetylsalicylic acid (aspirin) and acute interstitial pneumonia in feedlot heifers. K. Stanford^{1*}, T.A. McAllister¹, M. Ayrout², T.M. Bray³, and G.S. Yost⁴. ¹Alberta Agriculture, Food and Rural Development, Lethbridge AB; ²Faculty of Medicine, University of Calgary, Calgary AB; ³College of Health and Human Sciences Oregon State University, Corvallis, Oregon; ⁴Department of Pharmacology and Toxicology, University of Utah, Salt Lake City, Utah.

Effects of feeding 550 IU vitamin E or 1.5% cysteine-rich feathermeal for 40 d before slaughter on mortality and emergency slaughter rates due to acute interstitial pneumonia (AIP) were evaluated in commercial feedlots along with the utility of acetylsalicylic acid (aspirin) as a therapy for heifers clinically affected with AIP. Plasma and lung tissue were collected at slaughter from animals clinically diagnosed with AIP ($n = 83$), asymptomatic pen mates ($n = 40$) and heifers receiving feathermeal ($n = 20$) or vitamin E treatments ($n = 20$). Additional heifers with clinical signs of AIP ($n = 30$) were treated with 31.2 g aspirin every 12 h until slaughter. The left lung was subsampled for histological examination, analysed for 3-methyleneindolenine adduct (3ME) and reduced glutathione (GSH). Supplementation with feathermeal or vitamin E had no effect on death loss or emergency slaughter attributable to AIP and did not influence levels of 3ME or GSH in blood. For aspirin-treated heifers, 63.3% survived to be slaughtered through normal channels, with 33.3% requiring emergency slaughter and 3.3% dying prior to slaughter. Results from aspirin treatment of heifers clinically affected with AIP are preliminary but promising as the case fatality rate of AIP-affected cattle can exceed 50%.

Use of real-time PCR to predict dry matter disappearance of individual feeds in a total mixed ration. T. W. Alexander*, Y. Wang, and T. A. McAllister. Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB, Canada.

A new method, utilizing plant-specific real-time PCR assays, was developed that enables prediction of single feed digestion in a total mixed ration (TMR). Alfalfa and corn substrates (0.5 g DM) were incubated in buffered rumen fluid at pH 6.8 or 5.5 for up to 48 h. Regression analysis between DNA disappearance and dry matter disappearance (DMD) for 100% alfalfa or corn was used to predict DMD in mixed rations containing 75:25, 50:50, and 25:75 ratios of alfalfa to corn throughout fermentation, after plant DNA quantification. The actual DMD was compared against the total predicted DMD by summing the values predicted for alfalfa and corn in the mixed rations. The method was relatively accurate with a concordance correlation of 0.87. Differences between the actual and total predicted DMD ranged between -9.78 and 5.71% or -15.18 and 12.12% when the pH was 6.8 or 5.5, respectively. The DMD of alfalfa was significantly affected ($P < 0.05$) by interactions between time and pH or time and ration, whereas DMD for corn was only affected by time ($P < 0.05$). This method of predicting DMD may lead to redefined models to more effectively estimate the available energy of a TMR.

Proposal of modification in the carbohydrate c equation of the Cornell net carbohydrate and protein system¹. Mário Adriano Ávila Queiroz², Romualdo Shigueo Fukushima^{3*}, Catarina Abdalla Gomide⁴. ¹Financial support provided by Fundação de Amparo à Pesquisa do Estado de São Paulo, SP, Brasil; ²Graduate student in Ciência Animal e Pastagem, Escola Superior de Agricultura Luiz de Queiroz – Universidade de São Paulo (USP), Piracicaba, SP, Brasil; ³Faculty member of Faculdade de Medicina Veterinária e Zootecnia – USP, Av. Duque de Caxias-Norte, 225,

Zip code: 13630-000, Pirassununga, SP, Brasil. CNPq researcher. Corresponding author. ⁴Faculty member of Faculdade de Zootecnia e Engenharia de Alimentos – USP, Pirassununga, SP, Brasil.

The Cornell Net Carbohydrate and Protein System (CNCPS) equations that estimate carbohydrate fractions were employed on three sunflower (*Helianthus annuus* L.) cultivars (fresh or silage). The experimental design was a completely randomized, 3 × 2 factorial. Data were analyzed employing the PROC MIXED procedure of SAS. Some Cornell's equations employ ash and protein free neutral detergent fiber (NDFap) as one of its components; however, as it is questionable the characterization of NDF as being cell wall, because of missing pectin, this work compared crude cell wall preparation (CW) versus NDF in these equations. This substitution showed no differences in the C fraction which estimates the indigestible cell wall. Because of this comparison, we found that fraction C could be simplified: lignin can be expressed as a ratio of DM, instead of NDFap as it is widely used today. The practical aspect: it is easier to relate lignin as a ratio of DM rather than as a ratio of ash and protein free NDF (no need to correct ash and protein for NDF). Cornell's C equation: $C (\%CHO) = 100 \times [NDFap (\%DM) \times 0.01 \times \text{lignin} (\%NDFap) \times 2.4] / CHO (\%DM)$ Proposed C equation: $C (\%CHO) = 100 \times [\text{lignin} (\%DM) \times 2.4] / CHO (\%DM)$.

The effects of feeding condensed distillers solubles on grain fed veal calf growth performance and carcass composition. P. L. McEwen*, Ridgetown College, University of Guelph, Ridgetown, Ontario, Canada.

Effects of feeding condensed distillers solubles (CDS) were examined on 53 Holstein bull calves (169 ± 26 kg). Each calf was randomly assigned to one of three dietary treatments. Eighteen calves (CON) were individually fed control diets containing whole shelled corn and supplement while another four pens were fed control diets (CDS₁) with ab libitum access to CDS from lick-wheel containers. The remaining calves (CDS₂) were fed diets contained 5% CDS on a DM basis. Grower diets (17.5% CP) were fed until pens averaged 225 kg body weight followed by an assigned finisher diet (15% CP) until market weight (327 ± 14 kg). Daily gains (kg) were similar ($P > 0.85$) for each dietary treatment [1.6 (CON), 1.6 (CDS₁), 1.6 (CDS₂); SE = 0.04]. Days to market, total and daily dry matter intake and dry matter to gain [3.8(CON), 3.8(CDS₁), 3.6(CDS₂); SE = 0.1] were also unaffected ($P > 0.10$) by diet. Hot carcass weight, dressing percentage, intramuscular fat (ultrasound), ribeye area and subcutaneous fat measurements were also similar ($P > 0.05$) while rump fat depth (mm) increased ($P < 0.05$) for CON versus CDS₁ (3.0 vs. 2.5; SE = 0.2). Therefore CDS was a very acceptable and palatable feedstuff when fed to grain fed veal calves at 5 percent of ration dry matter.

Effects of grain induced subacute ruminal acidosis (SARA) on feeding behaviour of dairy cows. J.C. Plaizier*, S. Wamnes, E. Khafipour, A. Nikkhal, and D.O. Krause. Department of Animal Science, University of Manitoba, Winnipeg, MB.

A total of eight lactating dairy cows, four of which were rumen fistulated, were used in a cross over design with two 6-wk periods. During weeks 1 to 5 of both periods, cows received a total mixed ration (TMR) ad libitum containing. The TMR contained 52.4% dry matter, 17.3% DM crude protein, and 39.9% DM NDF. During week 6 of SARA was induced in all cows by replacing, on average, 18% of the dry matter intake of the TMR with pellets containing

50% ground wheat and 50% ground barley. These pellets contained 89.2% dry matter, 15.5% DM crude protein, and 17.6% DM NDF. During three successive 24-h periods in week 4 and week 6, cows were videotaped continuously. Feeding behaviour (eating, ruminating, or idle) was analyzed using a 5 min scan sampling technique. Rumen pH was monitored continuously in the rumen fistulated cows. Induction of SARA reduced average daily pH from 6.17 to 5.97 and increased the duration of the rumen pH below pH 6 and below pH 5.6 from 491 to 678 min d⁻¹ and from 118 to 278 min d⁻¹, respectively. On average, induction of SARA reduced dry matter intake from 19.0 to 16.1 kg d⁻¹, reduced time spent eating from 6.0 to 4.8 h d⁻¹ ($P < 0.001$), reduced time spent ruminating from 8.6 to 7.7 h d⁻¹ ($P < 0.05$) and increased time spent idle from 9.5 to 11.5 h d⁻¹ ($P < 0.005$). These results show reduction in time spent eating and time spent ruminating due to grain induced SARA is proportional to the reduction in dry matter intake.

The effects of different plants extracts on ewe lamb performance and carcass characteristics. Alexander Chaves^{1*}, Kim Stanford^{2,3}, Lorna Gibson³, Chaouki Benchaar⁴, and Tim A. McAllister¹. ¹Agriculture and Agri-Food Canada, Lethbridge Research Centre - 5403 - 1 Avenue South - Box 3000, Lethbridge, AB, T1J4B1, Canada; ²Alberta Agriculture Food and Rural Development, Agriculture Centre, 5401-1st Avenue South, Lethbridge, AB, Canada T1J 4V6; ³Agriculture and Agri-Food Canada, 6000 C & E Trail, Lacombe, AB, Canada T4L 1W1; ⁴Agriculture and Agri-Food Canada, Dairy and Swine Research and Development Centre, P.O. Box 90, Collège Street, Sherbrooke, QC, Canada J1M 1Z3.

Feed intake, gain, feed efficiency, and carcass yield of 40 ewe lambs (initial weight = 23.5 ± 1.1 kg) individually fed pelleted diets containing 0 (control) or 200 mg/day of garlic oil (GAR), juniperberry (JPY) or cinnamaldehyde (CIN) were compared over 13 wk. Lambs had ad libitum access to pelleted diets and water. Animals were weighed (LW) on a weekly basis and slaughtered after reaching 45 kg live weight. At slaughter, weights of liver and rumen were determined and saleable meat yield was calculated by processing the lambs into primal cuts. Addition of plant extracts did not affect dry matter intake (1163.1 g DMI d⁻¹ $P > 0.37$) or final LW (45.0 ± 1.23 kg $P > 0.11$) although lambs receiving CIN and JPY diets had higher ADG (>50 g d⁻¹) than those receiving control or garlic diets ($P = 0.0001$). Feed conversion (DMI/ADG) was improved in ewes fed JPY and CIN compared to control and GAR treatments (4.7 vs. 5.4 kg DM eaten/kg gain). Saleable meat yield was similar for all treatments. Ewes receiving GAR, JPY and CIN had increased liver weights, relative to controls ($P < 0.005$). In the current study, rates of gain were increased in the animals treated with JPY or CIN compared to control and GAR, possibly due to changes in fat metabolism.

Fat composition and carcass quality of pasture-finished beef is affected by tall fescue or red clover pasture. J.L. Duynisveld^{1*}, E. Charmley², M.A. McNiven³, and B. Trueman¹. ¹Crops and Livestock Research Center, Agriculture and Agri-Food Canada, Nappan Research Farm, Nappan, NS B0L 1C0; ²CSIRO Livestock Industries, JM Rendel Laboratory, Rockhampton Qld 4702; ³Department of Health Management, Atlantic Veterinary College, University of PEI, Charlottetown, PE C1A 4P3.

The effect of pasture species on beef fat composition was studied using tall fescue and red clover swards. Twenty-four steers and 12 heifers (initial BW = 380 kg) grazed either a tall fescue or red

clover pasture from June until slaughter in September. Animal weight, sward yield and sward quality were measured during trial and pasture intake was estimated. After 112 d, l. thoracis samples were collected at slaughter. Subcutaneous fat biopsies were taken from 12 steers and the 12 heifers at the beginning and end of the trial to measure change in fat composition. Average daily gain was similar between treatments (1.13 kg d⁻¹). Intake of red clover (11.2 kg d⁻¹) was 15% lower than fescue DM intake ($P < 0.01$). Steers finished on red clover had 3% heavier carcasses (281 vs. 272 kg; $P < 0.05$), 4% greater dressing percentage (55% vs. 52%; $P < 0.01$) and 23% thicker back fat (6.4 mm vs. 5.1 mm; $P < 0.05$). Subcutaneous fat samples showed a 41% increase in polyunsaturated fatty acids ($P < 0.001$) during the trial. Red clover increased l. thoracis concentrations of *cis*-9, *trans*-11 CLA by 17% ($P < 0.05$), but contained 15% less 18:3 ($P < 0.05$). We conclude that pasture species affects carcass characteristics and fat composition of grass-fed beef.

Impact of cattle grazing management on microbial indicators of fecal pollution. A. Unc¹, P.H. Sharpe^{*2}, J. Pitty Del Cid², S. Springthorpe¹, S.A. Sattar¹, R. Marcelissen², and M. Goss². ¹University of Ottawa; ²University of Guelph Kemptville College.

Access of grazing cattle to surface water leads to microbial water contamination. We monitored the impact of changes in the water availability to grazing cattle, on the microbial quality of a small creek. Pregnant Holstein heifers were rotationally grazed on a five acre pasture next to a creek. For four weeks in 2005, they could choose to drink either from a water trough or from the creek, then for another four weeks they could only drink from the creek. The creek water and sediments were sampled once to twice weekly upstream and downstream from the cattle and at three locations along the grazing section of the creek. Indicators of microbial contamination in water samples [both bacteria (*E. coli*, *Salmonella*, faecal *Streptococci*, *Clostridium perfringens*) and viruses (*Coliphages phi174* and MS2)] were enumerated. Microorganism numbers were analysed by the GLM procedure of SAS, using location and sampling date as fixed effects. Sampling date was always significant ($P < 0.05$). When cattle could only drink from the creek, numbers of *E. coli*, *Enterococci* and MS2 were significantly greater in the test area than both upstream and downstream locations ($P < 0.05$). When cattle could choose between the trough and creek, there were no significant differences in microorganism numbers by location. A related study showed that these cattle drank significantly more often from the trough than from the creek. Thus the concentration of microbial indicators of fecal pollution was lower when a water trough was supplied to grazing cattle.

Pasture opportunities in Ontario. Jack Kyle*. Ontario Ministry of Agriculture Food and Rural Affairs, 322 Kent Street, W, Lindsay, Ontario Canada K9V 4H7.

There has been renewed interest in pasture in the last number of years. This is partially due to the low commodity price of corn and soybeans, and also the keen interest in livestock production by Ontario farmers. The largest demand for pasture has come as a result of the growth in the number of beef cows and sheep over the past decade and the need for an economical feed source. Intensive rotational grazing has proven very successful for many producers. These producers are finding that a well managed grazing system can return more dollars to the farm enterprise than any other cropping system. According to the 2001 census, Ontario has 773 650 acres of improved pasture and 1 314 335 acres of unimproved pasture. There is a wide variation in soil types and climatic conditions,

which provides a range of grazing opportunities and challenges. Soil characteristics vary from deep loamy soils to very shallow soils over limestone bedrock. There are a number of options available to use annual crops to supplement perennial forage. Some of these annuals can be grown as a second crop following cereal or other early harvested crop. Ontario has wide variety of soil conditions and climatic zones which give rise to many different pasture opportunities throughout the province.

Yield, quality and etiolated growth of new forage varieties under grazed conditions. C. Ward^{1*} and H.A. Lardner^{1,2}. ¹Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, S7N 5A8; ²Western Beef Development Centre, Humboldt, SK, S0K 2A0.

Traditionally, forage species have been evaluated in small plot trials using mechanical methods of defoliation, such as mowing or clipping. However, new forage varieties require evaluation under grazed conditions to determine their suitability for pasture use. A grazing study was conducted near Lanigan, Saskatchewan to evaluate cumulative dry matter yield (CDMY), crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF) and in vitro organic matter digestibility (IVOMD) of crested wheatgrass [*Agropyron cristatum* (L.) Gaertn.] cv. Goliath, meadow brome grass (*Bromus riparius* Rehm.) cv. Paddock, smooth brome grass (*B. inermis* Leyss) cv. Carlton, hybrid brome grass (*B. riparius* Rehm. × *B. inermis* Leyss) cv. AC Knowles and tall fescue (*Festuca arundinacea* Schreb.) cv. Courtney compared with an old stand of CWG (*A. cristatum*) over two grazing seasons. All pastures were grazed once during the 2004 and 2005 growing seasons and CDMY was measured using grazing exclusion cages randomly placed in paddocks. During the 2004 grazing season, there were no significant differences ($P > 0.05$) between species for CDMY. However, in 2005 Goliath crested wheatgrass outyielded ($P < 0.05$) all other pasture species. In 2004, Goliath crested wheatgrass had greater ($P < 0.05$) NDF and ADF than all other bromes at late maturity. Digestibility (IVOMD) of Paddock meadow brome grass and Goliath crested wheatgrass was greatest ($P < 0.05$) in 2004 at the late and early stages of maturity, respectively. At early maturity in 2005, all species had greater CP ($P < 0.05$) than crested wheatgrass control pastures. Finally in 2005, IVOMD was greatest ($P < 0.05$) for tall fescue at early maturity and meadow brome grass for late maturity stage. An experiment is currently being conducted to estimate spring energy reserves prior to grazing through measurement of spring etiolated growth on these species.

The effect of cow age and spring (early June to late July) pastures for grazing on milk fatty acid composition of beef cows. P.S. Mir^{1*} and A. Iwassa². Agriculture and Agri-Food Canada Research Centres, ¹Lethbridge, AB and ²Swift Current, SK.

The effect of grazing mixed or monocultured grass pastures in spring on milk fatty acid composition from beef cows (Hereford × Red Angus) was evaluated. Two groups of 30 cows were grazed through a series of pastures that were split in two for a similar period of time in the order: CWG (crested wheatgrass), RWR (Russian wildrye) and MIX (Altai wildrye, RWR, native grasses and CWG). During the last 2 days of grazing each pasture, 100 mL milk samples were taken from the hind quarters of three 4-year-old and three 9-year-old cows and analyzed for fat content and fatty acid composition by gas chromatography. Interaction between cow age and pasture species was observed ($P < 0.05$) for weight percent (wt%) of C17:0, C20:0 and C20:4 fatty acids. In milk from younger cows, the wt% of C6:0, C8:0, C10:0 and C17:1 was lower, but C16:0,

C21:1, C22:5 and C22:6 were higher than of older cows. Grazing RWR increased wt% of fatty acids up to C16:0, but C18:0 was highest for cows grazing the MIX. Grazing CWG increased wt% of C18:1 and C18:2. The wt% of C18:3 and CLA *cis-9 trans-11* were highest in milk of dry lot cows. Data indicated that pasture species grazed affects milk fatty acid composition to a greater extent than cow age.

Measurements of greenhouse gas emissions from a swine barn in Ontario. Goretty M. Dias^{1*}, Gudmundur H. Johannesson², C. Wagner-Riddle², and Grant C. Edwards³. ¹Guelph, Ontario, Canada N1E 5X6; ²Department of Land Resource Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1; ³Ottawa, Ontario, Canada.

Real-time measurements of greenhouse gas fluxes in Canadian agriculture are important for understanding and mitigating these emissions. A mass balance technique was applied to continuously measure methane and nitrous oxide emissions from a swine barn in Ontario, Canada during the fall of 2001 and spring of 2002. Gas concentrations were measured inside the mechanically-ventilated facility using tunable diode laser trace gas analyzers, and flow measurements were conducted using a hot-wire anemometer. Daily methane emissions averaged 46.9 mg s⁻¹ and 62.1 mg s⁻¹ for the fall and spring, respectively. Average daily nitrous oxide emissions were 48.8 µg s⁻¹ and 79.4 µg s⁻¹, in the fall and spring, respectively. Event-driven emissions, specifically the draining of manure pits, resulted in increased methane concentrations. These practices can increase the overall emissions on a yearly basis. Average daily methane and nitrous oxide emissions were strongly correlated to average daily air temperature, suggesting that temperature could be a good method of estimating emissions from mechanically ventilated barns. As yearly average temperatures increase, this will be an important consideration for GHG emission inventory updates. These direct and continuous measurements of greenhouse gas emissions from livestock confinement facilities are the first of their kind in Canada.

Comparative study of chicken hepatocyte resistance against toxicity induced with toxic doses of carbon tetrachloride and acetaminophen in rat. R. Jajvandian¹, M. Dashtizad², and M. Anvari^{1*}. ¹Islamic Azad University, Bojnourd Branch, Iran, ²Islamic Azad University, North Tehran Branch, Iran.

Objective: Here are evidences that show that broilers show more liver resistance against some toxins. To compare the liver resistance in broilers with mammals, In this research; we studied the comparative effect of CCL4 and acetaminophen on hepatic enzymes and other factors in broilers. Animals: male broilers (Arian strain) at age 20 d in six groups ($n = 6$). Procedure: Oral treatment with CCL4 0.5, 1, 2.5 cc kg⁻¹ BW for 10 d; oral treatment with acetaminophen 650 mg kg⁻¹ BW for 30 d and the control. Inscription of daily weight gain, some body factors, HCT, PTT and the seromic level of GOT, GPT and ALP and pathologic study at liver and at the end, Statistical analyses with spss. for compare with rat. The mean weight of liver in experimental chicks is increases. But in rats treatment with 0.5 mg kg⁻¹ BW ccl4 during 4 days or acetaminophen 300 mg kg⁻¹ BW, induced acute hepatotoxicity with centerilobular necrosis that end to death. Results: Our results show that treatment with ccl4 and acetaminophen at chicken can not induce acute hepatotoxicity such as the experimental model in rat. And there is not any necrosis. Conclusion: It suggested that broilers have very strong detoxification system. Ever at lower ages. Treatment with killer doses of this hepatotoxin in rat, in broilers only induced lower rate of growth and changes in some

hematological and somatic factors. It seems that such resistance is related to GSH different synthesis and the reduction of gaps between hepatocytes and some outoprotection mechanisms at broilers.

Health and productive traits analysis in broiler chickens treated with probiotic and source of lactose. Mahmoud Radfar^{1*} and Kamyar Heidarneshad². ¹Department of Young Researcher Club, Islamic Azad University of Tabriz, Tabriz, Iran; ²Department of Animal Science, Islamic Azad University of Tabriz, P.O. Box 1655, Tabriz, Iran.

This study was carried out to determine the effect of probiotic (*Pediococcus acidilactici* bacteria) and dried whey (lactos:75%) on productive performance, carcass trait and immune system of broiler chickens. Two hundred day-old commercial broiler chicks were utilized for 28 days experimental period. All chickens were fed the basal diet and different levels of Probiotic, dried whey and Probiotic plus dried whey: (control, $P = 0.01\%$, $W = 1\%$, $P + W = 0.01 + 1\%$ and $P + W = 0.005 + 0.5\%$). Throughout the study, body weight, feed intake and FCR were calculated, and at the end of experiment, tow birds of each replicate was selected. Birds weighed, then decapitated and viscera were collected immediately, then number of cecal oocysts were detected. Furthermore after slaughter, elements of blood and carcass trait were measured. Supplementations of Probiotic and dried whey improved production performance. Likewise, all treatments except control caused to significant decrease in number of cecal oocysts and significant increase in rate of blood globulin ($P < 0.05$). The highest WBC belonged to diet containing Probiotic plus dried whey (0.01 + 1%). Also the highest carcass efficiency belonged to group that received Probiotic plus dried whey (1 + 0.01% & 0.5 + 0.005%) and dried whey (1%).

Broiler responses to feed restriction during the finisher period. A. Aghazadeh*. Urmia University, College of Agriculture, Urmia, Iran.

Two hundred forty broiler chicks at 28 d were divided in to 35 treatments (four replication of 12 birds each) as follows: 1) control, fed ad libitum from 28 to 56 d, 2) fed ad libitum from 28 to 35 d, reduction in feeding time by 1 d/week from 35 to 56 d, 3) reduction in feeding time from 28 to 49 d by 1 d/week and from 29 to 56 d by 2 d/week, 4) reduction in feeding time from 28 to 42 d by 1 d/week from 42 to 56 d by 2 d/week, 5) reduction in feeding time from 28–35 d by 1 d/week and from 35 to 56 d by 2 d/week. On day 56, body weight of restricted birds in groups 3, 4 and 5 was significantly ($P < 0.05$) lower than groups 1 and 2, although body weight gain over 28 to 56 d was not significantly different ($P < 0.05$). On day 56, feed efficiency was highest for group 5 and chicks in groups 1, 2 had significantly ($P < 0.05$) lower feed efficiencies than groups 3, 4 and 5.

The effect of different levels of dietary fat and L-carnitine on performance, carcass characteristics and blood parameters of broilers. Ahmad Ghodrtnama^{1*} and Amir Atar². ¹Agricultural and Natural Resources Research Centre of Khorasan, Mashad, Iran; ²Animal Science Department of Mazandran University, Sari, Iran.

In order to study the effect of different levels of dietary fat (1, 3, 5%) and L-carnitine (0 and 250 mg kg⁻¹) on broiler performance, carcass characteristics and some blood parameters, 360 male commercial broilers were allocated to 6 treatments with four replica-

tions (15 broilers in each) for 42 days (starter, 0–21 d., grower, 22–42 d), in factorial arrangement (2×3) based on completely randomized design. Feed intake, weight gain and feed conversion ratio were measured weekly. At the end of production period, broilers were weighted; blood samples were obtained and slaughtered. The results showed increase of dietary fat improved performance at the grower and whole period ($P < 0.05$). The dietary L-carnitine had no significant effect on broiler performance. Breast meat percentage was increased by different levels of dietary fat ($P < 0.05$). Abdominal fat percentage was increased by the increase of dietary fat significantly ($P < 0.05$). The liver weight increased along with increasing of dietary fat ($P < 0.05$). Dietary L-carnitine was reduced the blood triglyceride (TG), cholesterol, and very low density lipoprotein (VLDL) concentration. While dietary fat concentration had not significant effect on blood TG, and glucose concentration, VLDL concentration affected quadratic ($P < 0.05$). According to these results we concluded the beneficial effect of dietary fat combined with L-carnitine on performance and carcass characteristics of broilers.

Effects of physiological serum injection and early feeding on broiler chick's subsequent performance. M.Bejaei^{1*}, M.Shivazad¹, M.Zaghari¹, and M.M.Kiaei². ¹Department of Animal Science, Faculty of Agriculture, University of Tehran, Karaj, Iran; ²Faculty of Veterinary Science, University of Tehran, Tehran, Iran.

An experiment was conducted to investigate the effects of physiological serum injection and immediate posthatch feed access on the subsequent performance of broilers. Experiment was carried out using a completely randomized design with factorial arrangement ($2 \times 2 \times 2 \times 2$). Factors were egg weight (medium and small eggs), physiological serum injection (control with no injection and 0.3 mL physiological serum injection), feeding in transportation boxes during shipping period (chicks fed Oasis and those hold with no access to feed and water) and house arrival feeding (chicks that receive feed immediately at arrival and those suffer a 12 h additional starvation). Treatments were replicated three times with 25 chicks per each. Live weight (tables 1 and 3) and feed intake were measured for each experimental unit at 7, 21 and 42 d of age and then weight gain and feed: gain was calculated. On days 3, 21 and 42, two chicks from each replicate were killed for carcass analysis including yolk sac residue weight (third day), duodenum, jejunum and ileum weight and length and also liver and gizzard weight. Results show an improved weight gain (WG) and feed efficiency ($P < 0.05$) in chicks from medium eggs compared to those from small eggs. A significant interaction ($P < 0.05$) between physiological serum injection and egg weight was observed, so that chicks of small eggs with physiological serum injection show a significant ($P < 0.05$) depression in WG. Chicks with immediate access to Oasis had higher ($P < 0.05$) duodenum and jejunum relative weight on day 3 and duodenum on day 42. Oasis fed chicks also had better WG and breast meat yield ($P < 0.05$) while feeding Oasis did not influence feed efficiency. Feeding Oasis also increased yolk utilization. Chicks with delayed access to feed in the house compensate their depressed WG of first week during the later stages. Results of this study show no beneficial effect of physiological serum injection whereas immediate access to feed in posthatch chicks improved performance.

Posters

Comparing two enzymeimmunoassays to a radioimmunoassay for measuring progesterone concentrations in bovine plasma, whole milk and skim milk. M.G. Colazo¹, D. J. Ambrose^{1*}, J.P.

Kastelic², and J.A. Small². ¹Alberta Agriculture Food and Rural Development, ²Agriculture and Agri-Food Canada.

We compared two enzymeimmunoassays (EIA) to a radioimmunoassay (RIA) for measurement of progesterone (P4) concentrations in bovine plasma, whole milk and skim milk. Samples ($n = 216$) from 24 lactating dairy cows in estrus, anestrus, diestrus or pregnant states were analyzed by RIA, a solid-phase EIA (SPEIA-included a solvent extraction step), or a direct EIA (DEIA-no solvent extraction). Data were analyzed by ANOVA procedures of SAS. Determination of P4 among assays did not differ ($P < 0.4$). Regardless of sample type, RIA determined higher P4 in diestrus and pregnant cows than SPEIA ($P < 0.03$; 7.3 ± 3.9 and 6.1 ± 3.8 ng mL⁻¹); proportion of cows with P4 concentrations < 1 ng mL⁻¹ was 0, 8 and 0% for RIA, SPEIA and DEIA, respectively ($P < 0.05$). In contrast, DEIA tended to determine higher P4 in estrous and anestrus cows than RIA ($P < 0.08$; 1.1 ± 0.6 and 0.2 ± 0.1 ng mL⁻¹). Furthermore, RIA tended to determine higher P4 in plasma ($P = 0.09$) than in skim milk whereas both EIAs determined greater ($P < 0.001$) P4 in plasma than in skim or whole milk. In summary, in diestrus or pregnant cows, SPEIA determined lower P4 concentration than RIA or DEIA, whereas DEIA tended to overestimate P4 values in estrous and anestrus cows.

Stability of bovine milk progesterone under different thawing temperatures. A. Lamont, M.G. Colazo, D.J. Ambrose*. Agriculture Research Division, Alberta Agriculture Food and Rural Development, 204, 7000 - 113 Street, Edmonton, AB T6H 5T6.

The objective was to determine the effects of thawing temperatures on the stability of bovine milk progesterone (P4). Whole milk samples from 19 pregnant dairy cows were analyzed in duplicate using a commercial ELISA (QUANTICHECK, Budapest, Hungary). Data (reported as Mean \pm SE) were analyzed by Mixed procedures of SAS. Milk samples were collected and divided into three subsamples (30 mL each). All samples were assayed fresh (unfrozen control) and then stored at -20°C . Subsamples were thawed at 35°C (waterbath), 21°C (room temperature), or 4°C (refrigerator), assayed and refrozen 4 consecutive times (at 7, 14, 28, and 56 d of storage). Progesterone declined in all groups during the 56 d of storage ($P < 0.01$; from 5.2 ± 0.1 to 3.7 ± 0.1 ng mL⁻¹). The largest decline in P4 (1.1 ± 0.1 ng mL⁻¹) occurred in the first 7 d. However, thawing temperature did not affect P4 ($P < 0.8$; overall mean, 4.2 ± 0.1 ng mL⁻¹). Results indicate that storage affects P4 stability but thawing temperature had no detrimental effect.

Stability of bovine milk progesterone under different storage conditions. A. Lamont, M.G. Colazo, and D.J. Ambrose*. Agriculture Research Division, Alberta Agriculture Food and Rural Development, 204, 7000 - 113 Street, Edmonton, AB T6H 5T6.

This study determined the effects of storage conditions on the stability of bovine milk progesterone (P4; ng mL⁻¹). Whole milk samples from 19 pregnant dairy cows were analyzed in duplicate using a commercial ELISA (QUANTICHECK, Budapest, Hungary). Data were analyzed by Mixed procedures of SAS. In exp. 1, samples with or without preservative (Brotab 10, Systems Plus, New Hamburg, ON) were stored at 4°C or at 21°C . Samples were assayed at 0 (fresh control), 3, 7, 14, 28, and 56 d after storage. Overall, P4 declined ($P < 0.01$) from 0 to 28 d (5.2 ± 0.1 vs. 3.3 ± 0.1). However, P4 decline was lower ($P < 0.01$) at 4°C than at 21°C (4.3 ± 0.1 and 3.8 ± 0.1 vs. 3.9 ± 0.1 and 3.0 ± 0.1 at 3 and

56 d, respectively). Brotab tended ($P < 0.08$) to reduce P4 decline. In exp.2, samples were stored at -20°C and analyzed at 14 or 56 d; P4 declined ($P < 0.01$) from 0 (5.2 ± 0.1) to 14 d (4.1 ± 0.2) but did not decline further at 56 d (4.2 ± 0.2). Results indicate that P4 is highest in fresh milk, and that storage temperature affects P4 stability. At room temperature, even without a preservative, milk P4 remained relatively stable for up to 56 d.

Development of microsatellite markers in the American mink (*Mustela vison*). S. Ansari^{1*}, A. Farid¹, R. Anistoroaei², K. Christensen², and B.F. Benkel¹, ¹Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, Nova Scotia, B2N 5E3, Canada, ²Division of Genetics, Department of Basic Veterinary & Animal Science, The Royal Veterinary and Agricultural University, Grønnegaardsvej 3, 1870 Frederiksberg C, Denmark.

Two size-selected mink genomic libraries were constructed by digesting DNA with either Sau3A1 or NlaIII enzymes. Recombinant colonies ($n = 6144$) were screened with two pools of probes to detect rare tetranucleotide repeats, in addition to the more abundant dinucleotides. The AC pool included (AAAC)₈, (AAAT)₈, (AACC)₈, (ATGG)₈ and (AC)₁₅, and the AG pool contained (AAAG)₈, (AAGG)₈, (AGGG)₈, (ATAG)₈ and (AG)₁₅ oligonucleotides in equal amounts. Hybridization revealed 122 positive colonies, whose DNA inserts were PCR amplified and bi-directionally sequenced. Ninety three new microsatellites were identified, which consisted of 58 dinucleotides, 10 tetranucleotides and 25 complex repeats of which eight were tetranucleotides associated with other repeats. The AC pool resulted in the detection of a greater number of microsatellites as percentage of recombinant colonies (1.18%) compared with the AG pool (0.65%). The number of tetranucleotides and complex repeats were similar between the two pools of probes, but the AC pool revealed almost 3 times greater number of dinucleotides than the AG pool, which is expected in view of the fact that AC/TG repeats are more abundant than AG/TC repeats in mammalian genomes. These markers will almost double the coverage of the linkage map of the mink genome which is under construction.

Preservation of high-moisture alfalfa hay with buffered propionic acid. J. Baah*, F.H. Van Herk, and T.A. McAllister. Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB, Canada T1J 4B1.

Preservation of high-moisture alfalfa hay with buffered propionic acid was studied by monitoring internal bale temperatures for 60 d and by chemical and microbiological analyses of forage and cured hay. Second growth alfalfa (*Medicago sativa* L.) cut at mid-bloom was baled at 23% (high, HM), 18% (medium, MM), or 13% (low, LM) moisture content. At baling, buffered propionic acid (Hay Green; Wausau Chemical Corp., Wausau, MI), or an equal volume of water (for controls), was applied to the forages at rates of 2 kg tonne⁻¹ onto LM, 4 kg tonne⁻¹ onto MM, and 8 kg tonne⁻¹ onto HM. Control and treated bales were prepared consecutively (800-kg square bales) from triplicate windrows randomly assigned to moisture level. Data were analyzed using the MIXED models procedure. With LM and HM alfalfa, average daily temperatures were similar between control and treated bales, but with MM, treated bales averaged 5.4°C cooler ($P < 0.001$) than the controls. Microbial populations at d 60 were unaffected ($P > 0.29$) by treatment in HM and MM bales, but with LM alfalfa, lactobacilli populations had decreased ($P = 0.01$) and yeasts were more numerous ($P = 0.02$) in treated compared with control bales. Treated MM hay

had higher crude protein content (19.5% vs. 18.4%; $P = 0.03$) than did MM control. All other chemical components were similar ($P \geq 0.07$) among treatments. Buffered propionic acid reduced heating and improved crude protein retention in alfalfa baled at 18% moisture, but in this study, no advantage of treatment was observed when forage was baled at 13% or 23% moisture.

A direct-fed microbial product reduces fecal shedding of *Escherichia coli* O157:H7 by feedlot cattle during finishing. S. J. Bach¹, J. Baah^{2*}, L. R. Barbieri², and T. A. McAllister². ¹Agriculture and Agri-Food Canada, ²Pacific Agri-Food Research Centre, Summerland, BC V0H 1Z0; and ²Lethbridge Research Centre, Lethbridge, AB T1J 4B1.

The effect of including a direct-fed microbial product (DFM) in feedlot diets on fecal shedding of *Escherichia coli* O157:H7 was monitored in 100 individually fed Hereford x Angus steers over 252 d. The backgrounding and finishing diets comprised barley grain, barley silage, and supplement in ratios of 35:60:5 and 86:9:5, respectively (DM basis). The DFM was a mixture of *Lactobacillus casei*, *Lactobacillus lactis* and their fermentation products. It was incorporated into the diets at 0 (control), 40, 80 or 120 million cfu kg⁻¹ (as fed), yielding treatments CON, DFM40, DFM80 and DFM120, respectively ($n = 25$). Fecal samples were collected from each steer (rectal grab) on day 0 and at 28-d intervals thereafter, and assessed for the presence of *E. coli* O157:H7. *Escherichia coli* O157:H7 was detected only once (DFM40; d 28) during backgrounding. During finishing, fewer ($P < 0.05$) samples were positive for *E. coli* O157:H7 in DFM80 and DFM120 than in CON or DFM40. Fewer ($P < 0.05$) steers tested positive for *E. coli* O157:H7 in DFM80 than in the other treatment groups, but the number of steers that shed the organism on multiple occasions was lowest ($P < 0.05$) in DFM120. Including this DFM in feedlot diets at levels of 80 or 120 million cfu kg⁻¹ may reduce shedding of *E. coli* O157:H7 by cattle during finishing and the associated prevalence of this pathogen in the feedlot environment.

Correlation between feeding consumption rate and *Penaeus indicus* weight changes in shrimp culture ponds in Helleh site. Mehrab Banafi*. Aquaculture Dept., Fishery Research Center, Bushehr, Iran.

One of the most important subjects in aquaculture is detection of relationship between biotic and abiotic factors, and their effects on growth and survival. This study was carried out in three ponds of 0.4 ha stocked by 25 shrimp pl/m² was allocated in Helleh site in Bushehr province in 2002. The mean production and the FCR and the mean weight of *Penaeus semisulcatus* was obtained to be 1014, 1, 11/57 respectively. Among factors such as water temperature, salinity, pH, planktonic bloom, food consumption rate, ammonia, nitrate, phosphate and dissolved oxygen, food consumption rate has showed the most correlation to shrimp weight ($r = 0/842$).

Effect of treating whole-crop barley (WCB) with urea on degradability. B. Bazrgar*, E. Rowghani, M. J. Zamiri, Department of Animal Science, College of Agriculture, Shiraz University, Iran.

In situ dry matter and protein degradation of urea supplemented whole-crop barley in the rumen of Mehraban rams were studied. DM degradability estimated from disappearance of DM from dactron bags. The degradable fraction CP is converted to ammonia, fatty acids and CO₂, with a portion of ammonia being used for microbial protein synthesis in the rumen. The undegradable frac-

tion escapes digestion in the rumen and subsequently available for intestinal digestion and absorption. Degradability coefficients of DM and CP were determined by using Dacron bags in three rumen fistulated rams. Bags were made of dacron having an average mesh size of 48 mm. Approximately 5 g (oven dry) of the three diets (preserved WCB with 50 and 75 g kg⁻¹ DM urea and preserved WCB without urea) placed in dacron bags which were tied shut with nylon string. Then the bags suspended in the rumen of the rams for 2, 4, 8, 16, 24, 48, 72 and 96 h. At the end of each incubation time the bags were removed from the rumen and washed under running tap water until the rinsing was colorless (approximately 1 min). Washed nylon bags were dried in oven at 650C for 48 h. The content of each bag was subjected to Kjeldahl N analysis. The percent disappearance of dry matter (DM) and nitrogen (N) at each incubation time was calculated from the proportion remaining after incubation in the rumen. The disappearance rate was fitted to the following equation (Ørskov and McDonald 1974) $p = a + b(1 - e^{-ct})$. Degradability data were analyzed using the Fig. P computer software. Coefficients of DM and CP disappearance (g kg⁻¹ DM) from dacron bags for each three diet are shown in table 1 and 2. Urea treatment resulted in an increase in degradability (a + b) of CP. Degradability of DM decreased for 50 g kg⁻¹ DM urea-treated WCB but increased slightly for 75 g kg⁻¹ DM urea-treated WCB. The results of the present study indicated that the addition of urea to whole crop barley at 0.75% fresh weight may be recommended in order to increase the feeding value of the preserved WCB.

Simultaneous detection of eight single nucleotide polymorphisms in the ovine prion protein gene. B.F. Benkel^{*1}, E. Valle², N. Bissonnette³, and A. Farid¹. ¹Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3; ²Bioproducts and Bioprocesses Program, Lethbridge Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada T1J 4B1; ³Bioproducts and Bioprocesses Program, Dairy and Swine Research and Development Centre, Lennoxville, QC, Canada J1M 1Z3.

Amino acid polymorphisms in the endogenous prion protein gene (PrP) affect the susceptibility of sheep to scrapie, a transmissible spongiform encephalopathic (TSE) disorder. In particular, amino acid substitutions at codons 136, 154 and 171 of the ovine PrP gene are associated with differing degrees of susceptibility to the most common form of scrapie, caused by "typical" scrapie agents. Existing genotyping tests for scrapie susceptibility normally interrogate only the three single nucleotide polymorphisms (SNPs) most relevant to "typical" agents. Recently, however, a number of novel variants of the scrapie agent have been discovered. The ability of these new, "atypical" scrapie variants to infect sheep that are resistant to "typical" variants has raised concerns about the reduction in genetic variability that may result from intense selection for resistance to "typical" scrapie. Moreover, interest in assessing the role of specific PrP genotypes in modulating performance traits is promoting a move toward more extensive characterization of haplotypes at the PrP locus. Here we describe a single-tube method for the interrogation of eight SNPs within codons 112, 136, 141, 154, 171, 231 and 241 of the ovine PrP gene. The method is as accurate as direct sequencing and can be automated for high-throughput sample screening.

Proteomic mass profiling of biomarkers in saliva – application to animal welfare. Nigel J. Cook^{1*}, Denise Froehlich¹, Pierre Lepage², John S. Church¹, and Allan L. Schaefer². ¹Alberta Agriculture, Food and Rural Development, Lacombe Research

Centre, Alberta; ²Agriculture and Agri-Food Canada, Lacombe Research Centre, Alberta.

Biomarkers of disease, stress, pain and emotional states such as fear, are crucial to the assessment of animal welfare. Proteomics is defined as the simultaneous analysis of all protein species in biological samples e.g., serum, saliva, CSF. The technique used for this analysis is matrix assisted laser desorption/ionization, time of flight, mass spectrometry (MALDI/TOF/MS). The mass spectrogram of protein peaks is termed a protein mass fingerprint (PMF), or profile (PMP). Thus, a unique PMP biomarker can be generated for different biological states and comparisons among PMPs used to identify highly specific protein biomarkers. Saliva-based analyses have been used for diagnostics, reproductive and stress endocrinology for many years. Saliva-based assessment of biomarkers has advantages due to the relative ease of sample collection. However, major technical difficulties need to be overcome before consistent and reliable PMP can be derived from saliva. The complexity of raw sample, particularly the abundance of a relatively few proteins, tends to mask the presence of less abundant species. Acidification of saliva samples, prior to separation on C18 magnetic beads, increased the numbers of peaks detected from 97 with 0.1% TFA to 174 peaks with 0.5% TFA and 177 peaks with 1.0% TFA. This paper reports on initial experiments in the collection, handling, storage and processing of saliva samples for MALDI/TOF/MS analysis.

Responses of selected milk fatty acids to incremental feeding of sunflower oil and analysis by principal components. C. Cruz-Hernandez*, R. J. Weselake, E.K. Okine, J.J. Kennelly, J.G.K. Kramer, and L.A. Goonewardene. Department of Agriculture Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada T6G 2P5.

The objectives were to recognize linear or quadratic trends of milk fatty acids, CLA isomers, milk yield and components in response to feeding incremental levels of sunflower oil (SFO) and study the interrelationships among components by principal component analysis. Holstein cows (n=78) were randomly allocated to dietary treatments: control (n = 19), 1.5 (n = 20), 3.0 (n = 19) and 4.5% (n = 20) SFO fed on a dry matter basis. Trends were determined by analysis of variance while correlations and principal components were obtained by CORR and PRINCOMP procedures in SAS respectively. Short chain fatty acids (SCFA) showed a linear decrease (P < 0.01). C18:1-12t, C11t_9c-CLA, C10c12c-CLA and C11c13c-CLA showed a quadratic trend (P < 0.01) in response to incremental SFO, while total CLA and isomers C18:1-11t, C9c11t-CLA, C7t9c-CLA, C9t11c-CLA, C10t12c-CLA and C11t_9c-CLA showed a linear increase (P < 0.01). C9c11t-CLA and total CLA were highly correlated (r = 0.93–0.94; P < 0.01) with C18:1-11t hence could be accurately predicted from C18:1-11t (r² = 87–88%). Percent fat was negatively correlated with all the CLA isomers including C10t12c-CLA (r = -0.40, P < 0.01), suggesting that C10t12c-CLA depresses fat synthesis. The first two PCs accounted for 60.73% of the total variation. Twelve of the variables C18:1 5t, C18:1 6-8t, C18:1-10t, C18:1-11t, C18:1-12t, total 18:1 trans, C9c11t-CLA, C7t9c-CLA, C9t11c-CLA, C9t_10t_7t, total CLA, 9c11t+7t9c+9t11c that were included in PC1, showed a linear response to feeding incremental levels of SFO and were either precursors or products formed from a common metabolic pathway. Incremental feeding SFO is effective in increasing the total CLA, C18:1-11t and C9c11t-CLA but in C10c12c-CLA, C11c13c-CLA, C11t13t-CLA little or no increase was obtained beyond the 3% SFO level.

Evaluating the effects of Carophyll Red[®], Carophyll Yellow[®] and crab meal as dietary carotenoids on egg yolk pigmentation in laying hens. M.A. Daniel*, T.L. MacKinnon, and D.M. Anderson. Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, Nova Scotia, Canada B2N 5E3.

This study was conducted to investigate the effects of various dietary carotenoid sources on egg yolk pigmentation in laying hens. Two hundred and forty, Babcock White Leghorn hens (65 wks of age) were randomly allocated to 1 of 5 diets (Control (C), 10 g tonne⁻¹ Carophyll Red[®] (CR), 20 g tonne⁻¹ Carophyll Yellow[®] (CY), 10 g tonne⁻¹ CR + 20 g tonne⁻¹ CY (CR/CY), 80 kg tonne⁻¹ crab meal (CM)). All hens were fed the pigment depleted wheat based diet (C) for 15 d prior to the trial. Yolk pigmentation (L*, a*, b*) was measured initially and then every 15 d for a 60 d period. L* scores decreased on day 30 and day 45 for CR (59.49 ± 0.34, 60.17 ± 0.34), CR/CY (57.74 ± 0.34, 57.89 ± 0.34) and CM (58.19 ± 0.34, 58.95 ± 0.34) when compared with C (62.67 ± 0.34, 63.54 ± 0.34). There was an increase in red pigmentation (a* score) on day 30 and day 45 among treatments supplemented with CR (13.74 ± 0.33, 11.78 ± 0.33), CR/CY (16.72 ± 0.33, 16.23 ± 0.33) and CM (15.67 ± 0.33, 13.40 ± 0.33) when compared with C (4.02 ± 0.33, 2.84 ± 0.33) ($P < 0.05$). Yellow pigmentation (b* score) on day 45 increased for CY (57.59 ± 1.07) and CR/CY (57.08 ± 1.07) when compared with C (51.08 ± 1.07) ($P < 0.05$). There were no effects ($P > 0.05$) on performance with supplementation of dietary pigments. The addition of CR, CY and CM altered the pigmentation of yolks to the extent that may be aversive to consumers. Further research would be beneficial to determine the appropriate inclusion levels in order to meet consumer preferences.

Life cycle analysis of an environmental technology for on-farm pyrolysis of poultry manure for energy production. Goretty M. Dias^{1*}, Lindita Bushi¹, Steven B. Young¹, Carlos M. Monreal², and Peter Fransham³. ¹GHGm.com, Guelph, Ontario, Canada, N1H 4W8; ²Agriculture and Agri-Food Canada, Ottawa, Ontario; ³Advanced Biorefinery Inc., Ottawa, Ontario, Canada.

A Canadian agricultural life cycle analysis (LCA) model was used to analyze the environmental performance of an on-farm facility using a fast pyrolysis process designed to convert poultry manure to a biofuel (BioOil), gases and a nutrient-rich char co-product. The BioOil can be used as a heating fuel, while the gases can be used for producing electricity in poultry production systems. The on-farm environmental performance of the new technology was compared to the benchmark poultry production system, in which day-old chicks are raised to 8 weeks in an energy-intensive production cycle. The use of chicken manure for heat and power will offset greenhouse gases generated by use of fossil fuels for heat and electricity. Additionally, bioliquids are a source of high commercial value chemicals, which have potential to improve the economic status of farmers. Preliminary results from the LCA showed that 97% of the poultry production system's energy needs came from the energy produced from pyrolysis of the poultry litter. Using BioOil also resulted in greenhouse gas emission reductions through displacement of fossil fuels in the benchmark production system. The LCA indicates that excess BioOil produced could also be sold and further reduce greenhouse gases by displacing fossil fuel use.

Effect of resting bunks on glycemic control and body condition of lactating mink (*Mustela vison*). Jennifer Dobson*, Kirsti Rouvinen-Watt. Nova Scotia Agricultural College, 58 River Road, Truro, Nova Scotia, Canada B2N 5E3.

In late lactation, mink dams can no longer recover their energy losses from food alone, resulting in weight loss leading to hyperglycemia. In severe cases this results in nursing sickness, ending in death. Flexible resting bunks in the cages of lactating mink were believed to provide a temporary escape from lactational demands and the heat the nest box, allowing more movement of the dam. And therefore an ideal body condition, resulting in normoglycemic levels. This experiment used 200 female mink (100 with bunks and 100 controls). Fifty control and 50 bunk mink were tested for blood glucose concentration, body weight and body condition score at the start of the project, day 1 PP (post-partum), day 21 PP and day 42 PP. After parturition, kit data was collected. Results showed no significant differences between the two groups in blood glucose concentrations, body weight nor body condition score. In the control group more kits were born live on day 1 and average litter weights were heavier on day 42. This suggests that the introduction of the bunks in late gestation may have had a negative impact on the viability of kits. An earlier introduction of the bunks may help eliminate this problem.

The fatty acid composition of mature versus youthful Canadian beef: emphasis on the conjugated linoleic acid (CLA) and trans-18:1. M.E.R. Dugan^{1*}, J.L. Aalhus¹, D.C. Rolland¹ and J.K.G. Kramer². ¹Agriculture and Agri-Food Canada, Lacombe Research Centre, 6000 C&E Trail, Lacombe, Alberta, Canada, T4L 1W1; ²Food Research Program, Agriculture and Agri-Food Canada, Guelph, ON, N1G 5C9.

Mature cattle typically consume high levels of forage and forage versus concentrate feeding increases levels of "healthy" fatty acids (omega-3, conjugated linoleic (CLA) and trans-vaccenic acids). The present work was undertaken to obtain baseline Canadian data on the fatty acid composition of youthful beef (A/AA-grade; maturity judged by ossification) which are over and under 30 months of age (age estimated by dentition) and the mature commercial beef D grades. Subcutaneous fat between the 12th and 13th ribs was obtained from 18–20 animals per grade. These were subjected to analyses using silver-ion HPLC and GC with a highly polar 100 m column. There were no differences in total trans-18:1 content between any grades but animals over 30 months (youthful and D grades) had more trans-vaccenic acid ($P < 0.05$) whereas animal under 30 months of age had more t10-18:1 ($P < 0.05$). Animal under 30 months had less total CLA ($P < 0.05$) mainly due to a lower level of c9,t11-CLA, but they did have slightly more t7,c9-CLA ($P < 0.05$). Animals over 30 months had more omega-3 fatty acids (0.56% versus 0.29%; $P < 0.05$). Overall, animals over 30 months had fatty acid profiles with higher levels of "healthy" fatty acids. It is not known whether these would counterbalance the effects of 46% saturated fatty acids found in fat from all grades of beef.

Differences between European and North American Suffolk sheep in haplotype frequencies at the prion protein gene. A. Farid^{1*}, B.F. Benkel¹, and D.G. Bishop². ¹Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3; ²Department of Engineering, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3.

Alanine (A) or valine (V) at codon 136, histidine (H) or arginine (R) at codon 154 and glutamine (Q), R or H at codon 171 of the prion protein gene influence the degree of resistance of sheep to the typical strains of scrapie agent. Genotypes of 168 registered mature Suffolk sheep from 13 farms in Nova Scotia were determined at these three codons. The rare H₁₇₁ allele was not distinguished from Q₁₇₁. The frequencies of the A₁₃₆R₁₅₄R₁₇₁ (low risk),

A₁₃₆R₁₅₄Q₁₇₁ (intermediate) and V₁₃₆R₁₅₄R₁₇₁ (high risk) haplotypes were 0.29, 0.67 and 0.03, respectively. The corresponding values for 329 Suffolk sheep from 20 farms in British Columbia were 0.38, 0.59 and 0.03, respectively. The frequencies of the A₁₃₆R₁₅₄R₁₇₁ were comparable with those in the Suffolk breed from the USA and Japan (0.17 to 0.23), but were considerably lower than 0.62 to 0.78 reported in several studies in European countries. The observed differences may be due to genetic drift, the high incidence of scrapie in Europe compared to North America, and the presence of associations between the susceptible haplotype and genes that modulate traits that are favoured by breeders in North America, such as body dimensions and appearance. The possibility of crossbreeding in the ancestry of North American Suffolk cannot be ruled out.

Effects of growth rate, sex and slaughter weight on fat firmness and total fat composition of pig bellies. J.A. Correa^{1,2}, J.P. Laforest¹, M. Marcoux³, J. Rivest⁴, C. Gariépy⁵, and L. Faucitano^{3*}. ¹Département des sciences animales, Université Laval, Ste.-Foy, Quebec, Canada G1K 7P4; ²F. Ménard Inc., Ange Gardien, 251, Route 235, Ange-Gardien, Quebec, Canada J0E 1EA; ³Agriculture and Agri-Food Canada, Dairy and Swine Research and Development Centre, P.O. Box 90, Sherbrooke, Quebec, Canada J1M 1Z3; ⁴Centre de Développement du Porc du Québec, 2795 boul. Laurier, Ste.-Foy, Quebec, Canada G1V 4M7; ⁵Agriculture and Agri-Food Canada, Food Research and Development Centre, 3600 Bld. Casavant West, St-Hyacinthe, Quebec, Canada J2S 8E3.

A total of 119 Duroc × (Landrace × Yorkshire) pigs were used to investigate the effect of growth rate (fast vs. slow), sex (barrows vs. gilts) and slaughter weight (107, 115 and 125 kg) on commercial belly fat characteristics. Backfat was thicker in barrows as the weight increased ($P < 0.05$), but fat firmness score was only affected by sex ($P < 0.05$), gilts showing softer bellies than barrows. Belly fat from gilts and slow growing pigs showed higher proportion of C18:2 ($P < 0.01$) and PUFA ($P < 0.001$ and $P < 0.01$, respectively), as well as higher ratios of PUFA:SFA ($P < 0.001$) and n-6:n-3 ($P < 0.01$), and increased IV ($P < 0.001$) than barrows and fast growing pigs. Belly fat from barrows and fast growing pigs had higher stearic fatty acid (C18:0; $P < 0.01$) and SFA proportions ($P < 0.001$ and $P < 0.01$, respectively) than those from gilts and slow growing pigs. Furthermore, the proportion of PUFA tended to be higher in the belly fat from gilts slaughtered at 125 kg ($P = 0.06$). Belly fat from gilts and slow growing pigs is healthier for human consumption but is also more prone to rancidity during storage.

Effect of physical and heat processing of cottonseed on chewing activity of Holstein dairy cows. A.R. Foroughi^{1*}, A. A. Naserian², R. Valizadeh², and M. Danesh Mesgaran². ¹Education Centre of Khorasan Jihad-Agriculture, Animal Science Department, Mashhad, Iran. ²Ferdowsi University of Mashhad, Animal Science Department, Mashhad, Iran.

Based on chewing response, whole cottonseed (WCS) appears to be the most effective fiber source from byproduct feeds. Multiparous cows ($n = 12$) were used in a 4 × 4 Latin square design. Cows were fed total mixed diets: 1) WCS; 2) WCS + 16 g Met & 20 g Lys (WCS2); 3) ground cottonseed (GCS) heated in 140°C and steeped for 20 minute (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute + 20 g Met & 30 g Lys (GHCS2). Chewing activity was estimated through a visual observation method at 5-minute intervals during 24 h. The mean DMI was significantly ($P < 0.01$) affected by diets and in treatments of 1, 2, 3

and 4 were 21.08, 21.19, 22.57 and 27.63 (kg d⁻¹), respectively. Physical processing of WCS and ruminally protected Met and Lys(RPML) did not affect ruminal pH and mean for treatments was 6.48. The mean rumination times between treatments (min/kg NDF intake) were significantly different and for treatments 1, 2, 3 and 4 were 37.01, 36.49, 35.70, and 34.61, respectively. Chewing activity was similar for four treatments averaging 775.03 min 24 h. Significant differences were not observed in eating activity min/24 h and min/kg NDF Intake and ruminating activity (min 24 h), Grinding and heat treatment of cottonseed and RPML supplement did not affect of chewing activity of dairy cows.

Effect of ruminally protected amino acids on milk yield and composition of Holstein dairy cows fed processed cottonseed. A.R. Foroughi^{1*}, A. A. Naserian², R. Valizadeh², and M. Danesh Mesgaran². ¹Education Centre of Khorasan Jihad-Agriculture, Animal Science Department, Mashhad, Iran. ²Ferdowsi University of Mashhad, Animal Science Department, Mashhad, Iran.

The objective of this study was to evaluate the effect of processing (grinding and moist heat) of whole cottonseed (WCS) and ruminally protected lysine(Lys) and methionine(Met) on milk composition and production of Holstein lactating cows during early lactation. Multiparous cows ($n = 12$) were used in a 4 × 4 Latin square design. Cows were fed: 1) WCS; 2) WCS + 16 g Met & 20 g Lys (WCS2); 3) ground cottonseed (GCS) heated in 140°C and steeped for 20 minute (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute + 20 g Met & 30 g Lys (GHCS2). The mean DMI was significantly ($P < 0.01$) affected by diets and in treatments of 1, 2, 3 and 4 were 21.08, 21.19, 22.57 and 27.63 (kg d⁻¹), respectively. Physical processing of WCS did not affect ruminal pH and mean for treatments was 6.48. MY was significantly ($P < 0.01$) affected by the diets and was greatest for HGCS2 (35.78 kg d⁻¹) and the lowest for WCS (33.07 kg d⁻¹). Milk fat percentage and yield were unaffected by diets. Milk protein percent was progressively increased, averaging 3.21%, 3.30%, 3.28% and 3.48% for 1, 2, 3 and 4 treatments, respectively. Results indicated that when cows were fed WCS and processed cottonseed associated ruminally protected lysine and methionine milk yield and composition were improved.

Effect of ruminally protected methionine and lysine on milk nitrogen fractions of Holstein dairy cows fed processed cottonseed. A.R. Foroughi^{1*}, A. A. Naserian², R. Valizadeh², and M. Danesh Mesgaran². ¹Education Centre of Khorasan Jihad-Agriculture, Animal Science Department, Mashhad, Iran. ²Ferdowsi University of Mashhad, Animal Science Department, Mashhad, Iran.

The experiment was conducted to investigate the effect of processing (grinding and moist heat) of whole cottonseed (WCS) and ruminally protected lysine(Lys) and methionine(Met) on milk nitrogen(N) fractions of Holstein lactating cows during early lactation. Multiparous cows ($n = 12$) were used in a 4 × 4 Latin square design. Cows were fed: 1) WCS; 2) WCS + 16 g Met & 20 g Lys (WCS2); 3) ground cottonseed (GCS) heated in 140°C and steeped for 20 minute (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute + 20 g Met & 30 g Lys (GHCS2). MY was significantly ($P < 0.01$) affected by the diets and was greatest for HGCS2 (35.78 kg d⁻¹) and the lowest for WCS (33.07 kg d⁻¹). Milk protein percent was progressively increased, averaging 3.21%, 3.30%, 3.28% and 3.48% for 1,2,3 and 4 treatments, respectively. Met and Lys supplementation of HGCS2 resulted in increased ($P < 0.05$) in casein N and in treatments of 1, 2, 3 and 4 were 0.37%, 0.39%,

0.39% and 0.42%, respectively. Total and whey N showed the same pattern of response as observed for casein N. There isn't significant difference between milk NPN treatments. Physical processing of WCS and amino acid supplement can affect milk protein and N fractions.

Ruminal parameters and plasma metabolites of Holstein dairy cows fed processed cottonseed. A.R. Foroughi^{1*}, A. A. Naserian², R. Valizadeh², and M. Danesh Mesgaran². ¹Education centre of Khorasan Jihad-Agriculture, Animal Science Department, Mashhad, Iran. ²Ferdowsi University of Mashhad, Animal Science Department, Mashhad, Iran.

The study was carried out to determine the effect of processing (grinding and moist heat) of whole cottonseed (WCS) and ruminally protected lysine (Lys) and methionine (Met) on ruminal parameters and plasma metabolites of Holstein lactating cows during early lactation. Multiparous cows ($n = 8$) were used in a 4 x Latin square design. Cows were fed: 1) WCS; 2) WCS + 16 g Met & 20g Lys (WCS2); 3) ground cottonseed (GCS) heated in 140°C and steeped for 20 minute (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute + 20 g Met & 30g Lys (GHCS2). Diets were formulated to contain 20% alfalfa hay, 15% corn silage, 12% different processed cottonseed. Ruminal samples were taken via stomach tube at approximately 2 h postfeeding and blood samples from coccygeal blood vessels at the time of ruminal sampling. Supplementation with HGCS1 and HGCS2 resulted in decreased ($P < 0.05$) in ruminal N-NH₃ concentrations and in treatments of 1,2,3 and 4 were 14.04, 13.64, 10.11 and 9.76 (mg dL⁻¹), respectively. Blood urea showed the same pattern observed for ruminal N-NH₃. Physical processing of WCS and ruminally protected Met and Lys(RPML) did not affect ruminal pH, plasma triglycerides and albumin. Significant differences ($P < 0.05$) were observed in glucose concentration, but processing of WCS did not affect low density lipoproteins.

Neutral detergent fiber digestibility of selected fiber sources. A. M. Gehman*, P. J. Kononoff, and Z. D. Alger. University of Nebraska, Lincoln, 68583 USA.

In vitro neutral detergent fiber digestibility (IVNDFD) of corn silage (CS), alfalfa haylage (AH), and wet corn gluten feed (WCGF) were compared. Feeds were fiber sources from a 305-d milk production experiment replacing CS, AH, ground corn, and soybean meal with WCGF. NDF content of the feeds were 43.5, 46.5, and 37.6% DM for CS, AH, and WCGF. IVNDFD was determined at 0, 2, 4, 8, 16, 24, 36, 48, and 96 h. Rate of NDF digestion was slower ($P < 0.01$) for CS and WCGF 6.93 and 6.58 %/h than AH (11.43 %/h) but not different ($P > 0.05$) between CS and WCGF. NDF digestion lag was longer ($P < 0.01$) for CS (9.60 h) than AH and WCGF (5.21 and 4.51 h), but AH and WCGF were not different ($P > 0.05$). Potential extent of digestion (PED) of NDF was different among feeds ($P < 0.01$): 62.6, 37.3, and 77.8% for CS, AH, and WCGF. The differences in PED among feeds may be attributed to lignin content: 8.5, 15.3, and 3.7% of the NDF fraction for CS, AH, and WCGF. These findings help to explain why cows consuming rations containing WCGF had higher DMI and milk production.

Using of potato vines in fattening of Lori-Bakhtiari growing lambs. Ahmad Ghodrathnama^{1*}, Mehrab Faraji-Nafchi². ¹Agricultural and Natural Resources Research Centre of Khorasan, Mashhad, Iran, ²Agricultural Organization of Kohkelye-Boyerahmad Province, Iran.

An experiment was conducted to evaluate the effect of replacing of alfalfa with aerial parts of potato in Lori-Bakhtiari fattening lambs. Forty male lambs with initial weight of 41.35^{kg} were allocated to five treatments with eight replicate of each treatment during 80 days of fattening period. A basal ration consisted of 29% of forage (alfalfa) and 71% concentrate, as control and the other treatments (treatment 2 to 5 respectively) contained 6.25, 12.50, 18.75, and 25.00% of aerial part of potato replaced for alfalfa. All rations were isocaloric and isonitrogenous. The experience was arranged according to completely randomized design. Results of gain showed that there was no significant difference among the treatments, also daily feed intake was not affected by treatments. Feed digestibility, feed efficiency and carcass yield were not significantly influenced by dietary treatments. These results indicated that replacing aerial part of potato (potato vein) for alfalfa at 25% in the rations of fattening lambs had no negative effect on animal performance, carcass characteristics and yield.

Effect of an active dry yeast on intake and gain by feedlot cattle. Darryl Gibb^{1*}, Gordon Donaldson², and Tim McAllister¹. ¹Agriculture and Agri-Food Canada, Lethbridge Alberta Canada, ²Lallemand Animal Nutrition, Milwaukee, WI.

The effects of feeding an active dry yeast (*Saccharomyces cerevisiae* CNCM-1077; Levucell-SC, Lallemand Animal Nutrition, Milwaukee, WI) on performance of feedlot cattle fed barley-based diets was investigated using 1195 British cross heifers (initial weight 394 ± 7.4 kg) randomly assigned to 12 feedlot pens (96 to 100 heifers per pen). The yeast product was included in the supplement mash delivered to six of the pens, to target a daily intake of 0.40 g (80 billion CFU) per heifer. Backgrounding diets were fed for 38 d, and contained monensin at 22 mg kg⁻¹ DM. Finishing diets contained monensin at 22 mg kg⁻¹ (control) or 33 mg kg⁻¹ (Levucell-SC diet), as well as tylosin phosphate at 11 mg kg⁻¹ DM, and were fed until heifers in a pen were deemed finished by the feedlot manager and were sold. Finished weights were similar between control heifers and those fed yeast (580 ± 3.7 vs. 585 ± 3.3 kg; $P = 0.31$). During backgrounding and overall, DM intake by control and yeast-fed heifers was similar (10.6 vs. 1.8 kg d⁻¹; $P = 0.47$ and 10.0 vs. 10.2 kg d⁻¹; $P = 0.52$). During finishing, however, the product tended to improve gain/feed (0.111 vs. 0.106; $P = 0.11$) and rate of gain (1.12 vs. 1.06 kg d⁻¹; $P = 0.10$), resulting in fewer days (165 vs. 182; $P = 0.03$) required to reach finish weight. Feeding Levucell-SC allowed reduced use of monensin with slightly improved performance.

Effects of manipulating the NO/cGMP pathway on bovine oocyte nuclear maturation in vitro. Sylvie Bilodeau-Goeseels*. Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403 1st Ave. S., Lethbridge, Alberta, Canada T1J 4B1.

A better understanding of the mechanisms involved in the control of oocyte meiosis is necessary to improve the efficiency of in vitro embryo production. The objective of this study was to examine the effects of manipulating the nitric oxide/cyclic guanosine monophosphate (NO/cGMP) pathway on bovine oocyte nuclear maturation in vitro. Cumulus-oocyte complexes were recovered from slaughterhouse ovaries and cultured in M199 + FCS for 7 or 21 h in the presence of various molecules affecting the NO/cGMP pathway and then fixed and stained for evaluation of the stage of nuclear maturation. The iNOS inhibitor, aminoguanidine (AG) at 10 and 50 mM and the NO donor sodium nitroprusside (SNP) significantly inhibited meiosis after 7 h of culture. The effect of these agents was reversible showing that it is not a toxic effect.

Activation of guanylate cyclase with protoporphyrin or atrial natriuretic peptide, or inhibition of the enzyme with ODQ did not have any significant effect on meiosis after 7 h of culture suggesting that AG and SNP do not act by modifying cGMP levels. Similarly, ODQ and the PKG inhibitor KT5823 did not reverse the effects of SNP further supporting the idea that SNP does not act through the cGMP/protein kinase G pathway.

The effects of dietary fatty acid composition on milk fat and prostaglandin production in sows. Janet L. Rafuse¹, Derek M. Anderson², and Kathleen E. Glover^{2*}. ¹ACA Co-operative Limited, 43 Minas Warehouse Road, New Minas, Nova Scotia, Canada B4N 5A5; ²Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Nova Scotia.

Fish oil (FO) is rich in omega-3 polyunsaturated fatty acids (PUFA) including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) while flaxseed oil (FS) is rich in shorter chain omega-3 fatty acids. PUFA are precursors for prostaglandin synthesis. The objectives of this study were to determine the effects of feeding EPA and DHA-enriched fish oil to lactating sows on milk composition and prostaglandin production. Twelve sows were fed daily a lactation ration and 600 g FO, 600 g FS, or no oil. Milk samples were collected on day 5, 13, and 21 post-farrowing. Voluntary sow urine samples were collected on day 20 for prostaglandin analysis. On day 5, FO sows had significantly lower ($P = 0.05$) milk fat (5.8%) compared with 8.0% (control) and 8.0% (FS). The same was found for day 13 ($P = 0.07$; 5.4% FO, 7.1% control, 7.2% FS). On day 21, no significant difference was observed in milk fat ($P = 0.14$) although FO still had the lowest mean (5.6) and the FS milk fat percent had decreased (5.9%). Sows fed FO had the lowest mean levels of both PGE₂ (10.6 ng mL⁻¹ compared with 13.6 ng mL⁻¹ control and 19.12 ng mL⁻¹ FS; $P = 0.09$) and PGF₂α (5.4 ng mL⁻¹ compared with 12.2 ng mL⁻¹ control and 11.4 ng mL⁻¹ FS; $P = 0.0072$) in their urine, although for PGE₂ the FO treatment was not significantly different from the control.

Tissue distribution of beef primal cuts in composites and opportunities for harvesting lighter, younger and leaner cattle. L.A. Goonewardene*, J.A. Basarab, Z. Wang, M.A. Price, P. Ramsey, T. Marx, J. Aalhus, D. Milligan, E.K. Okine, and R.T. Berg. Agricultural Research Division, Alberta Agriculture Food and Rural Development, Edmonton, Alberta, Canada T6H 5T6.

The objectives were to compare weights and proportions of muscle, fat and bone in the carcass, primal cuts and fat depots and determine optimum slaughter times in five BeefBooster (M1, M2, M3, M4 and TX) composites ($n = 176$) serially harvested in two years. The study regrouped the five lines of cattle according to biological type. The small (SM) type contained the M3 composite made up of small breeds, Angus × Hereford (AH) type contained the M1 and M2 composites, having either an Angus or Hereford base, and the Gelbvieh (G), Limousin (L) or Charolais (C) composite (GLC) contained M4 made up of either G or L and TX made up of C. Weights and proportions were analyzed by covariance within slaughter age (274, 347, 372, 399, 427, and 456 d) with type (SM, AH and GLC) as fixed, year (1 & 2) as random and age as a covariate. In the carcass and primals, weight of muscle and fat and fat proportion increased while the proportion of muscle decreased with slaughter age. SM had less muscle ($P < 0.05$) than AH and GLC in the carcass and primal cuts with the exception of the loin, plate and rib at 399 d, and the shank and rib at 427 d. The muscle:fat ratio decreased with increase in slaughter age. The round had

the least amount and proportion of fat. The weight and proportion of fat in all primal cuts differed ($P < 0.05$) between composites. The GLC can be harvested at 456 d while the SM and AH composites can be harvested earlier. This would maximize the proportion of muscle and optimize carcass fat to between 25–31% giving producers flexibility in marketing diverse biological types.

In situ rumen degradability of deoxynivalenol (don) contaminated barley hulls detoxified through the use of high temperature, alkaline treatments. J.D. House^{1*}, J. C. Plaizier¹, D. Abramson², G. Gozho¹, and C.M. Nyachoti¹. ¹Department of Animal Science, University of Manitoba, Winnipeg, MB, R3T 2N2; ²Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg, MB, R3T 2M9.

Hull removal from DON-contaminated barley yields a product suitable for swine feeding, but a management strategy must be devised for the contaminated hull co-product. Two studies were conducted to a) characterize an alkaline DON detoxification procedure and 2) determine the in situ rumen degradability of the resultant detoxified barley hulls. DON-contaminated barley hulls (DON = 35.3 ppm) were subjected to 2 alkaline treatments (1.5 vol/wt of 0.5 or 1.0 M sodium carbonate), 3 temperatures (40, 60 or 80°C), and 5 times (0, 4, 8, 12, and 24 h). DON removal was significantly greater at higher sodium carbonate levels and temperatures ($P < 0.0001$), and followed a general decay curve over time. Mean DON levels did not reach levels below 1.0 ppm for any of the treatment combinations using 0.5 M sodium carbonate. For 1.0 M sodium carbonate, DON levels of 1.0 ppm were reached at 24 h @ 60°C and 8 h @ 80°C. In situ rumen degradability of the latter two hull treatments were determined using 3 fistulated jersey steers. These alkaline-heat treatments increased the % potential rumen degradability ($P < 0.0001$) of the barley hulls from 67% to 83–86%, yielding a potential feed ingredient for ruminants.

The effect of feeding a novel dry corn milling co-product to lactating dairy cows. B.N. Janicek*, P.J. Kononoff and A.M. Gehman, University of Nebraska-Lincoln, Department of Animal Science, C220b Animal Science, Lincoln, 68583-0908 USA.

The objective was to evaluate the effect of replacing forage with a novel corn milling co-product (Dakota bran cake; DBC). Twenty-three multiparous and sixteen primiparous Holstein cows, averaging 115 ± 61 DIM and 650 ± 83 kg BW, were randomly assigned one of three dietary treatments in a cross-over design. During each of the 28-d periods, cows were offered rations differing in proportion of DBC 1) 10% DM, 2) 17.5% DM, and 3) 25% DM. Diets were formulated to be chemically similar. Dry matter intake was not different ($P = 0.91$) among treatments, averaging 23.8 ± 0.31 kg d⁻¹. Milk production tended ($P = 0.07$) to increase with increasing levels of DBC (32.7, 33.4, and 35.8 kg d⁻¹ ± 1.30). There was no difference ($P = 0.40$) in 3.5% fat corrected milk, averaging 33.6 ± 0.72 kg d⁻¹. Milk fat percentage decreased ($P = 0.05$) with increasing levels of DBC (3.58, 3.49, 3.32% ± 0.10). Protein yield increased ($P = 0.02$) as DBC increased (0.97, 0.10, 1.09 kg d⁻¹ ± 0.04). Feed conversion also increased ($P = 0.03$) with increasing levels of DBC (1.39, 1.39, and 1.55 ± 0.05). Feeding DBC tended to increase milk production and protein yield while decreasing fat percentage.

Effects of time of feed delivery and subacute ruminal acidosis (SARA) on diurnal variation of free rumen lipopolysaccharide endotoxin (LPS) and acute phase proteins in lactating dairy cows. E. Khafipour*, J. C. Plaizier, and D. O. Krause. Department

of Animal Science University of Manitoba, Winnipeg, MB, Canada.

The effects of experimentally induced subacute ruminal acidosis (SARA) and feed delivery time on diurnal variations in rumen lipopolysaccharide (LPS) and peripheral acute phase proteins were studied in four rumen-fistulated dairy cows during two successive 6 wk periods. Between week's 1 and 5 of each period, cows received total mixed ration ad-libitum with forage: concentrate ratio of 50:50, either at 0900 or 2100. In both wk 6, SARA was induced by replacement of ~18% of feed DM with pellets containing 50% wheat and 50% barley. Rumen fluid and blood samples were collected 15 min before feeding and 6 and 12 h after feeding. Rumen pH was monitored continuously. Time of feed delivery did not affect daily averages of rumen pH, LPS and peripheral blood concentrations of the acute phase proteins serum amyloid-A and haptoglobin. There was a significant ($P < 0.05$) interaction between time of feeding and hours post feeding on diurnal variation in rumen pH and LPS. The acute phase proteins did not show diurnal variation. Rumen LPS at 6 h post feeding was higher (65,900 vs. 48,650) and rumen pH was lower (5.79 vs. 5.95) in PM fed cows than in AM fed cows.

The effect of different levels of feed intake on pancreatic growth and alpha-amylase concentration in beef cattle. M. Ko*, Y. Wang, Y. Montanholi, C. Mader, S. Holligan, and K.C. Swanson. Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario Canada.

The objective of this experiment was to determine the effect of different dry matter intake levels on pancreatic growth and alpha-amylase content in beef cattle. Twenty-four yearling Angus-cross steers (initial BW of 463.0 ± 24.2 kg) were fed individually using Calan gates a high-moisture corn-based finishing diet at one of four levels (1.25%, 1.50%, 1.75%, and 2.00% BW, DM basis) for an average of 45 d. After the feeding period, steers were slaughtered, the pancreas was removed and weighed, and a subsample collected for later analyses. Pancreatic weight (g) increased linearly ($P = 0.01$) and pancreatic weight (% of BW) numerically increased ($P = 0.19$) as intake increased. However, pancreatic DNA concentration (mg/g) decreased ($P = 0.002$) as intake increased, while RNA and protein concentration (mg/g) did not differ. There was a quadratic effect ($P = 0.03$) due to increased intake for pancreatic alpha-amylase concentration (IU/g) with the highest concentration observed in the 1.50% group. Total pancreatic alpha-amylase content (KIU) increased ($P = 0.07$) as intake increased. These data indicate that increased intake induced hypertrophy and an increase in alpha-amylase content in pancreas. Increases in total pancreatic alpha-amylase content were partly due to differences in pancreatic weight, which were partially due to differences in BW.

Ammonia emissions from beef feedlot cattle fed barley-based diets varying in protein concentration and source. K. M. Koenig*, S. M. McGinn, and K. A. Beauchemin. Agriculture and Agri-Food Canada, P.O. Box 3000, Lethbridge, AB T1J 4B1.

Ammonia emissions from feedlot pens and growth performance were quantified for growing and finishing beef cattle. Cattle were balanced by body weight ($247 \text{ kg} \pm 10 \text{ kg}$) and allocated to 24 pens of 13 steers each. The basal diets were barley-based and consisted of 55% silage and 45% concentrate for the backgrounding phase and 9% silage and 91% concentrate for the finishing phase. The four dietary treatments included a control with no protein supplementation (12% crude protein) and the control diet supplemented

with urea, urea and canola meal, or urea, corn gluten meal and a bypass soybean meal (~14.3% crude protein). Every 3 wk, one pen of steers fed the control diet and one pen fed one of the protein supplemented diets were moved to two isolated pens for the measurement of ammonia emissions using the passive diffusion technique. Ammonia traps were mounted daily for four days at heights of 0.5, 1, 2 and 3 m on the north, south, east and west sides of the pen. Ammonia emissions for the control and protein supplemented diets averaged 4 and 8 g N/steer/d for the backgrounding phase and 15 and 19 g N/steer/d, respectively, for the finishing phase.

Simultaneous haplotype model for QTL mapping using dense markers. D. Kolbehdari*, J. A. B. Robinson, and L. R. Schaeffer. Center for Genetic Improvement of Livestock, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1; Department of Animal Science, Aboureihan Campus, University of Tehran, Iran.

A simultaneous multiple marker haplotype model was used for detecting and locating a single QTL within a 10 cM region of DNA using 10 equally spaced SNP markers. The QTL was assumed to be bi-allelic and located between markers 5 and 6. Monte Carlo simulation of a granddaughter design with 30 sires and 400 sons was used. The model assumes linkage disequilibrium after many generations of historical recombination. Haplotype interval effects were estimated for all intervals simultaneously. The model was applied to four scenarios of parameter combinations. Combinations were the ratio of QTL variance to total genetic variance (0.1 or 0.05), the number of generations of historical recombination (100 or 25), and frequencies of marker alleles (0.5 or 0.8). The sum of absolute values of estimated haplotype interval effects within each interval pair provided a statistic for locating the QTL. Interval effects could be estimated using the same variance ratio for all intervals or using interval dependent variance ratios. The effect of increasing the number of markers to 20 (within a 10 cM region of DNA) was also studied. Power of detecting and locating the QTL with 20 markers was 0.84 to 0.99 versus 0.63 to 0.92 with only 10 markers. Precision in estimating QTL location was within a 1.32 to 1.36 cM region with 10 markers. Estimating interval specific variance ratios also gave better empirical power and precision.

Evaluation of triticale with or without a commercial dietary enzyme for broiler chickens. R. Jacobs¹, D.M. Anderson¹, J.L. MacIsaac^{1*}, and M.A. Mirza². ¹Nova Scotia Agricultural College, Truro, NS, Canada; ²Institute of Animal Nutrition & Feed technology, University of Agriculture, Faisalabad, Pakistan.

Triticale with and without a commercial enzyme was fed for 38 days in two trials with 736 male broiler chicks in trial 1 and 380 in trial 2. The experiment was a one way analysis in a completely randomized design with dietary treatment (0%, 22.5%, 45% triticale (Titan cv.), 45% plus a commercial enzyme (45%+E)) as the main factor. For trial 1, birds fed the 22.5% diet had lower ($P \leq 0.05$) 38-d body weights (2173, 1991, 2145, and 2135 g bird⁻¹ for 0%, 22.5%, 45% and 45%+E respectively) and consumed less ($P \leq 0.05$) feed (1166, 1074, 1179, and 1179 g bird⁻¹ for 0%, 22.5%, 45% and 45%+E respectively) than those fed other diets but there was similar ($P > 0.05$) feed conversion (1.61, 1.60, 1.60 and 1.60 feed gain⁻¹ bird⁻¹ for 0%, 22.5%, 45% and 45%+E respectively) among diets. Diet did not affect ($P > 0.05$) intestinal viscosity (1.93, 1.79, 1.92, and 2.14 cP for 0%, 22.5%, 45% and 45%+E, respectively). For trial 2, diet had no effect ($P > 0.05$) on growth performance. Feeding triticale (Titan cv.) at a level of 45% of the

diet had no detrimental effects on growth performance and the addition of a dietary enzyme was not required.

Association of visceral organ weights, plasma metabolites, and pancreatic enzyme levels with residual feed intake in feedlot steers of different breed types. C.J. Mader*, G. Schick, S.P. Miller, and K.C. Swanson. Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada.

Variation of feed efficiency in beef cattle is well-documented, but little is known about what is responsible for this variation. This study attempts to identify physiological mechanisms associated with variation in residual feed intake (RFI). Crossbred steers (316.4 ± 36.1 kg) from Piedmontese (PI, $n = 14$), Charolais (CH, $n = 20$) and Angus/Simmental (AN/SM, $n = 12$) sires were fed a corn-silage-based ration (56d) before being adapted to a high-moisture-corn-based finishing diet (min 89d) and individual feed intake was recorded. RFI was determined using a multiple regression prediction equation. At slaughter, visceral organ weights were recorded and tissue and blood samples collected. Pancreatic tissue was analyzed for total α -amylase (AML) and trypsin (TRP) activities, and plasma was analyzed for urea nitrogen. CH had heavier colons (% of BW; $P < 0.001$) than AN/SM or PI and spleen weights (% of BW) differed between all breed types (CH > PI > AN/SM, $P < 0.0001$). AN/SM had higher PUN ($P = 0.04$) than CH or PI. RFI did not differ between breed types ($P = 0.28$). However, RFI was correlated with TRP (-0.3163 , $P = 0.04$) and marbling (0.3609, $P = 0.01$). Results suggest that the partitioning of fat deposition may impact RFI. In addition, the process of protein digestion and utilization may be a significant contributor to variation in RFI.

Effect of seaweed supplement on shedding of *Escherichia coli* O157:H7 by cattle challenged via rectal or oral inoculation upon arrival at the feedlot. T.A. McAllister^{1*}, S.J. Bach², L.R. Barbieri¹, and Y. Wang¹. ^{1,2}Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403-1st Avenue South, Lethbridge AB T1J 4B1; and ²Pacific Agri-Food Research Centre, 4200 Highway 97, Summerland, BC V0H 1Z0.

A 2 × 2 factorial study was conducted with 32 Hereford × Angus calves (295 ± 8 kg) in eight feedlot pens to determine the effect of feeding sun dried *Ascophyllum nodosum* seaweed (Tasco 14; Acadian Seaplants Limited, Dartmouth, NS) on fecal shedding of *Escherichia coli* O157:H7 for 84 d following oral or rectal inoculation. The calves received 10 billion cfu of a mixture of five strains of nalidixic acid-resistant *E. coli* O157:H7 by mouth (oral, OR) or by swab to the rectal-anal junction (rectal, RC). The seaweed was fed for 40 d at 0 (control, C) or 2% (Tasco, T) of dietary DM, replacing barley silage in a diet containing 37% barley grain, 58% barley silage and 5% supplement (DM basis). Fecal (rectal grab), oral (mouth swab), and environmental (water; pen floor fecal pat) samples were collected weekly for 84 d. Duration and extent of shedding of *E. coli* O157:H7 was higher ($P < 0.05$) with OR than with RC. Seaweed reduced the duration ($P < 0.05$) and intensity ($P < 0.07$) of shedding following OR but not RC. Fecal samples were positive more frequently ($P < 0.001$) than were oral swabs. Frequency of positive oral swabs was similar ($P > 0.05$) among treatments. Five of 48 water samples were positive for *E. coli* O157:H7, as were 18, 11, 9 and 10 of 24 fecal pats from OR-C, OR-T, RC-C and RC-T, respectively. Pulsed-field gel electrophoresis revealed differential persistence among inoculated strains in the animals and the environment. Study design is underway to assess the effectiveness of Tasco-14™ for reducing shedding of *E. coli* O157:H7 by naturally infected cattle.

The effects of restrictive feeding and gender on pig growth performance and carcass quality. P. L. McEwen* and I. B. Mandell, Dept. of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada.

Feeding strategy and gender effects were examined on 108 market hogs using a 2 × 3 factorial design. Pens of six barrows or gilts (32.9 ± 3.3 kg) were assigned to either full feeding (FF) until pigs attained 110 kg market weight or 70 (R₇₀) and 85 (R₈₅) percent of FF feed intake until pens averaged 60 kg BW. Full feeding was then followed until marketed at 110 kg. Gains were increased ($P < 0.01$) for FF versus R₇₀ to 60 kg (1.06 vs. 0.89 kg) with increased ($P < 0.01$) gains for R₇₀ pigs [1.16 (R₇₀) vs. 1.02 (FF)] during the finishing phase resulting in similar ($P > 0.45$) overall performance [1.03 kg (FF), 1.03 (R₈₅), 1.05 (R₇₀)]. Gains were greater ($P < 0.01$) for barrows versus gilts (1.09 vs. 0.99 kg) with similar ($P > 0.10$) total feed intake. Total feed intake was increased ($P < 0.01$) for FF versus R₇₀ (197.2 vs. 183.0 kg) resulting in reduced ($P < 0.01$) F/G for R₇₀ (2.6 vs. 2.4). Dressing percentage and loin depth increased ($P < 0.05$) for gilts versus barrows with no effect ($P > 0.15$) of feeding strategy. Fat depth increased ($P = 0.01$) for R₇₀ versus FF while carcass yield was reduced ($P = 0.005$). Therefore gender and restrictive feeding affected ($P < 0.05$) growth, feed intake and carcass parameters.

Gene frequency distribution of the BoLA-DRB3 locus in Iranian Sistani Cattle. Amir Mohammadi^{1*}, Mohammad Reza Nassiry, Center of Excellence in Animal Science, College of Agriculture, Ferdowsi University of Mashhad, P.O. Box: 91775-1163 Mashhad, Iran.

This study describes the genetic variability of BoLA-DRB3 gene in Iranian Sistani cattle. Cows ($n = 50$) were genotyped for bovine lymphocyte antigen (BoLA)-DRB3.2 alleles by polymerase chain reaction and restriction fragment length polymorphism method. Bovine DNA was isolated from aliquots of whole blood and a two-step PCR followed by digestion with restriction endonucleases RsaI, HaeIII and BstYI was conducted on the DNA from Iranian Sistani Cattle. In the herd studied, we identified 19 alleles. Alleles 8 and 34 had the highest allelic frequencies (22.4 and 21.0%, respectively). Moreover, a new RFLP pattern combination (eac) with frequency of 8.1% was found which has not been reported already. For confirmation of new allele, sequencing was conducted. Based on the results we recommend this pattern to be considered as a new allele for BoLA-DRB3.2 system. Although additional studies are required to confirm the present findings, but our results indicate that exon 2 of the BoLA-DRB3 Locus is highly polymorphic in Iranian Sistani Cattle.

PCR-RFLP polymorphism of prolactin gene in Iranian Sarabi Cattle. Amir Mohammadi*. Department of Animal Science, College of Agriculture, Ferdowsi University of Mashhad, P.O.Box: 91775-1163 Mashhad, Iran.

Prolactin (PRL) is one of the most versatile hormones of the pituitary gland in terms of its biological activities. A silent A-G mutation in the codon for amino acid 103 in exon 3 of bovine PRL gene gives rise to a polymorphic RsaI site. It has been shown that PRL-RsaI locus has a significant effect on milk yield and milk fat percent in dairy cattle. The aim of this study was to estimate the allelic frequencies at the PRL-RsaI of Iranian native Sarabi cattle. For this purpose, total genomic DNA extracted from blood samples ($n = 49$) and a set of primer pair used in standard PCR reactions to amplify a 156 bp fragment of exon 3 PRL containing RsaI site. To identify the genotype of each animal, related PCR products were

digested by RsaI treatment, before separation by poly-acrylamide gel electrophoresis. In the herd studied, frequency of allele A (0.91) was ten times more than allele B (0.9). With X² of 1.26, three genotypes of AA, AB, and BB each accounted for 84%, 14%, and 0.02% of population, respectively. Further studies are needed to reveal the relationship between PRL genotypes and milk production characteristics in Iranian native breeds.

The effects of distillers dried grains with solubles inclusion rate and gender on pig growth performance, feed intake and carcass composition. P. L. McEwen*. Ridgetown College-University of Guelph, Ridgetown, Ontario, Canada.

Effects of distillers dried grains with solubles (DDGS) inclusion rate and gender were examined on 96 feeder pigs (33.2 ± 5.8 kg). Each pen (3 barrows and 3 gilts) was randomly assigned to one of three grower diets until they were 70 kilograms body weight (BW) followed by a finisher diet until market (≥ 110 kg BW). Diets contained either 0 (Con), 10 (DG₁₀) or 20 (DG₂₀) percent DDGS with similar grower (0.82%) and finisher (0.67%) lysine levels. Daily gains (kg) were similar ($P > 0.15$) for each DDGS inclusion rate [1.06 (Con), 1.04 (DG₁₀), 1.04 (DG₂₀); SE = 0.01] while gain was increased (1.09 vs. 1.01; SE = 0.01; $P < 0.01$) for barrows versus gilts. Daily and total feed intake and feed to gain were also unaffected ($P > 0.05$) by diet. After correcting for hot carcass weight, subcutaneous fat (mm) was increased ($P < 0.01$) for barrows (21.0 vs. 18.3; SE = 0.6) while loin depths ($P = 0.80$) were similar. At the start of the finishing period DG₁₀ pigs had an increased subcutaneous fat depth (11.1 and 11.2 vs. 12.1; SE = 0.2; $P < 0.01$) while final carcass fat and loin depths were similar ($P > 0.10$). DDGS inclusion rate was therefore a non-significant ($P > 0.05$) contributor to differences in pig performance, feed intake and carcass composition.

Effects of dietary omega-3 polyunsaturated fatty acids on milk composition in sheep. Doveasy Mitton*, Leslie A. MacLaren, Alan H. Fredeen, Catherine T. Enright, and Kathleen E. Glover. Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro NS Canada.

Modification of milk fat to contain increased levels of long-chain omega-3 (n-3) polyunsaturated fatty acids (PUFA) has potential for improving health of consumers. The objective of this research was to determine changes in milk composition resulting from dietary supplementation of n-3 PUFA from conventional sources, flaxseed and fish oil, and from varying levels and types of microalgae. Sixty lactating Rideau Arcott ewes were randomly assigned to one of ten different dietary supplements. The diets included three protected microalgal supplements and protected flaxseed oil fed at 10 g d⁻¹ and 20 g d⁻¹, and an eicosapentaenoic acid (EPA)/docosahexaenoic acid (DHA)- enriched fish oil fed at 20 g d⁻¹. Hydrogenated cottonseed oil was fed as a control supplement at 20 g d⁻¹. Milk fatty acid analysis was conducted on samples collected at the end of the third week. Milk fat from ewes fed fish oil and microalgae 1 had significantly higher levels of DHA at 1.02 and 0.59 g 100 g⁻¹ fatty acids (FA) respectively, compared to the cottonseed oil control at 0.07 g 100 g⁻¹ FA. Milk EPA content was significantly increased in ewes receiving the fish oil supplement only (0.70 versus 0.08 g 100 g⁻¹ FA for the control). Flaxseed oil supplementation increased α -linolenic acid (1.51 g 100 g⁻¹ FA) but not DHA or EPA (both 0.09 g 100 g⁻¹ FA) content. The other two microalgal supplements did not significantly alter n-3 PUFA. In conclusion, supplementation with selected marine microalgae can be used to naturally enrich ruminant milk in desirable n-3 PUFA such as DHA.

Relationships among residual feed intake, plasma urea nitrogen concentration and infrared images in beef cows. Y.R. Montanholi*, M. Ko, C. Mader, T. Caldwell, S.P. Miller, K.C. Swanson, I.B. Mandell, and F.S. Schenkel. Department of Animal & Poultry Science, University of Guelph, Guelph, ON, Canada.

Feed expenses represent around 60% of the costs in cow-calf production. Therefore, measures related to feed efficiency, such as residual feed intake (RFI), are desirable. One-hundred-fourteen pregnant crossbred beef cows were randomly assigned to dietary treatments consisting of mainly haylage with four levels of wheat straw (0%; 20%; 40% and 60%, DM basis). Diets were formulated to meet or exceed requirements for energy and protein. Blood samples and infrared images were taken in the first and last week (nine-week experiment) with feed intake recorded daily for individual cows. Plasma urea nitrogen concentration (mg dL⁻¹; PUN) was greatest ($P < 0.05$) for the 60%-straw (12.25) and lowest for the 40%-straw diet (5.78), with the 0%-straw and 20%-straw diets intermediate. Cows fed 0%-straw diet had the greatest ($P < 0.10$) hind temperature (HT). Both within and across diets, HT was numerically ($P > 0.10$) greater for cows with high RFI (RFI > 1.0 kg DMI d⁻¹, less efficient) than for cows with low RFI (RFI < 1.0 kg DMI d⁻¹). High and low RFI cows showed a negative correlation ($P < 0.10$) between HT and PUN (-0.21 and -0.19). As the use of the technology progresses, infrared images may be useful in the assessment of dietary treatment effects and also infrared images may have some predictive abilities for feed efficiency.

Effects of source of dietary non-structural carbohydrate on milk fatty acid profiles in Holstein dairy cows fed supplemental canola seed. T. Mutsvangwa*. Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada S7N 5A8.

Eight multiparous Holstein cows (676 kg BW; 120 DIM) were used in a replicated 4 × 4 Latin square design trial with 21-d periods to investigate the effects of four non-structural carbohydrate (NSC) sources on performance and milk fatty acid profiles in dairy cows. Four cows in one Latin square were fitted with permanent ruminal cannulae. The NSC sources evaluated were corn, barley, oats and wheat, which are commonly fed to dairy cows in western Canada and differ in their rates and extents of ruminal starch degradation. All experimental diets contained supplemental canola seed as a source of unsaturated fatty acids to achieve approximately 6% total dietary fat. Mean ruminal pH, dry matter intake and milk yield were unaffected ($P > 0.05$) by dietary treatment; however, cows fed corn or oats had higher ($P < 0.05$) milk fat content compared to those fed barley or wheat. Cows fed oats had higher ($P < 0.05$) milk fat contents of total mono- and polyunsaturated fatty acids, C18:1 *trans*, C18:1 *cis*, total C18:1, C18:2 *cis*-9, *trans*-11 and total CLA compared to those cows fed barley, wheat or corn. These results show that the source of dietary NSC affects milk fatty acid composition.

Rumen-protected methionine for early lactation Holsteins under high ambient temperatures. G. R. Ghorbani¹, D. Kyanzad¹, M. Alikhani¹, and A. Nikkha^{2*}. ¹Department of Animal Science, Isfahan University of Technology, Isfahan Iran. ²Department of Animal Science, University of Manitoba, Winnipeg, MB, Canada.

The objective of this study was to determine the impact of supplemental, rumen-protected methionine (Met) on performance of early-lactation cows under high ambient temperatures. Twenty five Holsteins were assigned to either a control or a Met treatment 2 wk

before parturition and monitored through 120 d in milk. The treatment cows received 12–17 g of Met daily in a TMR. Milk yield was recorded weekly, milk composition was measured biweekly, and body condition was scored at –14, 25, 60, and 110 d of calving. The ovary function and clearness of heat signs were quantified. The day ambient temperature during the trial varied between 27 to 45°C. Milk yield was regressed against time for individual cows, and the polynomial coefficients plus repeated data were analyzed as a Mixed Model. Feeding Met increased milk percent of protein, lactose and SNF in all cows; and tended to increase milk yields of fat and protein in second-calf cows. Met cows expressed more visible heat signs than control cows. Met cows tended to have a more consistent milk yield, evident by the lower curvature of lactation arch, than control cows. Results suggest that rumen-protected Met can benefit early-lactation cows under high ambient temperatures.

Diurnal patterns in feed intake of evening and morning fed lactating dairy cows. A. Nikkhah*, J.C.B. Plaizier, C. Furedi, and A.D. Kennedy. Department of Animal Science, University of Manitoba, Winnipeg, MB, Canada.

The effects of changing the time of fresh feed delivery from 0900 to 2100 on diurnal patterns in feed intake of lactating cows were determined. Eight tie-stall-housed Holsteins (83 d in milk) were used in a cross-over design with two 6-wk periods. A TMR containing a 50% concentrate was fed. The 24-h patterns in TMR intake were monitored continuously for the entire trial (Grow-Safe Sys, Model 4000). Data for week-5 of each period were analyzed with Proc Mixed of SAS (v. 9.1). The proportion of daily TMR intake consumed within 3-h postfeeding was 55% for 2100-fed cows but 46% for 0900-fed cows ($P = 0.06$). While proportion consumed within 6-h postfeeding was similar, within 9-h after feed delivery, 2100-fed cows consumed greater percent of their daily TMR intake than did 0900-fed cows (80 vs. 73%). By 15-h postfeeding, however, 0900-fed cows had consumed 96% but 2100-fed cows 90% of their daily intake. The evening feeding significantly increased dry matter intake in primiparous cows (20.4 vs. 18.4 kg d^{-1}) compared with morning feeding. Results suggest a significant impact of fresh feed delivery time on diurnal patterns in feed intake of tie-stall-housed dairy cows.

Time of fresh feed delivery and diurnal variation in rumen fermentation of lactating Holstein cows. A. Nikkhah*, J.C. Plaizier, C. Furedi, and A.D. Kennedy. Department of Animal Science, University of Manitoba, Winnipeg, MB, Canada.

Four rumen-cannulated mid lactation Holsteins cows received fresh total mixed ration (50% concentrate DM basis), at 0900 or at 2100. A cross-over design with two 6 wk periods, including 3 wk of adaptation, was used. Rumen pH was monitored continuously using indwelling pH probes, and rumen fluid was sampled at 0, 2, 3, 4, 6, 8, 12, 16, 20, and 24 h after feed delivery in wk 4. Daily averages of rumen pH and total VFA did not differ between treatments. Cows fed at 2100 tended to have a higher rumen VFA at 6-h post feeding and lower rumen pH at 5 and 6 h post feeding than cows fed at 0900. Acetate to propionate ratio was higher (3.6 vs. 3.2) in cows fed at 2100 compared to cows fed at 0900. Rumen ammonia at 2 h post feeding was higher, but daily averages of rumen ammonia were lower in cows fed at 2100 than in cows fed at 0900. Results show that time of feed delivery affects diurnal variation in rumen fermentation.

Feeding strategies to minimize the extent of enteric methane emissions from dairy cows into the environment. N. E.

Odongo^{1*}, A. Kramer², J. E. Las¹, O. AlZahal¹, B. Kerrigan³, E. Kebreab¹, J. France¹, T. May⁴, and B. W. McBride¹. ¹Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1; ²Department of Animal Sciences, Wageningen University, 6700 HB Wageningen, the Netherlands; ³54-2979 River Road, RR3 Chemainus, British Columbia, Canada V0R 1K3; and ⁴Mayhaven Farms, # 5209 Eramosa Township, Ontario, Canada.

Two experiments were conducted to i) demonstrate the effects of addition of fatty acids and ii) extent of dietary grain processing on enteric methane emissions in dairy cows. In experiment 1, methane emissions from 12 mature Holstein dairy cows (710 ± 17.3 kg, body weight) fed a control vs. myristic acid (50 g kg^{-1} DM) treated total mixed ration (% DM, corn silage, 33.2%; haylage, 22.1%; hay, 5.5%; corn, 20.2%; custom supplement, 18.9%) were compared. The experiment consisted of a 7-d pre-trial period when cows were fed a control total mixed ration to obtain baseline methane output, a 10-d adaptation period and a 1-d, 8-h methane measurement period. In experiment 2, methane emissions from steam flaked (SF; density, 479 to 509 g L^{-1}) vs. cracked corn (CC; density, 719 to 749 g L^{-1}) component-fed (as-fed, kg $cow^{-1} d^{-1}$, corn silage, 12.6; balage, 9.5; mixed hay, 2.5; corn, 5.5 and custom supplement, 5.0) cows on a commercial dairy farm were compared. The experiment consisted of a 14-d adaptation period and two 8-h methane measurements periods repeated after 6 consecutive days. Both experiments were conducted in tie-stall facilities. In experiment 1, addition of myristic acid to the total mixed ration reduced enteric methane emissions by 33% (613.6 vs. 409.5 L d^{-1} ; control vs. myristic acid diet, respectively, $P < 0.05$). In experiment 2, extent of grain processing had no effect ($P > 0.05$) on dry matter intake, milk yield and composition, oxygen and carbon dioxide concentration. The CC ration reduced methane emissions by 14% (615.7 vs. 704.2, CC vs. SF, respectively, $P < 0.05$). These results suggest that using simple dietary manipulation strategies, enteric methane emissions from dairy cows can be reduced significantly.

Feeding whole wheat of different varieties with or without dietary enzyme to broiler chickens. Khadijeh Rahimi^{1*}, Ali Mirza Agazadeh². ¹MSc Student, ²Assistant Professor, Animal Science Dept., Urmia University, 81110 Urmia, Iran.

A 2 × 2 × 2 factorial experiment with four replication of 10 chicks each was conducted to study the effect of two varieties with two wheat form (10, 25, 40 and 55% whole wheat replacing ground wheat during 7–14, 14–21, 21–28 and 28–42d, respectively), and two levels of xylanase (0 and 0.1 g kg^{-1} diet) on performance, digestive tract measurement and carcass characteristics of broiler chickens. The birds were pen-weighed at 7, 14, 21, 28, 35 and 42 d and feed consumption was determined for each of these periods. Feeding whole wheat in all of these periods except at 28–35 days of age did not significantly ($P > 0.05$) influence the growth rate and feed efficiency of birds. Wheat variety and enzyme addition had no effect ($P > 0.05$) on the bird performance. Wheat variety and Xylanase supplementation had no effects ($P > 0.05$) on the carcass characters, although whole wheat increased ($P < 0.05$) the relative weight of the gizzard and liver but had no effect on the influence ($P > 0.05$) carcass recovery, heart and the relative weight of abdominal fat pad. The results suggested that whole wheat feeding inclusion up to 40% improved performance and feed efficiency compared with the ground diets.

Feeding whole wheat of different varieties with or without dietary enzyme on the performance, digestive tract measure-

ment and gut morphology of broiler. Khadijeh Rahimi^{1*}, M. Agazadeh², R. Shahrooz³, and V. Sadati¹. Uremia University, M.Sc; and ²Faculty of Agriculture, Department of Animal Science and ³Department of Veterinary.

A 2 × 2 × 2 factorial experiment with four replication of 10 chicks each was conducted to study the effect of two varieties with two wheat form (10, 25, whole wheat replacing ground wheat during 7–14 and 14–21 d, respectively), and two levels of xylanase (0 and 0.1 g kg⁻¹ diet) on performance, digestive tract measurement gut morphology of broiler chickens. Two birds with body weight of close to the group mean were selected from each replication and slaughter at 21 d of ages for carcass analysis. Wheat variety, wheat form and enzyme supplementation had no significant effect on daily weight gain and feed conversion rate from 7 to 21 d of age. Although the birds from whole wheat (Zarin variety) with enzyme supplementation group (from 7 to 21 d of age) showed better performance than other experimental groups. Gizzard, intestine and pancreas weight were not significantly affected by wheat variety and enzyme supplementation. However whole wheat groups (irrespective of variety and enzyme supplementation) had significant effect on gizzard, pancreas and intestine weight ($P < 0.05$) Enzyme supplementation had no significant effect on villus height, villus diameter and crypt depth in the duodenum and ileum. Wheat variety (Zarin) significantly increased the villus height but decreased crypt depth in the ileum and duodenum. Wheat from (except villus height in the duodenum) had no significant effect on the other morphological traits.

Genetically modified canola and ruminal bacteria: investigations of horizontal gene transfer and effects of glyphosate in vitro. T. Reuter^{1*}, T. W. Alexander¹, T. Martinez², and T.A. McAllister¹. ¹Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB, T1J 4B1; ²Department of Applied Biology, University of Almeria, Almeria, Spain.

The use of glyphosate tolerant canola as feed for livestock has raised concern over the potential for horizontal transfer of transgenic material to ruminal bacteria, and over the possible effect on ruminal digestion of residual glyphosate on feedstuff. Diets containing 15% parental (PAR) or Roundup Ready (RRC) canola were used as substrates in anaerobic batch culture incubations. Inocula were prepared using ruminal fluid from two wethers fed the RRC diet. The incubation (300 mg substrate +20 mL inoculum in 35-mL serum vials; $n = 3$) was set up as a 2 × 5 factorial design of substrate type (PAR or RRC) × level of glyphosate included in the incubation (0, 5, 10, 50 or 100 mM). Gas production was measured after 3, 6, 12, 18 and 24 h of incubation. Fluid-associated bacteria were isolated from the 24-h vials for DNA extraction. PCR analysis was used for the detection of transgene in the bacterial DNA. Glyphosate did not impair ($P > 0.05$) ruminal fermentation, as indicated by gas production. Glyphosate may serve initially more as a feed substrate than a selective inhibitor for ruminal bacteria. Under the conditions of this study, no carryover of transgenic DNA fragments was observed.

Comparison among three methods to determine composition of pork loins from pigs fed different levels of wheat middlings. M.C. Rose*, D.M. Anderson, D.L. Patterson, and P.J. Gavin. Nova Scotia Agricultural College, 58 River Road, P.O. Box 550, Truro, NS, Canada.

Fifty pork chops analyzed using planimetry (P), image analysis (IA), and manual dissection (MD) were compared for percent tis-

sue lean, fat, and bone. Pigs at 20 kg initial weight were fed isocaloric and isonitrogenous diets containing 0% wheat middlings (WM), 20% WM or 40% WM, with or without dietary enzymes (E). Diets were formulated to meet specific nutrient requirements for pigs from 20–50 kg, 50–80 kg and 80–100 kg live weights. After commercial slaughter at 100 kg live weight, a common cross section of the loin approximately 20 mm thick was sampled, frozen and retained (–20°C). Percent fat for P, IA and MD were 34.6%, 36.2%, and 33.6% respectively. Percent lean for P, IA, and MD were 59.5%, 57.4%, and 56.0% respectively, while percent bone for P, IA, and MD were 5.9%, 6.4%, and 10.4% respectively. The three methods were compared using correlations comparing P and IA for fat, lean and bone were $r = 0.47, 0.43, \text{ and } 0.74$ respectively. Correlations comparing P and MD for fat, lean and bone were $r = 0.62, 0.49, 0.53$ and respectively. Correlations comparing IA and MD for fat, lean and bone were $r = 0.43, 0.40, \text{ and } 0.53$, respectively. Dietary wheat middling levels were not significantly different for the (mean + SEM) fat (34.8% + 0.75), lean (57.6 % + 1.0), and bone (7.6% + 1.4) in the pork chops ($P > 0.05$).

A comparison of two detection systems for the early identification of bovine respiratory disease (BRD) in calves. A.L. Schaefer¹, N.J. Cook², J.S. Church², J. Colyn^{1*}, P. Lepage¹, L. Holt-Klimec¹, S. Lohmann¹, D. Froehlich², D. Milligan³, and J. Basarab². ¹Agriculture and Agri-Food (AAFC), Lacombe, AB; ²Agriculture Food and Rural Development, ²Lacombe and ³Red Deer, AB.

Two methods of BRD detection were tested. Thirteen weaned and transported calves averaging 200 kg were exposed to commercial cattle carrying high titers for BRD viruses. Confirmation of BRD (true positive) was established in the 13 calves when two or more symptoms and cut off values (COV) were displayed: rectal temp $\geq 40^\circ\text{C}$, WBC < 7 or $> 11 \times 10^9/\text{L}$, clinical score (CS) ≥ 3 , a N/L ratio of < 0.1 or > 0.8 . BRD was confirmed in 4 of the 13 calves. Predictive values for BRD were calculated using CS or an orbital (eye) max infrared (IRT) temp. The COV for IRT was the mean orbital max value for the 13 calves $\pm 0.8\text{C}$ measured with a Flir S60 camera. Positive and negative predictive values and test efficiency were calculated three days and nine days post exposure to the commercial cattle. Once clinical BRD was apparent (CS ≥ 3) on day 9 both CS and IRT methods gave comparable results. However, when monitored on day 3 the diagnostic approached favoured the IRT method: PPV for CS = 25% vs. IRT at 75%; NPV for CS at 67% vs. 72% for IRT and E for CS at 54% vs. 77% for IRT. The data suggest that IRT is effective in the non invasive early detection of BRD in calves.

Beef feedlot cattle prefer more forage in their ration when given a choice. G. Zobel¹, K.S. Schwartzkopf-Genswein^{2*}, D. Veria³, B.M.A. Genswein², Gibb², A.M. Zobel⁴, D. Gibb², and M.A.G. von Keyserlingk¹. ¹Animal, Welfare Program, University of British Columbia, Canada, ²Agriculture and Agri-Food Canada, Lethbridge AB; ³Agriculture and Agri-Food Canada, Agassiz, BC. ⁴Institute of Spectroscopy, Trent University, ON.

Feedlot finishing diets in Western Canada typically contain 85–90% grain. These diets have been associated with ruminal acidosis and liver abscesses. The objective of this study was to determine the effects of allowing cattle to self determine their intake of concentrate and forage on growth and performance. 120 feedlot heifers (585 \pm 39 kg BW) were randomly assigned to either a Choice (animals self selected the amount of concentrate and forage) or a Control (TMR: 87% concentrate and 13% barley silage;

DM basis) treatment (4 pens/treatment). Cattle were provided ad libitum access to feed, water and a mineral block and individual daily DMI were collected for 68 d. Slaughter data included ribeye area, percentage of saleable meat and liver abscess scores. Choice heifers consumed 7% less concentrate than Control animals, and had a higher gain:feed ratio (0.17 ± 0.005 and 0.13 ± 0.005 kg kg⁻¹, respectively; $P < 0.003$). Daily DMI was also lower for the Choice heifers (7.60 ± 0.2 and 10.34 ± 0.2 kg d⁻¹, respectively; $P < 0.0001$). There were no treatment differences in ADG (1.36 ± 0.07 kg d⁻¹), or any of the carcass characteristics measured. These results suggest that feeding a TMR containing less concentrate to finishing cattle may be a viable, economical alternative to current feeding practices.

Stability of transgenic DNA in cell cultures. Ranjana Sharma*, Carolyn W Hurdle, Trevor W. Alexander, Tim A McAllister, and Sylvie-Bilodeau Goeseels. Agriculture and Agri-Food Canada, 5403- 1 Av. S, PO Box 3000, Lethbridge, AB T1J 4B1.

Genetically modified (GM) crops are widely adopted in the USA and Canada despite opposition in Europe and other countries. The public concern regarding GM plants revolves around consuming food which carries transgenic DNA sequences. We investigated the stability and uptake of 5-enolpyruvyl-shikimate-3-phosphate synthase (cp4 epsps) DNA from Roundup Ready® canola in human intestinal Caco-2 cells in vitro and monitored the process at 0.5, 1, 2, 4 and 24 h. After 0.5 h of incubation the complete (1.3 kb) transgenic DNA could not be detected by PCR in the culture media, cell washes or in DNA extracted from cells. However, transgene fragments (278 and 270 bp) could be detected from culture media at all time points especially at higher DNA concentration (100 ng mL). The fragments were taken up by the cells from extra cellular medium as early as 0.5 h seemingly by passive transport and were detected in DNA extracted from cells at 1, 2, 4 and 24 h. In conclusion, cp4 epsps DNA fragments can enter human intestinal cells in vitro but more experiments are needed to determine if the same phenomenon would occur when DNA is mixed with other food components.

Phylogenetic characterization of intestinal microflora using partial *cpn60* sequences – A preliminary analysis. Ranjana Sharma^{1*}, Robert J. Forster¹, S. J. John², Parasto Mirzaagha¹, and Tim A. McAllister¹. ¹Agriculture and Agri-Food Canada, 5403- 1 Av. S, Lethbridge, AB, Canada T1J 4B1; ²Lethbridge Community College, Lethbridge, AB, Canada T1K 1L6.

Conventionally, 16S rRNA gene sequencing has provided useful mapping and phylogenetic relationships for characterizing intestinal bacterial populations. However, due to the highly conserved nature of the 16S rRNA gene across different strains it does not always provide satisfactory resolution for the desired level of comparative analysis that is needed for selection and genotyping of certain strain-specific organisms. In recent years, alternate gene(s) have been identified to aid in the determination of phylogenetic relationships between different strains and for microbial community analysis. Using universal, degenerate primers based on a previous study (Hill et al. 2002), we amplified partial *cpn60* sequences for identifying and characterizing intestinal rumen bacterial populations. In this study, a sub set of rumen bacteria were selected on the basis of 16S rRNA gene similarity to compare the topography of the phylogenetic tree created using the *cpn60*. The bacteria selected were a combination of aerobes and anaerobes found in the rumen of cattle including closely related strains, and some that are phylogenetically distant based on known 16S data. Our results

indicate that *cpn60* is an accurate alternate approach and in fact may in some cases separate bacterial populations at a finer level than using 16S rRNA gene similarities.

Drinking and defecating frequencies and locations are affected by presence of a water trough when cattle graze near a creek. P.H. Sharpe^{1*}, A. Unc², J. Pitty Del Cid¹, R. Marcelissen¹, D.R. McKnight¹, and M. Goss¹. ¹University of Guelph, Kemptville College and ²University of Ottawa.

Environmental legislation requires cattle to be fenced away from waterways to avoid fecal pollution of the surface water. However, there are few previous reports that quantify the effect of grazing cattle near small waterways on fecal pollution indicators. The objective of this study was to determine the effect of a water trough in the paddock on the instances and locations of drinking and defecation. Fifteen pregnant Holstein heifers were submitted to two treatments (trough in paddock = T and no trough = NT), and rotationally grazed on a five acre pasture next to a creek in Kemptville, Ontario. During the T treatment, heifers had a choice of drinking location but during NT they could only drink from the creek. Heifers were observed 12 hours/day, 4 days/week, for 4 consecutive weeks in each treatment. Incidents of drinking and defecating (per zone: pasture, riparian, creek) were recorded. *LS means of drinking incidents/heifer/day were 2.26 for NT vs 7.13 for T* ($P < 0.01$), of which 7.05 were from the trough and only 0.08 were from the creek ($P < 0.01$). *Defecations/heifer/day (LS means) were 4.61 for NT and 3.00 for T on pasture; 0.21 for NT and 0.06 for T in the riparian zone; 0.15 for NT and 0.003 for T in the creek* ($P < 0.01$). In conclusion, the presence of a water trough increased the frequency of drinking away from the creek and decreased the frequency of defecations in the creek and riparian zone.

Influence of connective tissue architecture and maturity on brine distribution in moisture enhanced pork. B. Uttaro, J.L. Aalhus, M. McLaughlin, Agri-Food Canada, 6000 C & E Trail, Lacombe, AB T4L 1W1.

Ninety-one Duroc × Large White (D × LW) and Large White × Large White (LW × LW) barrows and gilts were slaughtered light (± 77 kg) and heavy (± 117 kg) to provide different stages of connective tissue maturity. Left sides were suspended conventionally, right sides from the aitch bone to stretch *longissimus dorsi* (LD) and *semitendinosus* (ST), and both cooled overnight at 2°C. LD and ST were removed, trimmed, machine-injected to 108% with brine containing 4.8% salt, 4.8% phosphate, and 200 ppm FDC Blue #1, and equilibrated overnight at 4°C. Muscles were sliced perpendicular to injection needle paths, photographed, and images analysed for area containing brine (% blue) and area of poorly distributed brine (% PDB). LW × LW LDs showed significantly more % blue ($P \leq 0.0001$). LDs and STs from heavy animals had significantly higher % blue ($P \leq 0.0001$) whereas % PDB was lower for LDs ($P \leq 0.0001$). Light STs had higher % pump ($P \leq 0.05$). Light LDs from LW × LW had significantly higher % pump ($P \leq 0.002$). Stretched LDs and STs had significantly higher % pump ($P \leq 0.005$) and % blue ($P \leq 0.02$), and lower % PDB ($P \leq 0.0006$). Addition of tension to the connective tissue matrix contributes to improved brine distribution to a similar degree as, but independently of, increased mature crosslinks.

Effects of turning technology and age of cattle on residual bone in mortality compost. K. Stanford¹, G.L. Wallins^{1*}, X. Hao², S. Xu¹, T.A. McAllister², and F. Larney². ¹Alberta Agriculture, Food and Rural Development, Lethbridge, Alberta; ²Agriculture and Agri-Food Canada, Lethbridge, Alberta Canada.

As mortality compost is land spread as a soil amendment, residual bones lack esthetic appeal and may damage tillage equipment. Consequently, the effects of two compost-turning technologies and age of cattle on proportion of bones remaining after completion of mortality composting were investigated. Compost windrows were constructed using barley straw and manure as amendments. Mature cattle mortalities (> 30 months of age, 11 020 kg wet weight) or feeder calves (< 30 months of age, 3895 kg wt weight) were added to duplicate windrows. Windrows were built in November and December of 2004 and turned 3 times at approximately 3-month intervals. Windrows were turned using a front-end loader or Allu grinding bucket (Allu Group, Hackensack, NJ). At the final turning, compost was passed through a 6 cm trommel screen (total weight 2000–3000 kg per windrow) and residual bones collected and weighed. Turning technology did not affect ($P > 0.05$) proportions of residual bones in compost. After adjustment for weight of mortalities, mature cow and feeder calf compost had similar proportions of residual bone, which in both cases comprised < 1% of finished compost. Consequently, residual bones are unlikely to impair land-spreading of large animal mortality compost.

A crude extract of Acadian seaweed: effects on in vitro ruminal fermentation and on *Escherichia coli* O157:H7. Y. Wang^{1*}, T. A. McAllister¹, and S. J. Bach². ¹Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB T1J 4B1 and ²Pacific Agri-Food Research Centre, Summerland, BC, VOH 1Z0.

A seaweed product (Acadian Seaplants Limited), shown previously to reduce *Escherichia coli* O157:H7 shedding by cattle, was studied as a crude methanolic extract (SWE) to further define its mode of action. In exp. 1, SWE was included at 0, 125, 250, or 500 $\mu\text{g mL}^{-1}$ in 48-h anaerobic incubations of forage substrate in ruminal inoculum. The SWE reduced ($P < 0.001$; linear and quadratic) gas production at 2, 4, 6, 8, 12, 24, and 48 h and volatile fatty acid accumulation at 12, 24, and 48 h, indicating an anti-microbial effect that inhibited ruminal fermentation. In exp. 2, growth curves of *E. coli* 25922 and three strains of *E. coli* O157:H7 (E318N, 3081, and EDL933) were determined with SWE present at 0, 250, or 500 $\mu\text{g mL}^{-1}$. The bacteria were inoculated (100 μg) into 95 mL of M9 buffer amended with 5 mL of stock solutions of SWE in 25% (vol/vol) dimethylsulfoxide and cultured for 24 h at 37°C (175 rpm). Optical density (OD600) was measured in 4-mL subsamples at 0, 1, 2, 3, 4, 6, 8, 12, and 24 h. In the absence of SWE, all four strains achieved maximum OD600 between 8 and 12 h, and held to 24 h. In contrast, growth was completely inhibited by 250 or 500 $\mu\text{g mL}^{-1}$ SWE. A non-specific anti-*E. coli* component in the methanolic extract of Acadian seaweed may be responsible for its observed anti-*E. coli* O157:H7 effects in vivo. Further work is required to determine the chemical nature and mode of action of this component.

Pluronic detergent administered in drinking water: effects on ruminal fluid characteristics of steers grazing alfalfa. Y. Wang^{1*}, B. Ralston², D. Milligan³, M. E. Olson⁴, and T. A. McAllister¹. ¹Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB T1J 4B1; ^{2,3}Alberta Agriculture, Food and Rural Development, ²Airdrie, AB and ³Red Deer, AB; ⁴Bow Valley Research, Calgary, AB.

The effects of a commercial bloat prevention additive (Alfasure, Rafter 8 Products, Calgary, AB) on ruminal fluid (RF) characteristics were assessed in a grazing study conducted over two years using 10 ruminally cannulated steers. The steers grazed vegetative alfalfa pasture for three 11-d periods in 2002, and for two 14-d

periods in 2003. During grazing, Alfasure (in 2003) or its active ingredient (in 2002) were administered in the drinking water at 0 or 0.06% (vol/vol). In each year, the steers crossed over treatment groups ($n = 5$) between grazing periods. Fresh paddocks were grazed each day from 0830 to 1430, followed by 18 h of access to water only. Ruminal fluid was sampled on the last 4 d of each period, immediately after steers returned from pasture. Both supplements reduced ($P < 0.05$) RF viscosity, compared with controls, but did not affect ammonia concentration or molar proportions of volatile fatty acids. Ruminal protozoa were less numerous ($P < 0.05$) in the treated steers than in the controls in two of three periods in 2002, but this was not observed in 2003. The stability of RF foam was greatly reduced ($P < 0.001$) with Alfasure, compared to control. It appears that Alfasure works primarily by reducing ruminal fluid viscosity and foam stability. These effects are related to the quantity of treated water consumed by the cattle.

Effects of Lanthanum on rumen fermentation, microbial protein synthesis and nutrient digestibility in steers. Q. Liu¹, C. Wang¹, Y.X. Huang¹, K.H. Dong¹, W.Z. Yang^{2*}, and H. Wang¹. ¹College of Animal Sciences and Veterinary Medicines, Shanxi Agricultural University, Taigu, Shanxi, P. R. China, 030801, ²Agriculture and Agri-Food Canada, Research Centre, P.O. Box 3000, Lethbridge, AB, Canada T1J 4B1.

Rare earth elements have been recently shown to improve growth performance of pig and may be used as safe and inexpensive alternative growth promoter in pig production. Objectives of this study were to evaluate the effects of La supplementation on rumen fermentation, microbial protein synthesis and digestibility in steers. Eight ruminally cannulated Simmental steers were used in a replicated 4 × 4 Latin square experiment. Treatments were control, La-low, La-medium and La-high with 0, 450, 900 and 1800 mg steer⁻¹ d⁻¹ LaCl₃, respectively. Diets were consisting of 60% corn straw and 40% concentrate (DM basis). Data were analyzed using the mixed model procedure of SAS. Intake (9 kg d⁻¹) was restricted to 90% of ad libitum. Ruminal pH (6.59 to 6.41) was linearly decreased ($P < 0.10$) but VFA concentration (74.2 to 88.6 mM) was linearly ($P < 0.05$) increased with increasing LaCl₃ supplementation. Ratios of acetate to propionate were linearly ($P < 0.01$) reduced from 3.26, 2.12, 1.84 to 1.78 for increasing LaCl₃ supplementation. Ruminal microbial protein was quadratically increased ($P < 0.10$) from 213, 242, 250 to 187 g d⁻¹ by increasing LaCl₃ supplementation from 0, 450, 900 to 1800 mg steer⁻¹ d⁻¹, respectively. Similarly, digestibilities of OM (72.1 to 77.9%), NDF (59.4 to 67.2%) and CP (72.1 to 77.3%) in the total tract were also quadratically improved ($P < 0.05$). The results indicate that LaCl₃ supplementation potentially improves rumen fermentation and feed digestion in beef cattle.

Effect of monensin and essential oil on feed intake, ruminal fermentation, milk yield and composition of lactating dairy cows. W. Z. Yang^{1*}, A. V. Chaves¹, M. L. He¹, C. Benchaar², and T. A. McAllister¹. ¹Agriculture and Agri-Food Canada, Research Centre, P. O. Box 3000, Lethbridge, AB, Canada, ²Agriculture and Agri-Food Canada, Dairy and Swine R&D Centre, Lennoxville, QC, Canada.

Four mid-lactating ruminally cannulated Holstein cows were used in a 4 × 4 Latin square experiment to evaluate the effects of monensin (MO) and essential oils (EO) on intake, rumen fermentation, milk yield and composition. The treatments were control (no additive), MO (33 mg cow⁻¹ d⁻¹), garlic oil (GAR; 5 g cow⁻¹ d⁻¹), and juniperberry oil (JPB; 2 g cow⁻¹ d⁻¹). Cows were fed ad libitum a

TMR consisting of 40% forage and 60% concentrate. Data were analyzed using the mixed model procedure of SAS. Intake (20.4 kg d⁻¹) and milk yield (29.3 kg d⁻¹) were not affected ($P > 0.15$) by the treatments. However, production of 4% fat corrected milk (FCM) increased ($P < 0.10$) about 9% for cows supplemented with GAR or JPB compared to the control. Cows fed MO had lower FCM yield (23.3 kg d⁻¹) than either cows with EO supplementation (27.2 kg d⁻¹) or the control cows (25.1 kg d⁻¹; $P < 0.06$). Higher FCM was resulted from higher ($P < 0.01$) milk fat content (%) with EO (3.46 and 3.40 for GAR and JPB, respectively) compared with control (3.14) or MO (2.68). Total rumen VFA concentration was similar across the treatments but cows supplemented with MO had lower ($P < 0.10$) acetate:propionate (2.46) versus control cows (2.72). The results indicate that garlic and juniper-berry oils changed milk fat metabolism but had minor effects on intake and rumen fermentation of cows in mid-lactation.

The influence of Piedmontese breeding on beef tenderness in performance tested yearling bulls. A.W. Zwambag, S.P. Miller*, J.W. Wilton, and I.B. Mandell. Department of Animal and Poultry Science, University of Guelph, Guelph, ON, N1G 2W1.

Beef tenderness is the primary quality attribute determining consumer satisfaction. Double muscled cattle such as Piedmontese, which carry the inactive form of the myostatin gene, have been found to produce more tender beef and are promoted in cross-breeding programs. To investigate this further yearling bulls ($n = 154$) were finished at the University of Guelph Elora Beef Research Centre between 2003 and 2005. The effect of the proportion of Piedmontese ($n = 29 \geq 50\%$), Continental ($n = 59 \geq 50\%$), and British ($n = 81 \geq 50\%$) breed composition on Warner-Bratzler shear force measures taken on longissimus steaks were determined with a fixed regression model accounting for contemporary groups ($n = 7$) and day of ageing ($n = 3$). Piedmontese was found to have significantly lower shear force (more tender) than the Continental breed group (-0.888 ± 0.404 kg, $P < 0.05$) with the British breed group having intermediate tenderness. Additional meat tenderness measures and a larger dataset is required to confirm these results, but these results provide promise for incorporating double muscled breeds into commercial beef production to improve meat tenderness. These results also show merit in the measurement of meat tenderness in yearling bulls that will permit selection for this economically important trait.

Reproduction parameters on the Caspian miniature colts. Shahram Dordari*. Tehran Agricultural Research Center, No 21 Mani Str., Tehran 15746-18741 Iran.

The Caspian miniature horse is an ancient breed of horse, which was thought to be extinct for many years. The objectives of this study were to (1) Determine age at puberty; and (2) Characterize seminal characteristics and sexual behaviour, of the Caspian miniature horse. The sexual behaviour was recognized as 4 degrees: (1) without sexual behaviour; (2) Erection and Flehman reflex; (3) Mounting and Intromission; and (4) Ejaculation. Seminal collections were attempted every 2 weeks from 50 to 140 weeks of age. For all collections, times to erection, mount and ejaculation and seminal characteristics were recorded. Age at puberty was defined as the first ejaculate containing 50 million spermatozoa with >10% motile. Age of puberty: 24.6 ± 8.2 months. Weight at the puberty: 189.8 ± 24.07 kg. Semen concentration at puberty: $57 \pm 0.32 \times 106$ cc. Semen volume: 18.2 ± 6.2 cc. Gel volume: 1.5 ± 1.2 cc. Motility: $24.2 \pm 14\%$ pH: 7.88 ± 0.7 . Testosterone concentration: 0.54 ± 0.2 ng/mL. In this study the differences and similarities

between this breed and other ponies were determined. In our study we found that puberty in the Caspian miniature colt was at 24.6 months.

Substitution of neutral detergent fiber for crude cell wall in the equations that estimate carbohydrate fractions of the Cornell system suggest creation of a specific fraction for pectin¹. Mário Adriano Ávila Queiroz², Romualdo Shigueo Fukushima^{3*}, Catarina Abdalla Gomide⁴, Márcia Regina Braga⁵. ¹Financial support provided by Fundação de Amparo à Pesquisa do Estado de São Paulo, SP, Brasil, ²Graduate student in Ciência Animal e Pastagem, Escola Superior de Agricultura Luiz de Queiroz – Universidade de São Paulo (USP), Piracicaba, SP, Brasil, ³Faculty member of Faculdade de Medicina Veterinária e Zootecnia – USP, Av. Duque de Caxias-Norte, 225, 13630-000, Pirassununga, SP, Brasil, CNPq Researcher, ⁴Faculty member of Faculdade de Zootecnia e Engenharia de Alimentos – USP, Pirassununga, SP, Brasil, ⁵Researcher at Instituto de Botânica, Secretaria de Estado do Meio Ambiente, São Paulo, SP, Brasil.

This work estimated carbohydrate fractions through the Cornell Net Carbohydrate and Protein System (CNCPS) of three sunflower (*Helianthus annuus* L.) cultivars (fresh or silage). The experiment was a 3×2 factorial, completely randomized design. The PROC MIXED procedure of SAS was used to analyze data. Neutral detergent fiber (NDF) is a component in some Cornell's equations; however, because NDF is not a true cell wall, for the missing pectin, this work compared substitution of NDF for crude cell wall preparation (CW) in these equations. This substitution showed differences in the A and B2 fractions, but no difference in the B1 fraction. Considerations on the C fraction appear in another abstract. Because estimates of B1 fraction (starch + pectin) by means of CNCPS were lower than laboratory determinations and based on other results obtained, we suggest that B2 fraction be allocated exclusively for pectin. For the digestible cell wall carbohydrates a new fraction, B3, be named. Evidences collected here, because we compared CW versus NDF, suggest that in the Cornell equations pectin was never part of B1 fraction but present in the A fraction. Hence, from the content of fraction A, pectin must be subtracted. Fraction B1 was actually only starch.

Nitrogen and phosphorus waste outputs by a rainbow trout cage farm. P.A. Azevedo^{1*}, C.L. Podemski². ¹Fisheries & Oceans Canada, Central and Arctic Region, Government of Canada, 501 University Crescent, Winnipeg, MB, Canada R3T 2N6; ²Bureau, D.P. Fish Nutrition Research Laboratory, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1.

Assessment of pollution potential of fish farm wastes is currently based on the monitoring of several water chemistry parameters. This chemical approach can be very costly and inaccurate. Studies have indicated that quantification of waste outputs from fish culture operations can be carried out inexpensively and in an accurate way following a biological and nutritional approach. A waste output model (Fish-PrFEQ) of Cho and Bureau (1998) and Bureau et al. (2003) was used in this study to estimate the total solid wastes and solid phosphorus (P) and nitrogen (N) and dissolved P and N waste outputs from a model rainbow trout farm in Lake 375 at the Experimental Lakes Area (Kenora, Ontario). Measured feed intake, feed composition and digestibility, as well as fish growth, fish carcass composition and nutritional retentions for a production cycle in 2005 were used as model inputs. Fish grew from 190 to 1100g with a thermal-growth coefficient (TGC) of 0.204% and

FCR (feed:gain) of 1.29 at 15°C. Total solid, solid N and P and dissolved N and P waste outputs were 236, 10.2, 6.0, 43.4, and 3.0 kg tonne⁻¹ of fish produced, respectively.

The protection study of turmeric (*Curcuma longa*) at liver, neural system, gastrointestinal system and kidneys against experimental toxicity in broilers (an histopathologic study). R. Jajvandian¹, P. Bahary¹, M. Dashtizad², and M. Anvari^{1*}. ¹Faculty of Veterinary Medicine, Islamic Azad University, Bojnourd Branch, ²Faculty of Developmental Biology, Islamic Azad University, North Tehran Branch-Iran.

Objective: Many of common disease in poultry industry, affect the liver, Urinary system and gastrointestinal tract that lead to lower metabolism and detoxification, which can result in lower growth rate in broilers. On the other hand many drugs can induce injuries at gastrointestinal tract and kidneys which trigger a positive feedback. In addition, the residual drugs in poultry meal is an important danger for people health, so it is more effective to protect these organs instead of treatment. Turmeric (*Curcuma Longa*) and its curcumin has protective effects on liver, digestive, nervous and urinary system. Based on the importance of poultry industry and toxic agents that induced disease in broilers, in this research we studied the protective effect of turmeric. Animals: Male broilers at age 35 days. Procedure: Based on the weight and the seromic level of GOT, GPT, AIP chicks divide to 3 groups ($n = 6$): (1) Pre-treatment with turmeric (1 mg kg⁻¹ BW included in capsules with oil) for 14 days and then treatment with acetaminophen (650 mg kg⁻¹ BW included in capsules) and turmeric for 30 days. (2) Treatment with acetaminophen (650 mg kg⁻¹ BW), (3) control. Daily body weight gain and behaviour recorded in special tables. At the end of experiment, after clinical examination of organs, histopathological slides of liver, small intestine, forestomach and kidney studied by a pathologist. Results: Our results show that group 1 had better rate of growth and statement of small intestine mucus and the liver and kidney statement is better than group 2 as the number of lipid degenerative changes in group 1 was very less than 2. On the other hand in group 2, from day 18 there was neuropatic changes and

muscle tremor in daily behaviour which appeared very later in group 2. all of the group 1 were alive till the end of experiment but in group 1 three chickens died. Clinical implications: It suggested that addition of Turmeric in poultry nutrient will be very useful for protection against toxins, such as aflatoxin or antibiotics at liver, digestive system and kidney. In addition with this natural product we can have better health status. It seems that neuroprotective effect of turmeric could be important in reducing of abnormal behaviour in farms against environmental and pathologic factors. On the other hand it can be used for decrease of appetite and weight gain without any toxicity or unfavorable side effect. Study the Other protective effects of turmeric on respiratory and immune system in poultry will be result to very useful results at poultry industry.

Application of the three R's in agricultural research and teaching: CCAC guidelines on: the care and use of farm animals in research, teaching and testing. Gilly Griffin^{1*}, Tarjei Tennesen², and Clément Gauthier¹. ¹Canadian Council on Animal Care, 1510-130 Albert St, Ottawa, ON Canada K1P 5G4; ²Department of Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, NS, Canada B2N 5E3.

The Canadian Council on Animal Care (CCAC) system of oversight is based on the Three R's tenet of Russell and Burch (Replacement, Reduction and Refinement. of animals used for scientific purposes). For the CCAC this fundamental ethic of animal experimentation is expressed in the CCAC policy statement on: the Ethics of Animal Investigation. The CCAC is currently developing guidelines on: the care and use of farm animals in research, teaching and testing. As part of this exercise, the CCAC subcommittee on farm animals has spent a substantial amount of time discussing the application of the Three R's in the environment of agricultural research and teaching involving livestock species. This poster presentation outlines the conclusions reached by the subcommittee and the manner in which the Three R's are being addressed within the draft guidelines.