Experimental diets were fed 2 kg/d during gestation and ad libitum during lactation. Individual feed intake of sows was recorded daily during lactation. Body weight and backfat thickness of sows as well as body weights of individual piglets were measured weekly until weaning at 21-d of lactation. The number of days return-to-estrus was recorded. Backfat thickness of sows measured at the P2 position did not differ (P=0.679) nor did average daily feed intake (P=0.524) among the treatments during the 21-d lactation period. All treatment groups had similar days return-to-estrus (P=0.778). Initial body weight of piglets did not differ among treatments after cross fostering (P=0.541). Piglets of sows fed 1 % L-arginine from gestation to lactation (ARG-ARG) were heavier (2.35 vs. 2.68 kg, P=0.026) at 7 d of lactation and had a greater weight gain (0.971 vs. 1.253 kg, P=0.037) from d 0 to d 7 of lactation compared to piglets of sows fed the isonitrogenous diet from gestation to lactation (ALA-ALA). However, there were no differences in weight gains from d 7 to 21 among the treatments. Arginine supplementation in sow diets may improve the growth of neonate during early lactation period.

Key Words: Arginine, Sows, Lactation

293 Skeletal muscle protein synthesis in neonatal pigs is stimulated by A-ketoisocaproic acid, but not by norleucine. J. Escobar*, J. W. Frank, A. Suryawan, H. V. Nguyen, and T. A. Davis, *Baylor College of Medicine*, *Houston, TX*.

In neonatal pigs, skeletal muscle protein synthesis is stimulated when plasma leucine is increased within the physiological postprandial range. We previously have shown that valine and isoleucine were not able to stimulate protein synthesis when their plasma concentrations were elevated within the physiological postprandial range. The objective of the present study was to determine the effect of an elevation in plasma levels of α-ketoisocaproic acid (KIC, the α-keto acid of leucine) and norleucine (an aliphatic leucine analogue that does not charge leucyl tRNA) on skeletal muscle protein synthesis and the activation of translation initiation factors. Piglets (5 d of age) were food-deprived overnight and infused intra-arterially with saline or 400 μmol•kg^{-1}•h^{-1} of leucine, KIC or norleucine for 60 min. At the end of the infusion period, protein synthesis and the activation of translation initiation factors were determined in longissimus dorsi muscle and liver. Plasma concentration of leucine was reduced ($P < 0.02$) by norleucine and increased ($P < 0.01$) by KIC compared to saline controls. Infusion of leucine and KIC increased the phosphorylation of eukaryotic initiation factor (eIF) 4E binding protein-1 (4E-BP1, $P < 0.01$), decreased ($P < 0.04$) the inactive 4E BP1•eIF4E complex, and numerically increased the active eIF4G•eIF4E complex in muscle. Both leucine and KIC increased ($P < 0.03$) muscle protein synthesis. Norleucine had no effect on muscle translation initiation factor activation or protein synthesis. In the liver, the activation of translation initiation factors and protein synthesis were not affected by any treatment. Our results indicate that the ability of leucine to act as a nutrient signal to stimulate skeletal muscle protein synthesis is likely specific for leucine or its metabolites. (NIH AR 44474 and USDA 58-6250-6-001)

Key Words: Leucine, Norleucine, α-Ketoisocaproic acid

294 A flooding dose of valine can be used to measure protein synthesis in growing pigs. A. J. Libao-Mercado*[1,3], M. Rademacher[2], and C. F. M. de Lange[1], [1]*University of Guelph*, *Guelph, Ontario, Canada*, [2]*Degussa AG*, *Hanau, Germany*, [3]*Cargill Animal Nutrition Phils.*, *Bulacan, Philippines*.

A key concern with flooding dose technique for measuring protein synthesis (PS) is that a large dose of amino acid (AA) can change the animals′ hormonal and nutritional status, which can influence PS. Among stable isotope tracers, 1-13C-valine is the preferred amino acid for measuring PS in gut tissue and mucins. A study was conducted to determine the impact of a flooding dose of valine on the metabolic status of pigs. Six barrows (12 kg BW) were randomly assigned, following a two-treatment cross-over design, to 12-minute intravenous infusions of either 150 mM valine (1.5 mmol/kg BW) or saline (control). Blood samples were taken at 10 min prior to infusion, at the end of infusion, at 10 min intervals for 1 hr, and at 90 and 120 min post infusion. Plasma concentration of insulin, glucose, AA, urea nitrogen and packed cell volume (PCV) were measured. Data were analyzed as repeated measures using Proc Mixed Procedure of SAS. Infusion of valine increased plasma valine levels (4178 vs. 532 μmol/L; $P<0.0001$) but had no influence on PCV (26.4 vs. 27.2%), glucose (5.8 vs. 5.9 mmol/L), urea nitrogen (8.5 vs. 7.8 mg/dL) and insulin (8.2 vs. 8.4 μU/mL; $P>0.10$). It also had no impact on plasma levels of most AA, particularly leucine (240 vs. 231 μmol/L) and isoleucine (308 vs. 332 μmol/L; $P> 0.10$). There was however a slight increase in threonine (225 vs. 263 μmol/L; $P<0.05$) and a tendency towards reduced glycine (1387 vs. 1312 μmol/L; $P<0.10$). There were also numerical increases in alanine (1186 vs. 1310 μmol/L) and glutamine (788 vs. 846 μmol/L) levels ($P>0.10$). The results indicate that a flooding dose of valine does not cause a substantial change in the metabolic status of growing pigs, and is therefore suitable for measuring PS rates in tissues with high protein turnover rates.

Production, Management and the Environment I

295 Comparison of swine manure composition using multiple manure sampling methods. D. M. Sholly*, R. B. Hinson, K. L. Saddoris, M. C. Walsh, D. T. Kelly, B. T. Richert, A. L. Sutton, and J. S. Radcliffe, *Purdue University*, *West Lafayette*.

Sixteen manure pits (30 pigs/pit) were sampled monthly during a wean-finish trial (22 wks) to compare the effects of sampling method on estimates of manure DM and ash. Eight pits were emptied monthly in a pull plug/recharge (PP) system, and 8 were kept as a deep pit (DP) system. Manure pits were sampled using: 1) mechanical core sampler (Coswala); 2) vacuum core sampler (vacuum); 3) cup sampler; and 4) agitated slurrystore sample (control, CTL). For core sampling, manure was obtained from 12 locations/pit and pooled. Cup samples were taken from 6 locations/pit and pooled. All data were analyzed using the GLM procedure of SAS. Within the PP system (40 obs/method), manure DM was 14.8% higher ($P<0.05$) for vacuum samples compared

to CTL samples, while DM was 30.3 and 44.5% lower (P<0.05) for Coswala and cup samples, respectively, compared to CTL samples. Manure ash content was 12.5% higher (P<0.10) for vacuum samples and 19.8% lower (P<0.05) for cup samples compared to CTL samples. Ash content of Coswala samples was 10.4% less than CTL samples, although statistically similar. Within the DP system (wk 22, 8 obs/method), manure DM was 28.6% lower (P<0.10) for cup samples compared to CTL samples. Manure DM was 7.7% higher for vacuum samples and 16.7% lower for Coswala samples compared to CTL samples, but neither were statistically different from the CTL. Numerically, DP system manure ash followed the same pattern, but no significant differences (P>0.10) were observed among sampling methods. From wk 8-22, manure DM from Coswala and cup samples increased from 53 to 79% and 47 to 71%, respectively, relative to vacuum samples in the DP system. Relative estimates of manure ash followed a similar pattern, although initial estimates were closer (67%) to vacuum samples. Outcomes of this trial demonstrate that manure sampling method can significantly influence manure composition, potentially impacting land application.

Key Words: Pigs, Manure, Sampling method

296 Comparison of daily milk weight data with the multiple trait prediction model. M. Quist*[1], D. Kelton[1], S. LeBlanc[1], K. Hand[2], D. Lazenby[2], and F. Miglior[3,4], [1]*University of Guelph, Ontario Veterinary College*, *Guelph, Ontario, Canada*, [2]*CanWest Dairy Herd Improvement Corporation*, *Guelph, Ontario, Canada*, [3]*Agriculture and Agri-Food Canada - Dairy and Swine Research and Development Centre*, *Lennoxville, Quebec, Canada*, [4]*Canadian Dairy Network*, *Guelph, Ontario, Canada*.

The objective of this study was to compare the MTP 305-day lactation yield with the non-traditional 305-day daily milk yield data (from on-farm automated meters and software) to examine the accuracy of the MTP at different stages of lactation. Many automated milking parlour systems have the ability to record and store individual milk weights for each cow at each milking. The availability of these data as inputs to regional and national milk recording programs needs to be evaluated. Traditionally, 24-hour milk and component yields are calculated using milk weights and samples collected 8-10 times per year by Dairy Herd Improvement (DHI) organizations. The Multiple Trait Prediction (MTP) model uses these data to predict 305-day lactation yields. The information generated by these models is used in genetic evaluation programs and for on-farm selection and management of dairy cattle. Daily milk weights were collected from milking cows on 5 farms using parlour milking systems with automatic animal identification. A total of 139 cows with complete 305-day lactation yields were included in the analysis. All herds were enrolled on a regular DHI program. In this preliminary analysis, 908 DHI test-days were entered into the MTP model and lactation yields were predicted. Test-days were grouped into 1st, 2nd and 3rd + lactations and within each lactation group, days in milk (DIM) were categorized in 3 stages (5-60, 61-120 and 120-305+ DIM) for a total of 9 classes Agreement analysis was used to compare the daily milk weights 305-day lactation yield to the MTP 305-lactation yield predictions, using inputs from various test-days throughout the lactations. Results suggest that the MTP model using monthly test day inputs predicted late lactation yields across all parity groups more accurately than early lactation yields.

Key Words: Daily milk weights, MTP model, Lactation yields

297 Simulation of variation in methane emissions from enteric fermentation in dairy cattle in the Netherlands. J. Dijkstra*[1], A. Bannink[2], K. W. van der Hoek[3], and W. Smink[4], [1]*Wageningen University*, *Wageningen, The Netherlands*, [2]*Wageningen University and Research Centre*, *Lelystad, Tthe Netherlands*, [3]*RIVM*, *Bilthoven, The Netherlands*, [4]*Feed Innovation Services*, *Wageningen, The Netherlands*.

Accurate estimation of methane emissions has a profound effect on mitigation options available to meet commitments under the Kyoto protocol. The objective of this study was to simulate the methane emissions from dairy cattle in the Netherlands during 1990-2003 using a mechanistic model of fermentation and digestion of nutrients and methanogenesis in the gastro-intestinal tract [Mills, J.A.N., J. Dijkstra, A. Bannink, S.B. Cammell, E. Kebreab and J. France. 2001. A mechanistic model of whole-tract digestion and methanogenesis in the lactating dairy cow. J. Anim. Sci. 79:1584-1597] and updated VFA stoichiometric coefficients that relate type of VFA formed to rumen pH and to type of substrate fermented. Diet and milk production data of Dutch dairy cattle were available from the Workgroup Uniform Manure and Mineral Figures and the Dutch Marketing Board Dairy Products. DMI increased from an average 14.7 kg/d (1990) to 17.6 kg/d (2003). In these years, the dietary proportion of grass decreased, and that of grass silage and corn silage increased considerably. Fat and protein corrected milk (FPCM) production increased from 17.5 kg/d (1990) to 22.7 kg/d (2003). The simulated methane production was 107.7 (1990) and 124.6 (2003) kg/year, or 16.8 and 15.0 g methane/kg of FPCM. The methane conversion factor decreased from 6.1 to 5.9% of GE intake in 1990 and 2003, respectively. This decline was the combined result of an elevated DMI and a change towards less fiber and more starch in the diet. Unlike the IPCC Tier 2 method which assumes a fixed 6% of GE intake loss as methane, the mechanistic model accounts for the effects of dietary manipulations on methane emissions required for full assessment of mitigation options. The simulation results will be included in the Dutch 2006 National Inventory Report of greenhouse gas emissions.

Key Words: Dairy cattle, Mechanistic model, Methane

298 Relationship between size of vegetated buffers and transport of fecal coliform bacteria from pasturelands treated with dairy cow manure. T. J. Sullivan[1], J. A. Moore[2], T. W. Downing*[2], D. Thomas[2], E. Mallory[3], K. U. Snyder[1], M. Wustenberg[4], and S. Mackey[1], [1]*E+S Environmental*, *Corvallis, OR*, [2]*Oregon State University*, *Corvallis*, [3]*Oregon Streamside Service*, *Tillamook, OR*, [4]*Kilchis Dairy Herd Service*, *Bay City, OR*.

Field spreading of dairy manure can contaminate streams and estuaries with fecal coliform bacteria (FCB), posing health hazards and impairing beneficial uses such as recreation and shellfish harvesting. The installation of vegetated buffers between application areas and streams is a common BMP. It is important that we determine buffer widths that will simultaneously protect water quality and require the smallest buffer width necessary. Buffer size requirements have typically been established by political process and it has been unclear what degree of treatment could be expected. Here we show that installation of a vegetated buffer on loamy soils dramatically reduced the bacterial contamination of runoff water from manure-treated pasturelands. However, the size of the vegetated buffer was not an important determinant of the extent to which bacteria were removed from runoff. Results from 17 experimental treatment cells during 9 rainstorms indicated that only 10% of the runoff samples collected from treatment

cells having vegetated buffers exhibited FCB concentrations > 200 colony forming units (cfu)/100 ml, and the median concentration for all cells containing vegetated buffers was only 6 cfu/100 ml. The presence of a vegetated buffer of any size, from 1 m to 25 m, generally reduced the median FCB concentration in runoff by more than 99%. This result was largely due to the observed high rate of infiltration of precipitation, even during large storms (up to 20 cm). It appears that FCB contamination of runoff from manure-treated pasturelands may be disproportionately associated with specific field or management conditions, such as the presence of soils that exhibit low water infiltration and generate larger volumes of runoff. Buffer size regulations that do not consider such differences may not be efficient or effective in reducing bacterial contamination of runoff.

Key Words: Vegetative buffers, Fecal coliform bacteria

299 Effects of dietary crude protein on ammonia emissions from dairy heifers. W. A. Jackson*, E. J. DePeters, J. G. Fadel, and F. M. Mitloehner, *University of California*, *Davis*.

Dairy operations are considered an important source of atmospheric ammonia (NH3) emissions impairing ambient air quality. The study objective was to evaluate the effects of dietary crude protein on NH3 volatilization from urine and feces of Holstein heifers housed in enclosed corrals. The hypothesis was that nitrogen (N) fed in excess of the heiferâ€™s dietary requirements is excreted in urine and feces, resulting in increased gaseous NH3 emissions. Heifer diets were formulated to bracket the NRC N requirements. Twenty-four short-bred heifers averaging 495 kg were randomly assigned to four groups. Every group was housed in one of four greenhouse-like enclosures that were used to allow for comprehensive measurements of gaseous emissions. At the onset of each treatment period animal groups were assigned to their rations, following a 4x4 Graeco-Latin square design. Diets were formulated to contain 12%, 14%, 16%, or 18% CP. Diets differed only in almond hull, barley, and soybean meal content to achieve the desired CP level. All diets contained 50% oat hay and 12% alfalfa hay. Heifers were fed ad libitum once daily for a 16 d period. On d 16, NH3 emissions were measured three times (2 h sampling intervals) using an EPA approved sampling train method. Random floor grab samples were taken from nine locations on the corral floor of each enclosure to assess pH, surface temperature, and total N. On d 17, heifers were weighed and blood samples collected to determine blood urea N. Urine and fecal samples were collected for total N analysis. Ammonia emission flux decreased incrementally from 18% CP (highest) to 12% CP (lowest). Urine urea N and blood urea N concentrations followed the same trend as the ammonia flux. Dry matter intake was similar across treatments. Present results show that high dietary CP concentrations lead to increased ammonia emissions. Further studies will identify CP levels needed to achieve optimal animal performance while minimizing environmental impacts.

Key Words: Dairy ammonia emissions, Crude protein

300 Nitrogen, phosphorus, and potassium balance and potential for reducing phosphorus imports in Idaho dairy farms. A. N. Hristov*, W. Hazen, R. Etter, and J. W. Ellsworth, *University of Idaho*, *Moscow*.

Eight commercial dairies from southcentral Idaho were surveyed to estimate the whole-farm balance of nitrogen (N), phosphorus (P), and potassium (K) and to investigate the possibility of reducing P excretion through dietary manipulation. Nitrogen, P, and K imports and exports were monitored in a 12-mo period and samples from the diets, feeds, feces, urine, and manure were collected at regular farm visits. Soils from manure-amended fields were sampled in the spring and fall. In all cases, the largest import of N, P, and K to the dairy was with purchased feeds (on average 90, 95, and 92% of all N, P, and K imports). Major nutrient export items were milk and manure and forages in the case of a dairy with a large land base (DairyF). Whole-farm N surplus varied from 91 to 604 t/year. The efficiency of use of imported N varied from 25 to 64%, with DairyF having the greatest efficiency. Phosphorus and K surpluses were also significant (average of 29 and 182 t/year, respectively). During the study period, DairyF was a net exported of K. The average efficiency of use of imported P and K was 66 and 58%, respectively. Soil P levels in the 30-cm layer were high and above state threshold standards, most likely reflecting accumulation of P on the farm and over application of manure. Soil nitrate-N concentrations were also high, but K concentrations were within the accepted range. The average P content of the lactating cow diets was 0.49% and was reduced ($P = 0.007$) to 0.38% in the second year of the study, which resulted in numerical decrease (by 16%; $P = 0.167$) in average fecal P concentrations. The estimated reduction in imported P due to the reduced dietary P levels was from 5.7 to 61.4 t/year/dairy. This study indicated that in addition to exports with milk and manure, export of nutrients with forages produced on the farm is a major factor in achieving whole-farm N, P, and K balance.

Key Words: Nutrient management, Whole-farm balance, Dairy cow

301 Daily manure production from a lactating cow facility. M. Hollmann*[1], K. F. Knowlton[1], C. M. Parsons[1], M. D. Hanigan[1], and T. N. Rensch[2], [1]*Virginia Polytechnic Institute and State University*, *Blacksburg*, [2]*Integrity Nutrient Control Systems, Inc.*, *Chambersburg, PA*.

Manure and its nutrient concentrations are important in meeting environmental regulations. This project determined the daily production of manure at the Virginia Tech Dairy in 2005. The herd consisted of 140 Jerseys, Holsteins, and crossbreds, with a mean bodyweight of 560 kg, and averaged 30.1 kg/d milk with 3.16% true protein. The intake of N and P was estimated from the formulated TMR, allowing for a 3% feed refusal. Approximately 103 kg/d of sawdust were used as bedding. The alleys in the freestall barn were flushed every 6 h with recycled wastewater and the slurry was collected. On 17 dates the volumes and constituents of the flushwater and the flushed manure were determined during a 6 h flush cycle. One sampling showed outlying results and was eliminated from the analysis. Net daily accumulations of solids and nutrients from the manure were calculated as the differences between masses in flushed slurry and flushwater. These results were compared with ASAE Standards for ″Manure Production and Characteristics″ with the Students t-test. Total (TS) and volatile solids (VS) per cow were 6.4 and 5.3 kg/d with bedding, and 5.7 and 4.6 kg/d without bedding. Production of TS and VS without bedding differed from the standards, but VS as a percentage of TS (84%) did not. Daily chemical oxygen demand was similar to the ASAE prediction of 6.2 kg/cow. Total Kjeldahl N (289 g/d), ammonia-N (144 g/d; n=12), and P (77 g/d) accumulations per cow were higher than predicted. Recovery in slurry of the P in feed and bedding minus P in milk was 93%. Recovery of N averaged 59%. Assuming a constant N loss from manure, N loss was 4.3%/h. Assuming that 60% of the manure N was in urine, the urinary N volatilization rate was 15.5%/h. These results showed less than predicted production of TS and VS in the manure of lactating dairy cows and provide a practical estimate of N volatilization and P recovery.

Key Words: Dairy farm mass balance, Manure production, Nitrogen volatilization