106 Emissions of ammonia and methane from concentrated dairy production facilities in Southern Idaho. A. B. Leytem*, D. L. Bjorneberg, and R. S. Dungan, *USDA-ARS, Kimberly, ID*.

The number of dairy cows in Idaho has increased by approximately 80% in the last decade with concentrated dairy production facilities being the norm. The majority of these production facilities are located in southern Idaho, which has generated regional air quality concerns. To determine the potential air quality impacts of these facilities, we determined emissions of ammonia (NH_3) and methane (CH_4) during four seasons on a 700 cow open-lot dairy (small) using open-path Fourier transform infrared spectrometry (OP/FT-IR) and over a one-year period at a 10,000 cow open-lot dairy (large) using a photoacoustic field gas monitor. Measurements were made at a background location and over the open lots at the small dairy or at the center of the lots at the large dairy. Average NH_3 concentrations over the lots at the small dairy were between 0.13 to 0.41 ppmv, while concentrations at the large dairy were between 0.39 and 0.74 ppmv. Average CH_4 concentrations over the lots at the small dairy were between 2.2 to 3.0, while concentrations at the large dairy were between 2.1 and 6.6 ppmv. Ammonia emission rates, calculated by the WindTrax model, ranged between 0.04 to 0.25 kg NH_3/cow/day for the small dairy and 0.12 to 0.19 kg NH_3/cow/day at the large dairy. Methane emission ranged between 0.20 to 0.55 kg CH_4/cow/day for the small dairy and 0.33 to 1.23 kg CH_4/cow/day for the large dairy. At these average emission rates, farms with greater than approximately 1,650 cows would be required by the State of Idaho to adopt best management practices to reduce ammonia emissions through a permit by rule.

Key Words: emissions, ammonia, methane

107 Ammonia emissions from beef feedlot cattle fed corn-based backgrounding and finishing diets varying in protein concentration and source. K. M. Koenig*, S. M. McGinn, and K. A. Beauchemin, *Agriculture and Agri-Food Canada, Lethbridge, AB, Canada*.

Ammonia (NH_3) emissions are becoming an important environmental and human health issue facing the livestock industry. The objectives of this study were to determine the effects of protein feeding strategies (varying in concentration and ruminal degradability) on NH_3 emissions and growth performance of feedlot cattle fed corn-based backgrounding and finishing diets. Steers (305 kg ± 0.4 kg initial BW) were ranked according to BW, allocated to 24 pens of 13 steers each, and 6 pens were randomly assigned to 4 dietary treatments. The basal diets were corn-based and consisted of 54% silage and 46% concentrate for the backgrounding phase and 9% silage and 91% concentrate for the finishing phase. The 4 dietary treatments included a control (11% CP) and the control diet supplemented (13% CP) with urea and canola meal, canola meal, or corn distillers grains. Feed was offered once per day for ad libitum intake (5% feed refusal). Every 3 wk, 1 pen of steers fed the control diet and 1 pen fed one of the protein supplemented diets were moved to 2 isolated pens for the measurement of NH_3 emissions using the passive diffusion technique. Ammonia traps were replaced daily over 4 consecutive days at heights of 0.5, 1, 2 and 3 m on the north, south, east and west sides of the isolated pens. Growth performance (DMI, ADG, G:F) was improved ($P < 0.05$) in steers fed the urea and canola, and canola supplemented diets during the backgrounding phase, but there was no effect ($P > 0.05$) of protein supplementation on performance of cattle during the finishing phase. Ammonia emissions for the control and protein supplemented diets averaged 3.0 and 4.2 g N/(steer d) for the backgrounding phase and 7.7 and 11.3 g N/(steer d), respectively, for the finishing phase. Feeding the diets with 11% CP compared to 13% CP, lowered NH_3 emissions by 30% with no effect on growth performance during the finishing phase, but performance was reduced during the backgrounding phase.

Key Words: ammonia emissions, protein, beef cattle

108 Methane emissions from finishing beef cattle offered maize silages harvested at four different stages of maturity. E. Mc Geough*[1,2], P. O'Kiely[1], T. M. Boland[2], K. J. Hart[2], P. A. Foley[2], and D. A. Kenny[2], [1]*Teagasc, Grange Beef Research Centre, Dunsany, Co. Meath, Ireland*, [2]*School of Agri., Food Sci. & Vet. Med., University College Dublin, Belfield, Dublin, Ireland*.

Sixty cross-bred beef steers, mean initial BW 531 (s.d. 23.8) kg were blocked by weight and randomly allocated to one of five dietary treatments over a 110-day finishing period. The four maize silage harvest dates (treatments I - IV) were, (I) 13 Sept., (II) 28 Sept., (III) 09 Oct., (IV) 23 Oct, with maize silage offered *ad libitum* and supplemented with 3 kg concentrates daily per head. A fifth treatment, *ad libitum* concentrates (ALC) supplemented with 5 kg grass silage daily per head was used as a positive dietary control. Daily methane (CH_4) emissions were measured using the SF_6 tracer technique over 5-day sampling periods. Data were analysed by two way ANOVA accounting for block and treatment using the PROC GLM procedure of SAS. The mean dry matter (DM) (uncorrected for volatiles) of maize silages I to IV was 274, 310, 333 and 328 g/kg respectively, with corresponding *in vitro* DM digestibilities of 710, 723, 734 and 715 g/kg, neutral detergent fibres of 485, 447, 437 and 434 g/kg DM and starches of 315, 362, 381 and 386 g/kg DM. Advancing maize maturity at harvest had no effect on absolute daily CH_4 emissions but all maize treatments were higher (297, 295, 284, 279, g/day; $P < 0.05$) than ALC (226 g/day). Methane emissions, when expressed relative to carcass gain (CG), tended to decrease linearly (354, 354, 311, 314 g/kg CG; $P = 0.06$) across maize treatments and were lowest (236 g/kg CG; $P < 0.05$) for ALC. When expressed on a DM intake basis, CH_4 emissions were higher ($P < 0.05$) for maize silage I than II and IV while ALC again exhibited the lowest CH_4 emissions overall. Maize maturity at harvest did not affect carcass gain, however, an increase in DM intake ($P < 0.01$) was observed with cattle offered harvest II maize silage. The ALC diet consistently reduced CH_4 emissions and supported superior rates of carcass gain when compared with the maize silage treatments.

Key Words: maize, harvest date, methane

109 Effect of ammonia volatilization on manure nitrogen isotope composition. C. H. Lee*[1], A. N. Hristov[1], and S. Silva[2], [1]*Pennsylvania State University, University Park*, [2]*U.S. Geological Survey, Menlo Park, CA*.

The objective of this experiment was to investigate the effect of ammonia losses from dairy manure on manure N isotopic composition *in vitro*. Feces and urine collected from a dairy cow fed a 16% CP diet were mixed (1:1, w/v) and incubated at 21°C for 20 d in 2-L capacity fermentation jars (n = 3). Samples from manure and emitted ammonia were collected daily for chemical and isotopic analyses. Initial concentration of ammonium in manure was negligible, but rapidly increased through d 5 due to hydrolysis of urinary urea. Concentration of urea in manure

decreased from 3.7±0.14 (d 0) to 0.7±0.02 mg/ml in 24 h. Ammonia emission rate peaked on d 5 (144±6.4 mg N/d) and declined thereafter. Cumulative ammonia losses increased exponentially ($r^2 = 90$; $P < 0.001$) during the incubation and were negatively correlated (r = -0.88; $P < 0.001$) with the amount of N in manure, which declined exponentially by 0.7 mg/g manure DM per d ($r^2 = 86$; $P < 0.001$) reaching a plateau by d 5. Similar to our previous observations, ^{15}N abundance of manure N rapidly increased from $\delta^{15}N$ of 0.1±0.36 (d 0) to 6.7±0.80 (d 2) and reached a plateau by d 5 (10.1±0.42‰). This rapid increase in $\delta^{15}N$ was due to the loss of depleted in ^{15}N ammonia. Delta ^{15}N of volatilized ammonia increased quadratically ($r^2 = 88$; $P < 0.001$) from -22.5±0.68 (d 1) to -16.5±0.09 (d 5) and -1.3±2.55‰ (d 20). At the maximum $\delta^{15}N$ of manure (d 5 and beyond), the decreasing concentration of ammonium in manure counterbalanced its increasing $\delta^{15}N$ as a result of volatilization. Cumulative ammonia loss (mg N) was best described ($r^2 = 92$; $P < 0.001$) by a 3-parameter model including an intercept (1778, SE=395), $\delta^{15}N$ of emitted ammonia (61.4‰, SE=4.1) and manure N (67.5‰, SE=19.0), and manure N concentration (-14.7 mg/g DM, SE=6.5). This experiment demonstrated that ammonia volatilization from manure is very rapid in the first 2-3 d (originating primarily from urinary urea) and that $\delta^{15}N$ of aged manure and emitted ammonia can be successfully used to predict ammonia emissions from cattle manure.

Key Words: manure, ammonia, ^{15}N isotope

110 On-farm evaluation and demonstration of ammonia reduction best management practices (BMPs) for feedlots and dairies. N. M. Marcillac-Embertson*, J. Pritchett, J. L. Collett, and J. G. Davis, *Colorado State University*, *Fort Collins*.

Globally, agriculture is the largest source of atmospheric ammonia (NH3), with livestock accounting for up to 60% of the total emissions. The purpose of this four part study was to minimize the negative impacts of NH3 through the adoption of field-tested, effective, and economical BMPs for Colorado dairies and feedlots. First, a comprehensive literature review was conducted to identify proven BMPs that had potential for NH3 reduction on dairies and feedlots. Second, a detailed survey was sent to dairy and feedlot producers in Colorado, Iowa, Kansas, and Nebraska to learn about producers current BMP practices and constraints to adoption of additional BMPs. Third, selected BMPs were tested on 6 dairy and 6 feedlot operations from June to October, 2007, 2008, to evaluate NH3 reduction potential, ease of use, and economic viability. Some of the 12 BMPs tested were: bedding, alum, scraping feedlot pens, freestall manure removal type, natural vs conventionally fed cattle, water application to drylots, composting vs stockpiling of manure, harrowing woodchips into drylots, and natural lagoon covers. Ammonia concentration was measured from surfaces using a real-time NH3 analyzer (Nitrolux-S, Pranalytica) at eight coincident measurements per sample location (multiple locations per sample area). Results for each BMP sampling model were analyzed using a mixed model that accounted for day and weather effects. Significance was evaluated at P=0.05 using lsmeans. Compost bedding in freestalls had 43% lower NH3 than sand over 30 days (P=0.06); alum application to feedlot pen surfaces was not economical, and had limited effectiveness (56% for 2 days, than back to baseline); scraping feedlot surfaces decreased NH3 by 10% (P=0.51); wood chips decreased ammonia in drylots by 40% (P=0.19). Part four was the development of BMP educational resources (i.e., website, handbook, online factsheets, a BMP photo gallery, and an NH3 reduction and implementation cost-estimator). The overall goal of the project was to provide producers with the necessary information to make good management choices, while preserving agricultural in Colorado.

Key Words: livestock, ammonia, BMP

111 Nitrogen volatilization losses from bed pack in dairy cow barns. A. S. Atzori*, R. Boe, P. Carta, A. H. D. Francesconi, and A. Cannas, *Dipartimento di Scienze Zootecniche, University of Sassari*, *Sassari, Sardinia, Italy*.

The objective of this work was to measure N volatilization (NVOL) from bedded-pack lactating dairy cow barns. Feed intake, milk production, bedding material used and air temperature were monitored in 3 dairy farms near the town of Arborea (Sardinia, Italy; 39°46'26" N, 08°34'53" E, 7 m a.s.l.) during one month per season from summer 2007 to spring 2008. In each season the bed pack of each farm was sampled and analyzed about once per week during the 1-month interval between excretion and removal of bed packs from barn floors. The N to P ratio marker method was used to estimate NVOL, considering P as an internal non-volatile marker in milk and manure. Nitrogen and P excretions were estimated by nutrient balance as intake minus N and P excreted in milk. The results showed limited variation among seasonal means of NVOL, with significantly higher values in summer than in fall (Table 1). NVOL losses were associated to bed-pack temperature (r = 0.32; $P<0.03$), DM (r = 0.40; $P<0.004$) and N content (r = -0.30; $P<0.04$) but not to mean air temperature (r = 0.18; $P>0.20$). As average, the measured annual mean NVOL in bed pack was equal to 39.1% of excreted N (Table 1). However, since concrete floor, instead of bed pack, covered the feeding and walking areas of the barns, a NVOL of 42.5% of N excreted (as measured in cubicle barns by Atzori et al., 2008) was considered for those areas. Therefore, the annual coefficient of NVOL in bedded-pack barns was equal to 40.8% of N excreted. This value is much higher than that considered by the regulations of many European countries.

Table 1. Air temperature, bed-pack characteristics and NVOL in bedded-pack barns.

Samplings		Air temperature	Bed-pack temperature	Bed-pack density	Bed-pack DM	Bed-pack N	NVOL
Season	n	C°	C°	kg/m^3	%	% DM	% of N excreted
Summer	12	24.4	26.4^{A}	268.0^{B}	35.8^{A}	2.06^{b}	44.1^{a}
Fall	9	17.2	26.2^{AB}	462.7^{A}	27.1^{B}	2.15^{ab}	35.9^{b}
Winter	12	9.3	23.1^{B}	502.6^{A}	24.8^{B}	2.22^{ab}	37.9^{ab}
Spring	16	17.3	24.7^{AB}	511.9^{A}	25.2^{B}	2.37^{a}	38.6^{ab}
Annual mean	4	17.1	25.1	436	28.2	2.20	39.1
SEM		2.7	0.7	49	2.2	0.06	1.5

^{A,B} = $P<0.01$; ^{a,b} = $P<0.05$

Key Words: bed pack, N volatilization, dairy cow

112 DairyGHG: A tool for evaluating the greenhouse gas emissions and carbon footprint of dairy production systems. C. A. Rotz* and F. Montes, *USDA/ARS*, *University Park, PA*.

Greenhouse gas (GHG) emissions and their potential impact on the environment have become important national and international concerns. Dairy production, along with all other animal agriculture, is a recognized source of GHG emissions, but little information exists on the net emissions from our farms. Component models for predicting all important sources of methane, nitrous oxide, and carbon dioxide emissions from

primary and secondary sources in dairy production were integrated in a software tool called the Dairy Greenhouse Gas Model or DairyGHG. This tool calculates the carbon footprint of a production system as the net exchange of all GHGs in carbon dioxide equivalent (CO2e) units per unit of milk produced. Primary emission sources include enteric fermentation, manure handling facilities, cropland used in feed production, and the combustion of fuel in the machinery used to produce feed and handle manure. Secondary emissions are those occurring during the production of resources used on the farm, which can include fuel, electricity, machinery, fertilizer, pesticides, plastic, and purchased replacement animals. A long-term C balance is assumed, which does not account for potential depletion or sequestration of soil carbon. Depending upon farm size, milk production level, and the feeding and manure handling strategies used, the carbon footprint of production systems was found to range from 0.4 to 0.8 kg CO2e per kg of milk produced. This footprint was most sensitive to the amount of methane produced through enteric fermentation, moderately sensitive to the GHG emissions during long-term manure storage, and mildly sensitive to the amount of fuel, electricity and inorganic fertilizer used on the farm. DairyGHG provides a relatively simple tool for evaluating management effects on net GHG emissions and the overall carbon footprint of dairy production systems. This tool is available at http://www.ars.usda.gov/Main/docs.htm?docid=17355 for download and installation on computers using Windows® operating systems.

Key Words: greenhouse gas, carbon footprint, dairy farm

113 Greenhouse gas emission rates from Holstein and Black Angus-Cross feedlot steers and calves. K. R. Stackhouse*, Y. Pan, Y. J. Zhao, M. J. Tobias, and F. M. Mitloehner, *University of California*, *Davis*.

According to United Nations estimates, livestock contributes 18% of the global anthropogenic greenhouse gasses (GHG); however, actual emission data that help verify emission models remain sparse. The present study quantified GHG emissions from a total of 56 steers and calves. Animal types were assigned to three replicate groups (n = 3) of three animals per group and included: 1) 544 kg Holstein steers (1200H), 2) 544 kg Black Angus-Cross steers (1200BA), 3) 340 kg Holstein steers (750H), 4) 340 kg Black Angus-Cross steers (750BA), 5) 159 kg Holstein steers (350BA), and 6) 54 kg Holstein calves (120H). Cattle were housed in an environmental chamber for 24 h, after which waste remained for an additional 24 h. Steers were fed a 90% concentrate diet and calves were milk bottle and grain fed. Greenhouse gasses carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) were measured in 20 min intervals, using a photoacoustic gas analyzer. Emission rates ($g^{-1}cow^{-1}h$) were analyzed over time using PROC MIXED in SAS. Compared to the background, GHG emissions increased when steers entered the chamber; e.g., 1200BA emissions of (CO_2) increased by 366.67 ($g^{-1}cow^{-1}h$), (CH_4) by 3.78 ($g^{-1}cow^{-1}h$)and (N_2O) by 0.05 ($g^{-1}cow^{-1}h$) ($P < 0.001$). Associations of GHG to body weight and cattle breed were identified ($P < 0.05$). In summary, GHG are mainly produced by enteric fermentation and respiration, rather than by the animals' fresh waste, and differ greatly across life stages of cattle. The present data will be useful to verify models and to enhance emission inventories for enteric fermentation, respiration, and fresh waste for numerous cattle life stages across the U.S. beef industries.

Key Words: beef cattle, greenhouse gas, environmental chamber

114 Effects of urine application on chemistry of feedlot pen surfaces. N. A. Cole*[1], A. M. Mason[1], R. W. Todd[1], and D. B. Parker[2], [1]*USDA-ARS-CPRL*, *Bushland, TX*, [2]*West Texas A&M University*, *Canyon*.

Beef cattle feedlots can emit significant quantities of ammonia that may adversely affect air quality and decrease the fertilizer value of manure. The major source of ammonia loss may be urinary urea. We conducted three studies to evaluate the effects of urine on the chemistry of feedlot pen surfaces. In Exp.1, samples were collected from the loose surface manure and the underlying layers (dry hard pack, wet hard pack, soil) of nine pens at each of three commercial feedyards. Samples were collected from an area that had recent (< 10 minutes) urine deposition, and a pen area devoid of urine. The samples were analyzed for DM, ash, pH, electrical conductivity (EC), nitrate-N, ammonium-N, and total N, C, and P. The loose surface manure from urine spots had lower ($P < 0.05$) DM content (59.7 vs. 88.2%), and greater ($P < 0.05$) pH (8.08 vs. 7.80), EC (1.45 vs. 1.22 S/m), ammonium-N (6,755 vs. 2,381 ppm), total N (3.00 vs. 2.73%), and ammonium-N:total N (21.8 vs. 8.5%) than urine-free areas. In Exp. 2 (Summer) and 3 (Spring), 4 L of deionized water or artificial urine (21.4 g of urea/L) were applied to 1 m square plots (6/treatment) on a feedlot surface. The loose manure on the pen surface was sampled for 7 d and chemically analyzed. Compared to untreated plots, ammonium-N concentrations of plots treated with artificial urine increased ($P < 0.001$) from 391 to 6,343 ppm and pH of plots increased from 8.1 to 8.5 in less than 5 min following application and remained elevated ($P < 0.05$) for 79 to 96 h. Water applications caused a short term (2 to 4 h) increase in ammonium-N concentrations. These results support the hypothesis that ammonia losses from feedlot pens occur rapidly from urine spots. Therefore, we conclude that 1) methods which do not take this spatial variability into account will greatly underestimate ammonia emissions, and 2) pen surface amendments used to control ammonia losses must be on the pen surface continuously for optimal efficacy.

Key Words: cattle, urine, ammonia

115 Modifying available grazing time to increase dairy cow urine capture. C. E. F. Clark*[1], K. L. M. McLeod[1], C. B. Glassey[1], P. Gregorini[1], K. Betteridge[2], and J. G. Jago[1], [1]*DairyNZ, Hamilton, Waikato, New Zealand*, [2]*AgResearch*, *Palmerston North, Manawatu, New Zealand*.

A major source of nitrogen in New Zealand's ground and river water is dairy cow urinary nitrogen excreted as a result of excess dietary protein in grazed pasture. Nitrogen loss to the environment may be reduced by modifying available grazing time to capture urinary nitrogen. Forty-eight Holstein Friesian cows milked twice a day in early lactation (Days in milk = 35±9 days) were allocated to three treatments replicated twice. Cows were offered perennial ryegrass pasture for four hours after each milking (2x4), eight hours between milkings (1x8) or for the 24 hour period excluding milking times (control). The 2x4 and 1x8 treatments were on a bark pad when not grazing or being milked to capture urination. During the experimental period, each treatment group was allocated the same daily herbage allowance of 33 kg DM per cow (pre-grazing cover 3,200 kg DM/ha, P=0.38). No supplements were fed. The frequency and location of cow urination events were determined for 6 cows within each treatment using urination sensors (AgResearch, Palmerston North, New Zealand) on day 1, 2, 7 and 8 after a 10 day adaptation period. There was no difference (P=0.10) between treatments in the number of urinations per cow per day nor the milk urea concentration (P=0.44). However, the 2x4 and 1x8 treatments captured approximately 25% more urinations (P<0.05) on the bark pad than the control. These findings highlight an opportunity to reduce nitrogen loss to the environment.

Table 1. Cow urination frequency and location for the 2x4, 1x8 and control treatments

	2x4[#]	1x8	Control	sed
Urinations/cow/day	13.82	12.73	14.28	6.02
Captured (pad + parlour)	0.35[a]	0.38[a]	0.10[b]	0.07
Uncaptured (pasture + race)	0.65[a]	0.62[a]	0.90[b]	0.07
Pasture	0.45[a]	0.51[a]	0.82[b]	0.06
Bark pad	0.13	0.23		0.08
Race	0.20[a]	0.11[ab]	0.07[b]	0.04
Milking parlour	0.22[a]	0.15[b]	0.10[b]	0.02
Milk urea (ng/mL)	7.76	8.20	7.29	0.61

[#]Different superscripts indicate significantly different means (P<0.05)

Key Words: pasture, urine capture, dairy

Ruminant Nutrition: Dairy 1

116 Production of angiopoietin-like protein 4 in ruminal tissue is decreased with increasing dietary fermentability. L. K. Mamedova*[1], G. B. Penner[2], K. A. Beauchemin[3], M. Oba[2], and B. J. Bradford[1], [1]*Kansas State University, Manhattan*, [2]*University of Alberta, Edmonton*, [3]*Agriculture and Agri-Food Canada, Lethbridge Research Centre, AB, Canada*.

Angiopoietin-like protein 4 (ANGPTL4, also known as FIAF) is a secreted protein that functions as a lipoprotein lipase inhibitor and a modulator of angiogenesis. Although it is produced by multiple tissues, gut secretion of ANGPTL4 has been implicated in host/microbe interactions, making the ruminal epithelium a site of interest. Ruminal tissues from 2 studies were used to assess effects of dietary fermentability on ANGPTL4 expression. In the first study, 12 mature, non-lactating, non-gestating Holstein cows were randomly assigned to low-concentrate (8% of dietary DM) or high-concentrate (64% of dietary DM) diets for a minimum of 28 d. Ruminal pH was monitored continuously for 3 d and ruminal fluid samples were collected for VFA analysis, then animals were euthanized and ruminal tissue was collected. In the second study, 8 beef heifers (700 kg final BW) were fed a finishing diet (90% concentrate, DM basis) for 140 d and then either left on the finishing diet or assigned to a backgrounding diet (60% concentrate, DM basis) for another 75 d. Ruminal pH was monitored continuously for 6 d prior to euthanization and ruminal tissue collection. Abundance of ANGPTL4 mRNA was measured by quantitative real-time PCR and protein by Western blotting. Diet effects were analyzed by ANOVA and correlations with rumen parameters were assessed by regression analysis. In the first study, the low-concentrate diet tended to increase ANGPTL4 mRNA by 120% ($P = 0.08$), although no effect on protein abundance was detected. Transcript abundance tended to correlate with mean ruminal pH ($P = 0.07$) and was inversely correlated with total VFA concentration ($P = 0.03$). In the second study, the backgrounding diet increased ANGPTL4 protein abundance ($P < 0.001$), and a positive relationship with ruminal pH was also observed ($P < 0.01$). These findings suggest that increased ruminal fermentation results in decreased expression of ANGPTL4 in ruminal tissue.

Key Words: rumen, epithelium, fermentability

117 Mammary transcriptomics response to milk fat-depressing or milk fat-enhancing diets in lactating dairy cows. G. Invernizzi*[1,2], B. J. Thering[1], D. E. Graugnard[1], P. Piantoni[1], M. A. McGuire[3], G. Savoini[2], and J. J. Loor[1], [1]*University of Illinois, Urbana*, [2]*University of Milan, Milan, Italy*, [3]*University of Idaho, Moscow*.

Gene networks regulating lipid metabolism were studied in mammary tissue biopsied at 0, 7, and 21 d of feeding mid-lactation cows (n = 5-6/diet) a milk fat-depressing (MFD, fish/soybean oil (1:2) at 3.5% of DM) or a milk fat-enhancing (MFE, EnergyBooster100, 3.5% of DM) diet for 28 d. Quantitative PCR was used for transcript profiling of 28 genes. Milk yield was not affected ($P > 0.05$) by diets (29 kg/d), but milk fat % (FP) decreased ($P < 0.05$) gradually (3.7% to ≈2.5%) with MFD and reached a nadir essentially by d 13 of feeding. MFE did not increase FP above controls and averaged 3.7%. MFE increased (interaction effect) genes associated with fatty acid (FA) import into cells (LPL, CD36), FA activation (ACSL1), intracellular transport (FABP3), and triacylglycerol synthesis (GPAM, LPIN1) mRNA at 7 and 21 d; whereas, MFD increased CD36, FABP3, GPAM, and ACSL1 mRNA only by 21 d. In addition, MFE increased mRNA expression of genes associated with fatty acid synthesis (ACSS2, ACACA, FASN) and synthesis of 20:5n3 (FADS1) during the treatment period. SCD abundance increased linearly through 21 d with MFE, whereas feeding MDF resulted in marked increase by 7 d followed by a return to basal expression by 21 d. ACACA was not affected by MFD and FASN increased by 21 d. Genes associated with lipid droplet formation and fat secretion (XDH, ADFP) in mammary tissue increased over time only with MFE. Among transcription regulators, MFE increased SREBF1 and INSIG1 throughout the study. MFD, however, resulted in higher expression of INSIG1 by d 7 and lower SREBF1 by d 21 vs. 0. Stearic, oleic, and palmitic acid molar yield was markedly lower by 7 through 21 d with MFD vs. MFE. Overall gene expression profiles with MFE agreed with production of milk fat and major fatty acids. Data also suggested a role for endogenous synthesis of oleic acid via SCD as well as INSIG1 in milk fat synthesis regulation.

Key Words: genomics, lipid nutrition, fatty acids

118 Mammary glucose metabolism in response to energy and/or protein supply in lactating dairy cows. S. Lemosquet*[1,2], F. Bardey[1,2], H. Rulquin[1,2], H. Lapierre[3], and J. Guinard-Flament[2,1], [1]*INRA, Rennes, France*, [2]*Agrocampus ouest, Rennes, France*, [3]*Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada*.

Milk yield usually increases in response to increased supply of energy (E) and protein (P), alone or in combination, in cows fed under require-