

**508 Optimizing brooding temperatures for large high yield broilers.** E. O. Oviedo-Rondón\*, M. J. Wineland, S. Funderburk, H. Cutchin, and J. H. Small, *Department of Poultry Science, North Carolina State University, Raleigh.*

Brooding is one of the most critical phases of broiler life due to their inability to thermoregulate. During the first days of life, birds mature from poikilothermic to homeothermic entities, and their body temperature is directly affected by ambient temperature. Two experiments were conducted in a commercial farm to estimate the best brooding temperature profiles for Ross-708 broilers raised to 9 weeks. The company standard house target temperature recommendations (CON) were compared with brooding profiles chosen to optimize the flock average rectal temperature (OB). Two paired houses with a comparable composition of day old broilers were used. In the first experiment, 19,800 chickens were placed in each house and processed at 66 days of age, during Winter/Spring conditions. In the second experiment 21,000 chickens per house were placed and processed at 63 days during Fall/Winter conditions. Rectal temperatures of at least 25 chickens per house were taken daily for the first two weeks and once a week until 35 days of age. House target temperatures were slowly reduced to avoid flock average rectal temperatures increasing above 105°F during the first 5 days. After first week, house target temperatures were adjusted to avoid average rectal temperatures rising above 107.5°F. Total BW, FCR, mortality, propane gas consumption, and flock uniformity were evaluated. Final average flock BWs were 77 and 50 grams better in the OB compared to CON in the first and second experiment, respectively. The OB group had better FCR in the first trial (1.88 vs 1.92) and no difference in the second trial (1.96). Flock uniformities improved with OB and gas consumption was reduced in 39%. The remarkable improvements in live performance and propane gas usage obtained with the OB treatment indicated that brooding temperatures could be optimized to maximize broiler performance and profitability.

**Key Words:** Broiler, Brooding Temperatures, Thermoregulation

**509 Influence of photoperiods and light intensities meeting American and European guidelines on broiler performance.** R. J. Lien\*, J. B. Hess, and L. M. Stevenson, *Auburn University, Auburn, AL.*

Broilers were subjected to photoperiods and intensities which independently meet US National Chicken Council (NCC) or European Union (EU) guidelines to determine effects on performance. Seventy broilers were placed in each of 12 light controlled rooms. Six rooms were subjected to NCC photoperiods (long) (wk 1, 23L:1D; wk 2-6 20L:4D; wk 7, 23L:1D) and six to EU photoperiods (short) (d 1-3, 23L:1D; d 4-46, 14L:4D:2L:4D; d 47-49, 23L:1D). Six rooms were subjected to a common US intensities (dim) (wk 1, 0.25 FC; wk 2-6, 0.025 FC; wk 7, 0.25 FC) and six to EU intensity (bright) (wk 1-7, 2 FC). BW and feed consumption were determined at 9, 23, 37 and 49 d. Ten birds/sex/room were processed at 49 d to determine parts weights and yields. Data were analyzed as a 2X2 factorial arrangement. Short-dim decreased 9 d BW; otherwise, BW were unaffected by treatment. Feed consumption was reduced by dim intensity at 9 and 23 d, and short photoperiod at 23 d. Feed conversion was reduced by dim intensity at 9 and 23 d, and in the long-dim treatment at 49 d. Uniformity was increased by short photoperiod at 23 d, and in long-dim and short-bright treatments at 49 d. Nine d mortality was increased by short-dim treatment. At 49 d, mortality was increased by short-dim, reduced by long-dim and short-bright, and intermediate in the long-bright treatment. Carcass yield was increased by bright intensity and long photoperiod. Wing weight was increased by dim intensity. Total breast and fillet weights were increased by long-bright, decreased by long-dim and short-dim, and intermediate in short-bright treatments. Front half and total breast yield were increased by long-bright treatment. Wing yield was increased by long-dim, reduced by long-bright and short-bright, and intermediate in the short-dim treatment. Fillet yields were increased by long-bright, slightly reduced by short-bright, and markedly reduced by long-dim and short-dim treatments. Results indicate differences in photoperiod and intensity specified by EU and NCC guidelines will influence both broiler live and processing performance.

**Key Words:** Broiler Chicken, Photoperiod, Light Intensity

## Ruminant Nutrition: Acid:Base Balance/Metabolism - Dairy

**510 Calcium homeostasis, acid-base balance, and health status in periparturient Holstein cows fed diets with low cation-anion difference.** W. X. Wu<sup>1,2</sup>, J. X. Liu<sup>\*1</sup>, G. Z. Xu<sup>1</sup>, and J. A. Ye<sup>1</sup>, <sup>1</sup>*Institute of Dairy Sciences, Ministry of Education Key Laboratory of Molecular Animal Nutrition, Zhejiang University, Hangzhou, China,* <sup>2</sup>*College of Animal Science, Guizhou University, Guiyang, China.*

Forty multiparous Holstein dry cows on d 21 prepartum were randomly allocated to four blocks of 10 cows to examine the effects of reducing the dietary cation-anion difference (DCAD) on calcium homeostasis, acid-base balance, health status, and subsequent lactation performance. The reduced DCADs (Na + K - Cl - S, mEq/kg DM) of +150, +50, -50, and -150 were obtained by addition of anionic salts. Reducing DCAD resulted in mild metabolic acidosis indicated by the sharp decline of urinary pH, and minor reductions of blood pH and HCO<sub>3</sub><sup>-</sup> concentration. Greater plasma calcium availability was sustained at the

highest level in cows fed -150 DCAD diet close to the time of calving, and the reduced DCAD had a close association with the means of plasma calcium from d 3 prepartum to d 3 postpartum. On d 1 and 2 postpartum, the highest colostrum composite calcium concentration was observed in cows receiving -150 DCAD diet. No case of milk fever occurred within any diets, but feeding negative DCAD diets improved cow health status over the two positive DCAD diets. The milk yield and fat, protein, and lactose compositions; and 4% fat-corrected milk production were not significantly affected by DCAD treatments. It is suggested that urinary pH is an effective indicator of extracellular fluid acid-base balance, and that feeding negative DCAD in late gestation period is beneficial for dairy cows in blood calcium homeostasis and improvement of health status.

**Key Words:** Dietary Cation-Anion Difference, Calcium Homeostasis, Periparturient Holstein Cows

**511 Dietary Na:K ratio effect on milk performance and mineral metabolisms in mid-lactation cows during summer.** W. Hu\* and L. Kung, Jr., *University of Delaware, Newark.*

The objective was to determine the effect of dietary Na:K ratio on milk performance and mineral metabolisms in lactating cows during summer. Fifteen mid-lactation Holstein cows averaging 160 days in milk were used in a replicated 3 × 3 Latin square design with treatments of dietary Na:K molar ratios (0.21, 0.53, and 1.06). The diets contained 0.25% Na and 2.00% K, 0.50% Na and 1.60% K, and 0.75% Na and 1.20% K [on a dry matter (DM) basis] respectively, with same dietary cation-anion difference (DCAD) of 33 meq (Na + K - Cl - S)/100 g of DM. Quadratic effect of the Na:K ratio occurred ( $P = 0.03$ ) on DM intake (28.4, 27.5, and 28.3 kg/d). The Na:K ratio did not affect ( $P > 0.10$ ) milk yield (39.2, 39.0, and 39.4 kg/d), milk composition (3.68, 3.53, and 3.59% fat; 3.00, 3.00, and 3.02% protein; and 8.60, 8.62, and 8.63% SNF), coccygeal venous plasma concentrations of  $\text{HCO}_3^-$  (30.0, 28.2, and 29.6 meq/l),  $\text{Na}^+$  (137.2, 136.1, and 136.7 meq/l),  $\text{K}^+$  (4.61, 4.52, 4.46 meq/l),  $\text{Cl}^-$  (98.2, 97.2, and 97.1 meq/l), Ca (9.99, 10.11, and 10.08 mg/dl), and Mg (2.55, 2.42, and 2.50 mg/dl), and urinary pH (8.35, 8.40, and 8.40) and  $\text{Cl}^-$ :creatinine (4.97, 4.20, and 3.88). Urinary  $\text{Na}^+$ :creatinine (1.80, 4.21, and 7.42;  $P < 0.01$ ), Ca:creatinine (0.035, 0.041, and 0.064;  $P < 0.01$ ), and Mg:creatinine (0.53, 0.60, and 0.77;  $P < 0.01$ ) increased linearly with increasing the Na:K ratio; whereas, urinary  $\text{K}^+$ :creatinine decreased linearly as the Na:K ratio increased (22.4, 15.9, and 10.3;  $P < 0.01$ ). Milk performance of mid-lactation cows was similar across dietary Na:K ratios with the same DCAD of 33 meq/100 g of DM.

**Key Words:** Sodium, Potassium, Performance

**512 Fertilization using potassium chloride decreased the DCAD of timothy hay.** M. Oba\*<sup>1</sup>, R. Hohm<sup>2</sup>, R. McKenzie<sup>2</sup>, and T. Dow<sup>2</sup>, <sup>1</sup>*University of Alberta, Edmonton, AB, Canada*, <sup>2</sup>*Alberta Agriculture and Food, Lethbridge, AB, Canada.*

The objective was to evaluate effects of KCl fertilization on dietary cation-anion difference (DCAD) of timothy (*Phleum pratense* L.) hay. We hypothesized that KCl fertilization would be effective at reducing DCAD of timothy hay. Treatments were fertilization protocols with a 2 × 5 factorial arrangement using two sources of potassium fertilizer (KCl vs.  $\text{KNO}_3$ ) and five rates of application (0, 50, 100, 200, and 400 kg of K/ha), and replicated in two locations: Bow Island and Lethbridge. Soil K concentration (0-15 cm) was greater at Bow Island compared to Lethbridge (293.3 vs. 187.7 ppm). For timothy grown in Bow Island, the K concentration was 1.64, 1.71, 1.69, 1.73 and 1.73 %DM for the K fertilization of 0, 50, 100, 200 and 400 kg/ha, respectively (linear effect:  $P < 0.05$ ). The Cl concentration was increased from 0.20 to 0.93 % (quadratic effect:  $P < 0.01$ ) and DCAD value decreased from 289 to 122 meq/kg DM (linear effect:  $P < 0.01$ ) by KCl fertilization while they were not affected by  $\text{KNO}_3$  fertilization. Similarly, in Lethbridge, K concentration of timothy hay was 1.52, 1.61, 1.67, 1.65 and 1.64 %DM for the K fertilization of 0, 50, 100, 200 and 400 kg/ha, respectively (quadratic effect:  $P < 0.01$ ). The Cl concentration was increased from 0.12 to 0.78 % (quadratic effect:  $P < 0.01$ ) and DCAD value was decreased from 237 to 91 meq/kg DM (linear effect:  $P < 0.01$ ) by KCl fertilization. The KCl fertilization increased the K concentration of timothy hay by 5% and 10%, but increased the Cl concentration by 365 and 550 % in Bow Island and Lethbridge, respectively. Consequently, KCl fertilization decreased

DCAD of timothy by more than 50% in both locations. Depending on the soil type, KCl may be an alternative and inexpensive source of Cl to produce low-DCAD timothy hay.

**Key Words:** KCl Fertilization, Timothy Hay, dietary Cation-Anion Difference

**513 Timothy hay differing in DCAD value affected Ca homeostasis in periparturient dairy cows.** M. Oba\*<sup>1</sup>, G. B. Penner<sup>1</sup>, G. F. Tremblay<sup>2</sup>, and T. Dow<sup>3</sup>, <sup>1</sup>*University of Alberta, Edmonton, AB, Canada*, <sup>2</sup>*Agriculture and Agri-Food Canada, Québec, QC, Canada*, <sup>3</sup>*Alberta Agriculture and Food, Lethbridge, AB, Canada.*

The objective was to evaluate effects of timothy (*Phleum pratense* L.) hay differing in dietary cation-anion difference (DCAD) on the capability to maintain Ca homeostasis in periparturient dairy cows. We hypothesized that feeding low-DCAD timothy hay to parturient cows would improve their Ca homeostasis right after calving. Thirty-five dry pregnant cows entering the second lactation or greater were used in a randomized block design. The timothy hay was obtained from an established timothy stand under a pivot irrigation system;  $\text{CaCl}_2$  was applied to the area between the second and third pivot towers at 224 kg/ha to produce the low-DCAD timothy hay, and control timothy hay was grown on the area between the fourth and fifth pivot towers of the same field. The Cl concentration was 1.05 and 0.07% DM, and DCAD value was 45 and 227 meq/kg DM, for low-DCAD and control timothy hay, respectively. Experimental diets, containing timothy hay at 65% of dietary DM (low DCAD vs. control), were fed ad libitum starting 30 d prior to the expected calving date. At the beginning of the study, urine pH and blood bicarbonate concentration averaged  $8.24 \pm 0.11$  and  $28.4 \pm 0.8$  mM, respectively. The low-DCAD treatment decreased ( $P < 0.05$ ) urine pH compared to control at 21 d (7.72 vs. 8.34), 14 d (7.70 vs. 8.23), and 7 d (7.68 vs. 8.23) before calving, and decreased ( $P < 0.05$ ) blood bicarbonate concentration 14 d (26.2 vs. 30.3 mM) and 7 d (26.9 vs. 30.8 mM) before calving. In addition, cows fed the low-DCAD treatment had greater ( $P < 0.05$ ) ionized Ca concentration compared to control at 0 h (1.07 vs. 0.97 mM) and 8 h (1.07 vs. 0.99 mM) post-calving; the treatment effect disappeared beyond 16 h post-calving. These data indicate that timothy hay differing in DCAD value affects the acid-base balance of periparturient dairy cows, and that low-DCAD timothy hay may prevent postpartum hypocalcemia.

**Key Words:** Chloride Fertilization, Timothy Hay, Hypocalcemia

**514 Effects of hypocalcemia at calving on intake, behavior and 305 milk production.** J. M. Huzzey<sup>1</sup>, T. F. Duffield<sup>2</sup>, S. J. LeBlanc<sup>2</sup>, D. M. Veira<sup>3</sup>, D. M. Weary<sup>1</sup>, and M. A. G. von Keyserlingk\*<sup>1</sup>, <sup>1</sup>*University of British Columbia, Vancouver, Canada*, <sup>2</sup>*University of Guelph, Ontario, Canada*, <sup>3</sup>*Pacific Agri-Food Research Centre, Agassiz, BC, Canada.*

Sub-clinical disease is often overlooked and rarely treated. The objective of this study was to describe the effects of sub-clinical hypocalcemia occurring shortly after calving on feed/water intake, feeding/drinking behavior and the longer-term effects on milk production. Intake and behavior of 93 Holstein dairy cows were

monitored from 3 wks before until 3 wks after calving. Within 24 h after calving a blood sample was taken from each cow and analyzed for serum total calcium (Ca) concentration. Daily milk yields were collected on each cow until 305 DIM. 28 cows were identified as hypocalcemic on the day of calving (Ca concentration was  $\leq 1.8$  mmol/L). Hypocalcemic cows had similar intakes to cows without hypocalcemia during the 3 wks before and 2 wks after calving, however DMI was on average 2 kg/d less in the hypocalcemic group during wk 3 ( $P=0.02$ ). There were no differences in feeding time between the two groups of cows over the course of the study ( $P=0.2$ ). Cows with hypocalcemia on the day of calving consumed on average 12 kg/d more water during wk 2 and wk 3 after calving relative to cows with normal calcium levels ( $P\leq 0.05$ ), but there were no difference between these groups in drinking behavior before or after calving. Hypocalcemic multiparous cows produced more milk during early and mid-lactation ( $P<0.01$ ). Over the course of their 305 lactation hypocalcemic multiparous cows produced on average 1190 kg more milk than multiparous cows with calcium concentrations  $>1.8$ mmol/L on the day of calving ( $P<0.01$ ). The greater requirements for calcium by cows with higher milk production may explain their increased risk of hypocalcemia and suggests that cows with higher potential may require special treatment.

**Key Words:** Hypocalcemia, Transition Cows, Feeding Behavior

**515 Strong ion concentrations in ruminal fluid of lactating dairy cows fed diets varying in fermentability.** C. S. Mooney\* and M. S. Allen, *Michigan State University, East Lansing.*

The objective of this experiment was to determine relationships among concentrations of strong ions and hydrogen ions in ruminal fluid of cows fed diets varying in fermentability. Eight ruminally cannulated Holstein cows in early lactation were used in an experiment with a duplicated  $4 \times 4$  Latin square design. A  $2 \times 2$  factorial arrangement of treatments was used with main effects of dietary starch concentration (32% vs. 21%) and conservation method of corn grain (dry, 90% DM or high-moisture, 63% DM). Ruminal fluid samples ( $n = 2,304$ ) were collected through a ruminal cannula every twenty minutes for 24 h per period during which feeding behavior and ruminal pH were monitored continuously. Hydrogen ion concentration of ruminal fluid was related negatively to sodium concentration ( $r = -0.50$ ,  $P < 0.0001$ ), positively to potassium ( $r = 0.28$ ,  $P < 0.0001$ ) and ammonium ( $r = 0.38$ ,  $P < 0.0001$ ) concentrations, and not highly related to chloride concentration ( $r = 0.04$ ,  $P = 0.09$ ). Change in ruminal potassium concentration was related to meal size ( $r = 0.83$ ,  $P < 0.0001$ ) which was expected because of influx of potassium from the diet. However, meal size and ruminal sodium concentration were negatively related ( $r = -0.64$ ,  $P < 0.0001$ ) despite influx from saliva and the diet. Sodium concentration of ruminal fluid was negatively related ( $r = -0.75$ ,  $P < 0.0001$ ) to the sum of potassium and ammonium concentrations causing the sum of sodium, potassium, and ammonium concentrations to be relatively constant ( $140.0 \pm 9.8$  mEq/L, mean  $\pm$  SD,  $n = 2246$ ). Hydrogen ion concentration of ruminal fluid was related negatively to strong ion difference measured as ruminal concentrations of sodium plus potassium minus chloride ( $r = -0.43$ ,  $P < 0.0001$ ). An alkalinizing strong ion difference was measured in all ruminal fluid samples ( $n=2245$ ). Maintenance of total cation concentration of ruminal fluid balances the charge of dissociated fermentation acids, maintains the bicarbonate pool, and controls ruminal osmolality.

**Key Words:** Rumen pH, Sodium, Potassium

**516 Feed efficiency of lactating dairy cows is related to dietary energy density.** D. P. Casper\*<sup>1</sup> and D. R. Mertens<sup>2</sup>, <sup>1</sup>*Agri-King, Inc., Fulton, IL*, <sup>2</sup>*USDA-ARS Dairy Forage Research Center, Madison, WI*.

Monitoring of the Feed Efficiency (FE) of lactating dairy cows has become more important in recent years due its direct effect on the profitability of the dairy operation. Our objective was to identify those variables associated with energy metabolism that influence the FE of lactating dairy cows. The Energy Metabolism Database is a compiled dataset of all energy and N balance trials that were conducted at the Energy Metabolism Unit of the USDA-ARS, which contains approximately 2,940 individual energy and N balance digestion trials with measurements of respiratory exchange using open circuit respiration chambers. Only 1,289 of these individual metabolism trials used lactating dairy cows of different breeds and stages of lactation that were fed diets that varied in forage types, grain sources, protein sources, and fat supplements. All data were analyzed using linear regression procedures of SAS. The initial data analysis indicated that ruminal acidosis may have occurred and affected FE results. Thus, metabolism trials of lactating dairy cows having inverted fat and protein ratios (acidosis criteria) were removed, which resulted in 460 observations for evaluating variables related to FE. The amount of dry matter absorbed by lactating dairy cows had a significant effect on FE ( $FE = 0.46 + 0.067 * DM \text{ Absorbed, g/d; } R^2 = 0.36, P < 0.01$ ). In addition, the greater the energy density of the diet ( $NE_L$ , Mcal/kg), the greater the FE of lactating dairy cows ( $FE = 0.004 + 1.156 * NE_L, \text{ Mcal/kg DM; } R^2 = 0.55, P < 0.01$ ). As expected, FE was positively related to milk production ( $FE = 0.60 + 0.03 * \text{Milk, kg/d; } R^2 = 0.77, P < 0.01$ ). It appears that ruminal acidosis negatively effects digestibility thereby affecting the energy metabolism of the lactating dairy cow. Without acidosis, the FE of lactating dairy cows was determined by the energy density of the diet. Improving the energy density of the diet through enhanced dry matter digestibility will improve FE and thereby increase profitability of the dairy operation.

**Key Words:** Feed Efficiency, Energy Density, Acidosis

**517 Factors affecting milk urea nitrogen in dairy cattle.** J. Ramirez\*<sup>1</sup>, D. Lefebvre<sup>2</sup>, and K. M. Wade<sup>1</sup>, <sup>1</sup>*McGill University, Montreal, QC, Canada*, <sup>2</sup>*Valacta, Ste. Anne de Bellevue, QC, Canada*.

The aim of this study was to estimate non-nutritional and nutritional factors that influence milk urea nitrogen (MUN) using machine-learning techniques. 2,253,667 milk test-day records were collected by the Quebec dairy herd improvement agency (VALACTA). The files contained test-day, body-weight and diet-composition records of 611,358 cows from 5,886 farms over a period of 5 years. A database was constructed from the animal identification file, test-day file, body-weight, and feed file. Descriptive statistical analysis was performed including breed (Ayrshire, Brown Swiss, Holstein and Jersey), parity, stage of lactation, season, year, and sampling time. Mean MUN values were 12.11, 13.44, 11.06, and 13.8 mg/dL in Ayrshire, Brown Swiss, Holstein and Jersey, respectively. These values decreased with increasing body weight. In Holsteins, MUN levels increased with parity number but parity variations were numerically small. The MUN concentration was lower during the first 30 DIM, but increased in subsequent months. There was a strong negative relationship between MUN and milk yield. Temporal variations suggested a drop in the levels of MUN during the summer followed by a peak during the fall



months. For an analysis using machine-learning techniques, MUN values were grouped into three classes (low, medium, and high). For each of the four breeds, a decision tree was induced to identify potential interactions among the variables in the dataset. Results for the Ayrshire breed indicated that MUN variations were principally due to SCC and time of milk sampling. Body-weight, DMI, and time of milk sampling had a strong influential effect on medium levels of MUN in Jerseys, while MUN levels in Holsteins seemed to be strongly influenced by the interaction of milk fat with SCC and stage of lactation.

**Key Words:** Milk Urea Nitrogen, Machine Learning, Decision Trees

**518 The relevance of milk components for the assessment of the energy, protein and structure balance of Holstein Friesian cows.** M. Kaske<sup>\*1,2</sup>, S. Seggewiss<sup>2</sup>, K. Horstmann<sup>2</sup>, M. Spolders<sup>3</sup>, and U. Meyer<sup>3</sup>, <sup>1</sup>*Physiology Weihenstephan, Technical University Munich*, <sup>2</sup>*Clinic for Cattle, University of Veterinary Medicine Hannover*, <sup>3</sup>*Institute of Animal Nutrition, Federal Agricultural Research Centre Braunschweig*.

The objective was to characterize the usability of milk component data for the assessment of the alimentary supply of dairy cows. Therefore, the correlations between energy, protein and structure balance and milk constituents (analysed twice per week) were estimated in 50 Holstein Friesian cows (8709 +/- 1472 kg FCM). Cows were fed maize and alfalfa silage (65:35 w/w; 5.9 MJ NEL/kg DM) ad libitum via computerized feeder stations and concentrates (8.3 MJ NEL/kg DM) according to milk yield by automatic feeders. For each cow, daily energy balance [EB], protein balance [PB] (on the basis of nXP) and structure balance [SB] (Hoffmann, 1990) were calculated. The value of the "9-field-table" (used to assess the energy supply based on milk protein and the protein supply based on milk urea) was tested for each month of lactation; a balanced supply was defined as  $\pm 15$  MJ NEL/d and  $\pm 300$  g nXP/d. - The EB of the cows was assessed correctly for 30.8–42.7% and the protein balance for 38.5–72.9 % of the samples. Only 13.8–32.2% of the samples were categorized correctly for both parameters. A significant negative correlation between EB and milk yield was found during the first four months of lactation ( $r = -0.15$  to  $-0.30$ ); thereafter, EB and milk yield were positively correlated ( $r = 0.15$ ). EB was negatively correlated to milk fat content ( $r = -0.16$  to  $-0.54$ ), fat-protein-ratio ( $r = -0.33$  to  $-0.44$ ) and fat-lactose-ratio ( $r = -0.28$  to  $-0.59$ ). SB and milk fat were positively correlated ( $r = 0.24$  to  $0.28$ ). - The effects of an energy restriction were examined on days 15, 29, 43 and 78 post partum by withdrawal of 8-10 kg concentrates for 24 hours. Milk yield and milk components did not change significantly compared to the days before restriction, but on the following day milk yield and milk protein decreased and milk fat content, fat-protein-ratio and fat-lactose-ratio increased significantly. - Conclusions: Milk fat content and fat-protein-ratio reveal severe energetic and structural deficits only on a herd basis. EB and PB of individual cows can not be assessed reliably by evaluation of milk components.

**Key Words:** Energy Balance, Milk Components, Milk Protein

**519 Evaluation of acute phase reactants and indices of liver function in serum from dairy cows fed different levels of energy prepartum.** N. A. Janovick Guretzky<sup>\*1</sup>, H. M. Dann<sup>1</sup>, M. Bionaz<sup>1</sup>, E. Trevisi<sup>2</sup>, G. Bertoni<sup>2</sup>, and J. K. Drackley<sup>1</sup>, <sup>1</sup>*University of Illinois, Urbana*, <sup>2</sup>*Universita Cattolica del Sacro Cuore, Zootechnica, Piacenza, Italy*.

Markers of inflammation have been associated with fatty liver in dairy cows. To investigate effects of prepartum plane of nutrition on inflammation and liver function, serum from 73 multiparous Holstein cows was used to profile acute phase response reactants and enzymes associated with liver function. Dietary treatments were assigned by expected date of parturition in a 3 x 2 factorial design. During the far-off (FO) period, cows were assigned to 1 of 3 dietary treatments: 1) fed ad libitum to supply  $\geq 150\%$  of  $NE_L$  requirements (HI) for dry cows in late gestation (NRC, 2001); 2) fed a diet containing chopped wheat straw to limit intake to approximately 100% of  $NE_L$  requirements (LIM); and 3) limit-fed to 80% of  $NE_L$  requirements (LO). During the close-up (CU) period, cows were fed ad libitum to supply  $\geq 150\%$  of their requirement for  $NE_L$  (ADLIB) or restricted to 80% of their requirement for  $NE_L$  (REST). At parturition, all cows were fed a common lactation diet. Data for variables analyzed in serum obtained pre- and postpartum were analyzed using repeated measures. Cows fed HI had lower (FO,  $P < 0.02$ ) paraoxanase prepartum compared with LIM or LO. Cows fed HI-REST tended to have higher haptoglobin prepartum than cows fed HI-ADLIB or LO-REST (FOxCU,  $P = 0.07$ ). Cows fed HI tended to have lower (FO,  $P = 0.06$ ) albumin compared with LIM and higher (FO,  $P = 0.04$ ) bilirubin postpartum compared with REST. Cows fed ADLIB had higher (CU,  $P = 0.04$ ) aspartate transaminase than REST cows regardless of FO treatment. Concentrations of total lipid and triglyceride in liver postpartum were positively correlated ( $P < 0.04$ ) with bilirubin and ceruloplasmin and negatively correlated ( $P < 0.01$ ) with paraoxanase measured postpartum. Overfeeding during the dry period may have compromised liver function postpartum and contributed to inflammation and development of fatty liver.

**Key Words:** Inflammation, Fatty Liver, Periparturient Period

**520 Gene expression in adipose tissue of the dairy cow during late pregnancy and lactation fed control diets or diets with supplemental chromium: Integration of gene expression into metabolic models.** J. P. McNamara<sup>\*1</sup>, J. M. Sumner<sup>1</sup>, J. L. Vierck<sup>1</sup>, and A. Jourdan<sup>2</sup>, <sup>1</sup>*Washington State University, Pullman*, <sup>2</sup>*Kemin Industries, Inc., Des Moines, IA*.

We conducted an analysis of gene expression in adipose tissue of dairy cattle in late pregnancy and early lactation. One objective was to determine gene expression between 30 days prepartum and 30 DIM; another was to determine if dairy animals fed supplemental Chromium Propionate had responses gene expression. Adipose tissue was biopsied from Holstein dairy cattle at 30 days pre and post partum. We extracted complete mRNA from samples from 3 cows at each time point (same cows, repeated measures) for gene array analysis. Among those genes increasing ( $P < 0.10$ ) to 30 DIM were those signaling for myosin heavy chain, several immunoglobulins and receptors, and neutrophil beta-defensin 5. Among those decreasing ( $P < 0.10$ ) from 50 to over

75 % included acetyl CoA Carboxylase (-79 %), ATP citrate lyase (-75 %), insulin receptor induced protein (-77 %), IGFI (-30 to 50%), and IGFBP3 (-55 %). Leptin expression (Genbank: NM\_173928.1) was reduced 57 %. In a separate study, we fed 10 mg/d of chromium from 21 d prepartum through 35 DIM. There were 223 genes that were increased 2-fold or more at d -7 versus controls, and 1150 were decreased 50% or more compared to control. There were 3517 genes lower in supplemented cows in which at least one of the signals had an expression of 50 or more on the Affymetrix chip. There were 24 genes that increased and 347 that decreased in CrP supplemented animals

at both days. The primary functional cluster of genes that were up regulated in supplemented animals included those functioning in cell synthesis and in the immune system, such as myosin heavy chain and immunoglobulin A receptor. Genes decreased at both times to chromium were NADH dehydrogenase, t-cell receptor, and prostaglandin PGH2. Leptin expression was decreased by KT at d 28, as was growth hormone receptor mRNA. We have integrated a preliminary gene expression map with a mechanistic model of metabolism in dairy cattle.

**Key Words:** Adipose, Gene Array, Lactation Model

## Ruminant Nutrition: Corn Milling Co-Products - Beef

**521 Environmental concerns with feeding corn milling co-products in feedlot diets.** T. J. Klopfenstein\* and G. E. Erickson, *University of Nebraska, Lincoln.*

The grain to ethanol industry is rapidly expanding which creates challenges and opportunities for the cattle feedlot industry. This expansion creates competition for grain; however, byproducts may offer opportunities to reduce costs of production. Meta analysis indicates that wet distillers grains have 25 to 45% more feed value than corn and wet corn gluten feed has equal to or 9.4% more energy than corn depending on the plant processes. Priced at or below the price of grain, byproducts are economically advantageous to the feedlot industry. Ethanol is produced from the starch in grain so by removing the starch, nutrients are concentrated in the byproducts (three times in distillers grains). The two nutrients of concern, from an environmental standpoint, are N & P. Nitrogen is a concern primarily because it is volatilized from the surface of open feedlot pens. Alternatively, P is not volatilized...what the cattle excrete is what must be managed in the manure. A diet containing 40% distillers grains on a dry basis has about 18% CP which is about 50% above the animal's requirement. All of the excess N is excreted. A diet with 40% gluten feed is near the animal's requirement for CP. Byproduct diets are less digestible than corn based diets and the additional OM in the manure helps retain some of the excess N. Frequent cleaning is also beneficial. There is still a net loss of N as ammonia. A diet with 40% byproduct has about 0.5% P which is about three times the requirement. This essentially doubles the land necessary to utilize the manure compared to a corn-based diet. For a 25,000 hd feedlot that may add \$2 to \$3 per animal to distribute the manure. However, because of the value of the P as fertilizer there is actually a net benefit of \$3 to \$5 per animal fed. Phosphorus is a distribution issue with byproduct feeding, not a negative economic issue. While ammonia loss from open feedlots is not currently regulated, it may be in the future. Methods of maintaining the N in the manure to capture its value as fertilizer need to be researched for both diets with and without byproducts.

**Key Words:** Cattle Feeding, Nitrogen, Phosphorus

**522 Effect of modified wet distillers grains level on feedlot cattle performance and nitrogen mass balance.** M. K. Luebbe\*, G. E. Erickson, T. J. Klopfenstein, and M. A. Greenquist, *University of Nebraska, Lincoln.*

A summer feedlot trial was conducted to evaluate the impact of modified wet distillers grains plus solubles (52% DM, WDGS) level on steer performance, manure N removed, and N lost via volatilization. Ninety-six yearlings (373 ± 24 kg) were stratified by BW and assigned randomly to 12 pens. Steers were fed for 133 d from June to October. Treatments consisted of 0, 15, and 30% dietary inclusion of WDGS (DM basis) replacing corn (CON, 15WDGS, 30WDGS, respectively). Basal diets consisted of high-moisture and dry-rolled corn fed at a 1:1 ratio, 7.5% alfalfa hay, 5% molasses, and 5% supplement (DM basis). The CON and 15WDGS diets were balanced for MP using the 1996 NRC, and 30WDGS was in excess of requirements. Nitrogen excretion was determined by the difference between N intake and individual steer N retention. Total N lost was calculated by subtracting manure and runoff N from excreted N. Dry matter intake tended (P=0.09) to increase linearly with WDGS level. Average daily gain was lower (P=0.05) for CON compared with 15 and 30 WDGS (1.80, 1.94, and 1.91 kg, respectively). Carcass measurements, G:F, and final BW were not influenced (P>0.10) by WDGS level. Manure OM linearly increased (P=0.02) with WDGS level. Nitrogen intake was greatest (P<0.01) for 30WDGS, intermediate for 15WDGS, and least for CON (42.9, 35.5, and 28.9 kg•steer<sup>-1</sup> over 133 d, respectively). Nitrogen retention did not differ (P=0.16) among WDGS level. Excretion of N was greatest (P<0.01) for 30WDGS, intermediate for 15WDGS, and least for CON (38.0, 30.5, and 24.3 kg, respectively). Manure N was greater (P<0.01) for 30WDGS (10.2 kg) compared with 15WDGS (6.5 kg) and CON (5.8 kg). Runoff N was not different (P=0.54) among WDGS level. Amount of N lost was greatest (P<0.01) for 30WDGS, intermediate for 15WDGS, and least for CON (26.5, 20.0, and 14.1 kg, respectively) but percent loss (percent of excreted N) was not different (P=0.32) among treatments. In this study feeding WDGS balanced for MP or in excess of requirements resulted in improved ADG and more N in the manure for 30WDGS. However, the amount of N lost was increased when WDGS was fed.

**Key Words:** Cattle, Nitrogen, Waste Management

**523 Effect of wet distillers grains level on phosphorus balance in beef feedlots.** M. K. Luebbe\*, G. E. Erickson, T. J. Klopfenstein, and M. A. Greenquist, *University of Nebraska, Lincoln.*

The effect of wet distillers grains plus solubles (WDGS) level on P mass balance was evaluated in two experiments. Calves were fed 167 d from November to May (WINTER) and yearlings were fed 133 d