717 Effect of management and milk yield on the incidence of lameness in dairy cattle. C. Lira Diaz and J. K. Margerison*, *Massey University*, *Palmerston North, New Zealand.*

Data was collected from 14 commercial farms, comprising a total of 6412 cows (mean 458 cows per farm). Farms were nominated by a nutrition consultant in 4 districts of the North Island, New Zealand. Data was collected weekly over the period of 1st July 2007 until 31st July 2008 by the same observer during farm visits to monitor overall productivity, nutrition and health. Cows were classified into either Holstein Friesian (HF), Jersey (J) or Jersey cross Friesian (X). Lameness cause, type of lesion, locomotion scoring and location of any lesions were recorded using a 5 point scale and lame cows were inspected to determine the type of lesion and classified into five groups: (1) White line; (2) Sole damage; (3) Foot rot; (4) Laminitis; (5) Tender feet (LS 2-3). Data each cow on the farm was available throughout the lactation and dry cow period, or until any animal was no longer in the herd. Holstein Frisian cows were 7.9 (95% CI=4.18-12.02) times more likely to become lame compared to Jersey cows. Likewise, Crossbred cows were 4.64 (95% CI=2.82-7.63) times more likely to be lame than Jersey cows. Of the cows were lame 0.74 were hind feet compared to 0.14 for fore feet. A higher percentage of cows lame was during winter and spring time, whereas summer time had significantly lower mean percentages than the other seasons. In winter cows were 2.78 (95% CI= 2.58-2.99) more likely to be lame than cows in summer. There was no significant effect of walking distance on frequency of lameness (P=0.5726). Cows in early lactation had the highest mean percentages of lameness and were 1.68 (95% CI=1.66-1.70) times more likely to be lame than cows in middle stage of lactation. Higher yielders were 1.95 (95% CI= 1.80-2.11) times more likely to be lame than low yielders and moderate producers were 1.35 (95% CI= 1.35-1.61).

Key Words: lameness, breed, management

718 Competition at the feed bunk affects DMI and feeding behavior of metritic dairy cows. K. L. Proudfoot*, D. M. Weary, and M. A. G. von Keyserlingk, *University of British Columbia*, *Vancouver, BC, Canada*.

Cows at-risk for metritis after calving decrease dry matter intake (DMI) in the weeks before and after calving. It remains unclear how competition at the feed bunk may impact the DMI and feeding behavior of cows at-risk for metritis. Our aim was to test the effect of a competitive feeding environment on the feeding behavior of cows that become sick after calving versus those that remain healthy. Using an electronic feeding system we monitored DMI and feeding behavior of 76 Holstein cows from 1 wk before to 2 wk after calving. Cows were assigned to a competitive (2:1 cows:bin) or non-competitive (1:1 cow:bin) treatment and were examined for clinical metritis every 3 d after calving. Multiparous cows on the competitive (n=8) and non-competitive treatments (n=8) diagnosed with clinical metritis after calving were matched with healthy cows on each treatment (n=8/treatment). Using PROC MIXED we tested fixed effects of treatment and health, and a treatment*health interaction for DMI, feeding time and rate of intake for the following 3 periods: wk-1 (d-8 to d-1 pre-calving), wk+1 (d1 to d8 post-calving) and wk+2 (d9 to d16 post-calving). We detected an effect of health on DMI and feeding time where sick cows, regardless of treatment, ate less and spent less time feeding than cows that remained healthy. During wk-1, competitively fed cows tended to eat less than non-competitively fed cows (13.4±0.8 kg/d vs 14.8±0.8 kg/d, P=0.07). We found no effect of health on feeding rate, but there was a trend for a health*treatment interaction for feeding rate during the wk+1 (P=0.10). When tested separately, competitively fed metritic cows ate faster than healthy cows (139±7 g/min vs 116±8 g/min, P=0.04). There were no differences in feeding rate between non-competitive health groups (P=0.77). We provide the first evidence that competition at the feeder can alter the DMI and feeding behavior of cows at-risk for metritis after calving. Future work should examine the effect of competition on social behavior before calving, and the links between social status and disease.

Key Words: transition, competition, DMI

Ruminant Nutrition: Minerals

719 Thirty-eight years of vitamin D and calcium research: From dairy cows to humans. R. L. Horst*, *Heartland Assays, Inc.*, *Ames, IA*.

There is a long-standing and continuing interest in the relationship between vitamin D status and calcium nutrition. In that regard, several facts have been well established: 1.) Vitamin D must be converted in the liver to form 25-hydroxyvitamin D, which is consider the most clinically useful metabolite in evaluating vitamin D status and 2.) 25-hydroxyvitamin D must be converted to its active metabolite, 1,25-dihydroxyvitamin D. In mammals and birds, the 1,25-dihydroxyvitamin D acts to maintain calcium homeostasis by stimulating intestinal calcium transport and bone calcium mobilization. All of the compounds in the vitamin D activation cascade (including vitamin D itself) have been used in some form in attempts to prevent periparturient hypocalcemia (milk fever) in dairy cows. These attempts were met with varying degrees of success, which has lead to more interest in controlling milk fever by dietary measures. Although vitamin D in mainly associated with calcium metabolism and bone health, it has recently received at lot of attention regarding its relationship with heart health, cancer and infectious diseases. Several epidemiologic studies in humans have suggest that vitamin D may account for several thousand premature deaths due to colon, breast, ovarian, prostate cancer. The active form of vitamin D, 1,25-dihydroxyvitamin D, has also been shown to up-regulate the innate immune response triggering direct antimicrobial activity against intracellular bacteria such as Mycobacterium tuberculosis. So, what was once thought to be a simple vitamin affecting only bone and calcium metabolism is now seen as a complex pre-hormone that is involved not only in calcium homeostasis but also in maintaining, down to the cellular level, the integrity various organ systems throughout the body.

Key Words: vitamin D, calcium, functions

720 The optimum dietary Ca concentration to minimize the risk of hypocalcaemia in dairy cows is affected by dietary cation-anion difference. M. Oba*[1], A. Oakley[1], and G. Tremblay[2], [1]*University of Alberta*, *Edmonton, AB, Canada*, [2]*Agriculture and Agri-Food Canada*, *Quebec, QC, Canada*.

The objective of this study was to determine whether dietary Ca concentration affects the ability to maintain Ca homeostasis in dairy cows fed diets differing in dietary cation-anion difference (DCAD). Eight non-lactating and non-pregnant multiparous Holstein cows (594 ± 80.3 kg

BW; 34.5 ± 11.4 month old) were fed diets low or high in DCAD (-5.4 vs. 9.7 mEq/100g DM, respectively) in combinations with low or high dietary Ca concentration (0.30 vs. 0.90% of dietary DM) in a duplicated 4×4 Latin square design with 14-d periods. Diets consisted of low or high DCAD timothy hay (70% of dietary DM) supplemented with low or high Ca concentrate mix (30% of dietary DM). Following 13-d diet adaptations, cows were subjected to an EDTA challenge; intra-jugular infusion of EDTA solution to decrease blood Ca concentration. In this protocol, the time required to reduce blood Ca concentration to 60% of the pre-challenge values and the time required to recover to 90% of the pre-challenge values after EDTA infusion is stopped were determined as resistance and recovery time, respectively. Blood pH (7.41 vs. 7.44; $P < 0.01$) and urine pH (5.67 vs. 6.86; $P < 0.01$) were lower for cows fed low DCAD diets compared to those fed high DCAD diets, but plasma parathyroid hormone concentration was not affected by treatment, averaged at 22.1 p*M*. Although dietary treatments did not affect the resistance time, feeding high Ca diet shortened the recovery time (106 vs. 134 min; $P < 0.05$) when DCAD is low, while low Ca diet shortened the recovery time (125 vs. 159 min; $P < 0.05$) when DCAD is high. Cows fed low DCAD diets mitigated metabolic alkalosis, but the ability to maintain Ca homeostasis was improved only for cows fed the high Ca diet. These results suggest that the optimum dietary Ca concentration to minimize the risk of hypocalcaemia in dairy cows is likely different depending on the DCAD value.

Key Words: DCAD, dietary Ca, EDTA challenge

721 Effects of copper deficiency on gene expression profiles of copper transporters and chaperones in steers. R. S. Fry*[1], M. S. Ashwell[1], S. L. Hansen[1], T. E. Engle[2], H. Han[2], and J. W. Spears[1], [1]*North Carolina State University*, *Raleigh*, [2]*Colorado State University*, *Fort Collins*.

An experiment was conducted to evaluate the gene expression profiles of Cu transporters and chaperones in the intestine and liver of steers in response to long-term Cu deficiency. Angus calves (n = 14) were born to cows fed one of the following dietary treatments for 410 d prior to calving: 1) Cu-adequate (+Cu; 10 mg supplemental Cu/kg DM) or 2) Cu-deficient (-Cu). Copper deficiency was produced by providing no supplemental Cu and supplementing the Cu antagonist Mo at 2 mg/kg DM. Calves remained on the same dietary treatments as their dams after weaning, and were individually fed treatment diets for an additional 310 d. Calves were harvested on d 493, and duodenal scrapings and liver samples were collected from steers and flash frozen for Cu content and analysis of several genes encoding proteins necessary for Cu metabolism. These Cu transporters and chaperones have been shown in rodents to regulate Cu entry into the cell (CTR1), deliver Cu to cytochrome c oxidase (COX17), to the trans-golgi network (ATOX1), and for Cu export into cuproenzymes (ATP7A and ATP7B). Plasma Cu (0.2 vs. 1.3 mg/L) and liver Cu (6.3 vs. 217.6 mg Cu/kg DM) on d 490 was lower ($P < 0.001$) in -Cu steers compared to +Cu steers. Duodenal expression of *Ctr1*, *Atox1*, *Cox17*, and *Atp7b* was not different due to Cu deficiency. There was a trend ($P = 0.12$) for duodenal *Atp7a* to be up-regulated in -Cu steers. Liver expression of *Ctr1* and *Atox1* was not different; however, *Cox17*, *Atp7a*, and *Atp7b* were differentially expressed. Copper deficiency markedly ($P < 0.01$) reduced the relative expression of *Cox17* and tended ($P \leq 0.10$) to reduce relative expression of *Atp7a* and *Atp7b*. Results from this study indicate that Cu deficiency decreases expression of certain Cu transporters and chaperones in cattle. Furthermore, it appears that Cu transporters in the liver are affected to a greater extent than duodenal Cu transporters.

Key Words: cattle, copper, transporters

722 Strategic use of naturally selenium-rich milling coproducts to manage selenium deficiency. J. B. Taylor*, *USDA, Agricultural Research Service*, *Dubois, ID*.

The objective was to use Se-rich milling coproducts to enhance the long-term Se status of ewes and their lambs. A complete randomized design experiment was used to test the null hypothesis that diets formulated with Se-rich wheat middlings will not alter the Se status of lactating ewes and their lambs. Mature Columbia x Polypay ewes (n = 28; BW = 76.9±1.9 kg) with twin lambs were placed in individual pens 6 h after parturition. Selenium treatments were assigned randomly to each ewe. Treatments were adequate or elevated dietary Se. The adequate-Se treatment was fortified with Na_2SeO_3 and the elevated-Se treatment was formulated with Se-rich wheat middlings to provide (DM basis) 0.02 and 0.11 mg of Se per kg of BW per day, respectively. Treatments commenced when ewes were placed in pens and continued for 19 d. Ewe feeding and watering receptacles were placed out of reach of the lambs; thus, the lambs' nutrition was restricted to their dam's milk. Milk samples were collected at 18 d of treatment. Skeletal muscle samples were collected from anesthetized ewes and lambs at the end of the 19-d treatment period, and 108 d later. The following data are least squares means with SEM in parentheses. Muscle Se was greater ($P<0.04$) in elevated-Se than in adequate-Se ewes; muscle Se (DM basis) was 0.88 and 0.46 (0.04) mg/kg at the end of the treatment period and 0.49 and 0.38 (0.04) mg/kg 108 d later, respectively. Milk Se was greater ($P<0.01$) in elevated-Se than in adequate-Se ewes; milk Se was 0.53 and 0.06 (0.03) mg/L at the end of the treatment period, respectively. Muscle Se was greater ($P<0.01$) in lambs nursing elevated-Se ewes than in lambs nursing adequate-Se ewes; muscle Se was 2.96 and 0.43 (0.07) mg/kg at the end of the treatment period and 0.74 and 0.25 (0.02) mg/kg 108 d later, respectively. Through strategic use of Se-rich milling coproducts, skeletal muscle in ewes and their lambs were simultaneously enriched with Se within a 19-d period. Selenium enrichment remained significant for 108 d. This information will enable livestock producers to utilize Se-deficient rangelands for extended periods of time without having to provide supplemental Se.

Key Words: deficiency, lactation, selenium

723 Effects of nutritional plane and selenium supply on intestinal mass, cellularity, and proliferation in the ewe. A. M. Meyer*[1], J. J. Reed[1], T. L. Neville[1], L. R. Coupe[1], J. B. Taylor[2], L. P. Reynolds[1], D. A. Redmer[1], K. A. Vonnahme[1], and J. S. Caton[1], [1]*North Dakota State University*, *Fargo*, [2]*USDA-ARS, U.S. Sheep Experiment Station*, *Dubois, ID*.

Objectives were to investigate the effects of maternal nutrition and Se supply during gestation on intestinal mass and growth in ewes at parturition and during early lactation. Rambouillet ewe lambs (n = 84) were allocated to treatments arranged as a 2 x 3 x 2 factorial. Factors were dietary Se (adequate Se [ASe, 8.5 µg/kg BW] or high Se [HSe, 80 µg/kg BW]), nutritional plane (60% [RES], 100% [CON], or 140% [HIGH]), and necropsy period (parturition or d 20 of lactation). At parturition, lambs were removed, and 42 ewes (7/treatment) were necropsied. Remaining ewes were transitioned to a common diet that met requirements of lactation and mechanically milked until necropsy on d 20. The small intestine was dissected and tissues were harvested at both necropsy periods. Where interactions were present ($P \leq 0.10$), least square means from the highest order interaction are presented. At parturition, small intestinal mass was greater ($P < 0.002$) for HIGH fed ewes than RES and CON (629 vs. 447 and 492 ± 32 g) and was greater ($P < 0.01$) for ASe than HSe (572 vs. 473 ± 25 g). Small intestinal mass increased (*P*

< 0.02) from parturition to lactation (523 vs. 732 ± 18 g). Ewes fed the HIGH diet had greater ($P \leq 0.02$) jejunal mass than RES and CON. At parturition, jejunal mass was greater ($P = 0.04$) for ASe than HSe fed ewes and jejunal mucosal density was less ($P \leq 0.01$) for RES fed ewes than CON and HIGH. Jejunal mucosal DNA concentration in ewes fed HSe was greater ($P < 0.001$) at parturition than lactation. Ewes fed the CON diet had greater ($P < 0.003$) jejunal mucosal RNA:DNA than RES and HIGH at parturition. Mucosal protein:DNA decreased ($P = 0.03$) from parturition to lactation. Jejunal cell proliferation was greatest ($P < 0.09$) in RES, intermediate in CON, and least in HIGH fed ewes during lactation. Total number of proliferating jejunal cells was greater ($P \leq 0.04$) in HIGH fed ewes than RES and CON at parturition, and was greater ($P < 0.05$) in RES fed ewes than CON and HIGH on d 20 of lactation. Results indicate that maternal intestinal growth is responsive to nutritional plane, dietary Se, and periparturient period.

Key Words: gestational nutrition, intestine, selenium

724 Mineral balances in California dairy farms. A. R. Castillo*[1], N. St-Pierre[2], and N. Silva del Rio[1], [1]*University of California, Cooperative Extension, Merced*, [2]*The Ohio State University*, *Columbus*.

Forty commercial dairy farms in Merced County (CA) were selected to study mineral balance in lactating animals (mean 787±592 lactating cows/farm). Dairies were selected based on total salt (TS) drinking water content (mean 560±343.3 TS mg/L, from 100 to 1680 mg/L) and on daily milk average yield per cow (mean 31.5±5.31 kg milk/cow per day, ranging from 20.6 to 43.5 kg milk/cow per day). Pearson correlation analysis was used to study the mineral balance and the milk utilization efficiency for each mineral. Duplicated samples of total mixed rations (TMR), water and milk were collected in each farm on two non-consecutive days, and analyzed for Ca, P, Mg, Cl, K, Na, S, Cu, Fe, Mn, Se, and Zn. Dry matter intake was calculated for each lactating group or farm based on the total daily amount of TMR supplied, divided by the number of cows in each feeding group, and corrected by estimated refusal. Milk yield per cow was obtained from Dairy Herd Improvement (DHI) records and when not available, from the total daily milk produced/number of milking cows. Dietary mineral content per farm was calculated according to TMR mineral content weighted by the proportion of animals in each production group. The daily mineral balance and gross utilization efficiency (%GUE) were calculated for each mineral as follow: balance = total mineral daily intake – total mineral milk output, and %GUE = mineral milk output/total mineral intake x 100. The dietary mineral contents were positively correlated to mineral balance (no less than r=0.90) and negatively correlated to %GUE (no less than r=-0.55), all the correlations were P<0.001. These results indicate that mineral contents in the diet might be used to estimate its correspondent mineral balance, the mineral milk utilization efficiency, and its possible excretion.

Key Words: mineral balance, dairy cows, mineral utilization efficiency

725 Effects of trace mineral amount and source on aspects of oxidative status and immune function in dairy cows. T. Yasui*[1], R. M. Ehrhardt[1], G. R. Bowman[2], M. Vázquez-Añon[2], J. D. Richards[2], C. A. Atwell[2], T. D. Wineman[2], and T. R. Overton[1], [1]*Cornell University*, *Ithaca, NY*, [2]*Novus International*, *St. Charles, MO*.

Multiparous Holstein cows (n=48) were used to determine effects of trace mineral amount and source on aspects of oxidative status and immune function. Cows were fed a basal diet meeting NRC (2001) requirements except for no added Zn, Cu, or Mn. After a 4-wk preliminary period, cows were assigned to one of four topdress treatments in a randomized complete block design: 1) NRC 2001 levels of Zn, Cu, and Mn using sulfates only; 2) NRC 2001 levels of Zn, Cu, and Mn using MINTREX® organic trace minerals (Novus International, Inc.); 3) Commercial inorganic (approximately 2X NRC) using sulfates only; and 4) Commercial organic using MINTREX®. Final concentrations of Zn, Cu, and Mn were similar between the inorganic and MINTREX® treatments and averaged 55, 8.3, and 21 ppm, respectively, for the NRC level and 75, 16, and 35 ppm for the commercial level. Cows were fed the respective mineral treatments for 6 wk. During wk 1 of treatment, cows fed Zn, Cu, and Mn at commercial levels tended (P<0.15) to have decreased activity of glutathione peroxidase in erythrocyte lysate (27,698 vs. 28,932 nmol/min*ml of packed cell volume), cows fed inorganic sources at NRC levels tended to have lower plasma total antioxidant capacity (1.25, 1.59, 1.58, and 1.55 mM; level x source, P<0.15), and cows fed MINTREX® tended to have decreased concentrations of plasma thiobarbituric acid reactive substances (TBARS; 5.26 vs. 4.39 μM; P<0.13). Cows fed MINTREX® had higher plasma IgG across the experimental period (2.35 vs. 2.68 g/dl; P < 0.01). All cows were administered an intramammary lipopolysaccharide challenge during wk 5; during wk 6 cows fed commercial levels of Zn, Cu, and Mn had higher plasma total antioxidant capacity (1.34 vs. 1.48 mM; P < 0.09) and cows fed MINTREX® had decreased plasma TBARS (4.16 vs. 3.60 μM; P<0.05). Overall, results suggest that varying level and source of dietary trace minerals can affect parameters related to oxidative status.

Key Words: trace minerals, oxidative status

726 Impact of phosphorus form on utilization in lactating dairy cows. K. J. Lager*, M. J. Brouk, B. J. Bradford, and J. P. Harner, *Kansas State University*, *Manhattan*.

Supplementation of phosphorus (P) in varying forms was compared to test the effects on intake and utilization. Twelve multiparous Holstein cows producing approximately 43 kg of milk (115 ± 55 DIM) were utilized in a 4x4 Latin square design with 21d periods. Four total mixed rations (TMR) were formulated for similar P concentrations. The forms of supplemental P chosen were a pellet, meal and liquid. Wheat middlings were used as a carrier for dicalcium phosphate in the pellet and meal forms while a cane molasses based liquid was the delivery form in the third diet. Corn dried distiller′s grains with solubles (DDGS) were used in the fourth diet for comparison between organic and inorganic P mineral sources. Cows were randomly assigned to treatments and blocked by parity, lactation number, and milk production. Data were analyzed using the Mixed model of SAS. Dry matter intake (DMI) was not affected by diet and intake of P was similar for the pellet, meal, liquid and DDGS diets (116, 116, 119 and 118 g/d, respectively). Cows consuming the liquid supplementation diet showed increased sugar intakes (P<0.001) and also the lowest daily milk production. Daily fat intake was significantly greater (P<0.001) for the DDGS than the pellet, meal, and liquid supplemented diets (1.15, 1.15, 1.12 and 1.36 kg, respectively). The distiller's grains replaced a portion of the corn grain in the DDGS diet which decreased (P<0.03) starch intakes of cows consuming that diet, but intake of NE_L was similar (P=0.55) for all diets. Differences (P=0.05) in milk production were noticed with the DDGS supplemented diet resulting in the greatest milk production (34.6, 35.5, 34.1 and 36.5 kg/cow). Percentage of butterfat in milk was greatest for the meal diet but no difference was observed between diets for milk protein percentage (P=0.32) or lactose production (P=0.22).

These data show that supplemental P form does not affect DMI or P intake and that an organic source of P in DDGS shows similar response as inorganic P mineral supplements.

Key Words: liquid feed, mineral supplementation, distiller's grains

727 Effect of 4-Plex® on milk production, reproduction and claw integrity of dairy cows. J. M. DeFrain*[1], M. T. Socha[1], D. J. Tomlinson[1], and D. Kluth[2], [1]*Zinpro Corporation*, *Eden Prairie, MN*, [2]*Standard Dairy Consultants*, *Omaha, NE*.

On a commercial dairy, 366 Holstein cows were blocked by parity and expected calving date and assigned to an experiment with a randomized complete block design to determine the effect of treatment on lactation, reproduction and claw integrity. Treatments were 1) all supplemental Zn, Mn, Cu and Co supplied by sulfates and 2) 360 mg Zn, 200 mg Mn, 125 mg Cu and 25 mg Co from sulfates replaced by similar amounts of trace minerals supplied by 4-Plex (Zinpro Corporation, Eden Prairie, MN). All cows were fed inorganic trace minerals for 4 months prior to initiation of treatments. Cows received treatments from 3 wk prepartum through 250 d postpartum. Treatments were mixed into a supplement then blended into a TMR. The TMR was delivered to 4 pens prepartum (2 pens/trt) and 4 pens postpartum (2 pens/trt). Cows were milked three times per day and milk yield recorded at each milking. Milk was sampled twice monthly and composition determined. All claws of cows were examined prior to initiation of treatments and at 17 and 36 wk postpartum by personnel trained in identifying claw lesions. Individuals involved with daily animal care and/or data recording were blinded to treatment assignments. The MIXED procedure of SAS® was used to analyze the data. There was no effect of treatment (P>0.10) on yields of milk, 3.5% fat-corrected milk or energy corrected milk. Cows fed sulfates tended (P<0.10) to produce more milk fat and milk with a greater fat content (P<0.05). Feeding cows 4-Plex tended (P<0.10) to reduce SCC content of milk and linear SCC scores. Survival curve analysis indicated that more cows fed 4-Plex became pregnant and these cows became pregnant at a faster rate (P<0.10) than cows fed only sulfate trace minerals. Feeding sulfates decreased (P<0.05) severity of sole hemorrhages, while feeding 4-Plex decreased (P<0.05) incidence of heel erosion. There was no other effect (P>0.10) of treatment on claw lesions. In conclusion, replacing a portion of the inorganic sulfate sources of Zn, Cu, Mn and Co with those trace minerals supplied by 4-Plex improved milk quality and reproductive performance.

Key Words: trace minerals, dairy cattle, reproduction

728 Metabolic and productive responses to supplemental chromium in early-lactation heat-stressed cows. M. Mirzaei[1], G. R. Ghorbani[1], M. Khorvash[1], H. R. Rahmani[1], and A. Nikkhah*[2,1], [1]*Isfahan University of Technology*, *Isfahan, Iran*, [2]*Zanjan University*, *Zanjan, Iran*.

An enormous challenge to the dairy industry is the coincidence of metabolic pressures of early lactation with heat stress. The effects of a chromium (Cr) supplement on feed intake, blood metabolites and hormones, and productivity of early lactation heat-stressed cows were determined. Fifteen Holstein cows at 38 ± 6 d in milk were grouped based on parity and randomly assigned to 3 levels of 0, 0.05 and 0.10 mg of Cr per kg of $BW^{0.75}$. Cows received a basal total mixed ration with a forage to concentrate ratio of 57.7:42.3, twice daily at 0900 and 1600 h. The Cr supplement was mixed with 100 g ground corn and top dressed with the morning feed. Blood was collected weekly at 1130 h via coccygeal vein for 7 wk. Milk was sampled weekly for 3 consecutive milkings. Data were analyzed as a mixed model with the best fit covariance structure for repeated measurements i.e., AR(1) for IGF-1, NEFA and cortisol, and ARH(1) for other measurements. Dry matter intake increased (24.2 vs. 21.8 kg/d ± 0.5, P<0.01) when 0.05 mg Cr per $BW^{0.75}$ was provided. As a result, milk fat (1.46 vs. 1.32 kg/d ± 0.05), protein (1.13 vs. 1.04 kg/d ± 0.03) and total solids (4.96 vs. 4.59 kg/d ± 0.12) yields increased (P<0.05) by providing supplemental Cr at 0.05 mg per $BW^{0.75}$. Respective milk yield was 38, 39.6 and 37.8 kg/d for the 3 groups. Both doses of Cr increased (P>0.05) milk protein (2.85% and 2.82% vs. 2.73% ± 0.02), but the higher Cr dose reduced (P<0.05) feed efficiency compared to when no supplemental Cr was provided (1.45 vs. 1.62 ± 0.05). Cows receiving 0.05 Cr per $BW^{0.75}$ lost body weight (-142 vs. 317 g/d, P=0.05) and tended (P<0.10) to have greater respiration rate than control cows (58.6 vs. 56.4 ± 1.2 per min). Blood insulin (8.2 vs. 8.9 ± 0.3 μIU/ml) and NEFA (145 vs. 159 ± 4.7 μEq/l) concentrations and the insulin to glucagon ratio (0.108 vs. 0.123 ± 0.005) decreased but serum albumin increased (3.91 vs. 3.77 ± 0.05 mg/dl, P<0.05) when cows received 0.05 mg of supplemental Cr per $BW^{0.75}$. Findings suggest that providing supplemental Cr to early lactation cows under heat stress improves feed intake and milk secretion

Key Words: chromium, early lactation, heat stress