hatch in the IO groups compare to controls. In conclusion, birds IO-fed ZnMet, had an improved digestive & absorptive capacity. However, the IO solution contained ZnMet added to carbohydrates & HMB had a long term effect on intestinal morphological development, expression and activity of brush border enzymes and transporters.

**Key Words:** Broiler, Intestine, Zinc-Methionine

**466 Effect of vitamin D source on broiler production and carcass composition.** J. L. Saunders-Blades* and D. R. Korver, *University of Alberta, Edmonton, AB, Canada*.

The effect of vitamin D source and time of feeding 25-OH vitamin D3 (HyD®) on broiler production efficiency and carcass composition was studied. The first hydroxylation of vitamin D in the liver results in 25-OH vitamin $D_3$ (25-$OHD_3$); providing dietary 25-$OHD_3$ to the bird reduces the need for this hydroxylation, potentially allowing for a more efficient use of vitamin D. The dietary treatments differed only in supplemental vitamin D source: the Control diet contained 3,000 IU/kg of vitamin $D_3$, the 25-$OHD_3$ diet contained 69 $\mu$g/kg of 25-$OHD_3$. Four dietary treatments were fed: Control (Control diet from 1-41 d), 25-$OHD_3$ (25-$OHD_3$ diet from 1-41 d), 25-$OHD_3$ Early (25-$OHD_3$ diet from 1-28 d, Control diet from 29-41 d), or 25-$OHD_3$ Late (Control diet from 1-28 d, 25-$OHD_3$ diet from 29-41 d). Birds were reared sex separately in 32 pens, with 4 replicates per treatment within each sex. Feed consumption and BW were measured at 0, 10, 28 and 41 d. At 42 d, 80 birds from each male pen were randomly selected for carcass and portion yield analysis. Birds in the 25-$OHD_3$ and 25-$OHD_3$ Early groups had a greater BW gain than the Control and 25-$OHD_3$ Late groups from 11-28 d, gaining 55 and 55 vs 53 and 53g·$bird^{-1}$·$d^{-1}$, respectively ($P<0.05$). By 42 d, birds fed the 25-$OHD_3$ treatment were heavier than those fed the Control and 25-$OHD_3$ Late treatments (2301 vs 2233 and 2234 g, respectively; $P<0.05$). All treatment groups maintained similar feed conversion efficiencies ($P>0.05$). Starved and eviscerated BW and absolute weight of the pectoralis major, wings and drums were greater for the 25-$OHD_3$ fed birds than those fed the Control and 25-$OHD_3$ Late treatments ($P<0.05$). Overall, the 25-$OHD_3$ treatment supported a faster BW gain, and greater breast and leg portions. All groups in this study developed field rickets around 11 d, however symptoms subsided and no treatment was administered. The results of this study are therefore confounded by the rickets, but may indicate that 25-$OHD_3$ helped to lessen the effects of rickets as shown by the greater growth rate.

**Key Words:** Broiler Production, Vitamin D, 25-OH-vitamin $D_3$

## Ruminant Nutrition: Beef - Minerals & Vitamins

**467 Effects of trace mineral source and feeding method on the productivity of grazing Braford cows.** J. D. Arthington*[1] and C. K. Larson[2], [1]*Range Cattle Research and Education Center, University of Florida, Ona*, [2]*Zinpro Corporation, Eden Prairie, MN*.

Braford cows (n = 160) were used to evaluate the effects of trace mineral source and feeding method on cowherd productivity over 3 yr. In yr 1, cows were stratified by age and randomly allocated to one of eight groups (n = 20 cows/group). Cows were allotted to eight of 16 bahiagrass pastures (8.0 ha each, one empty pasture between groups) and were rotated each week. Cow groups remained intact throughout the study with the exception of culled cows, which were replaced with 3-yr-old pregnant heifers. Cows were offered 2.27 kg of liquid molasses daily from early November until middle of April. One mature Braford bull was placed into each cow group starting in early January, remaining for 90 d. Bulls were rotated through cow groups each week. Two main factors were randomly applied to groups in a 2 x 2 factorial arrangement (two groups/treatment), consisting of 1) trace mineral source; inorganic vs organic, and 2) mineral feeding method; free-choice vs control-fed in a molasses supplement. Cow BW, body condition score (BCS), pregnancy rate, calving interval, and calf BW at weaning were obtained. Mineral intake was measured each week in pastures provided free-choice mineral. In yr 1 and 2, liver biopsy collections, for the determination of mineral status, were conducted at the start and end of winter supplementation on the same six randomly chosen cows/group. Cows assigned to free-choice treatments consumed 23% less ($P < 0.001$) mineral compared to control-fed cows, resulting in a greater ($P < 0.05$) decrease in liver Zn (yr 1) and liver Cu (yr 2) concentration compared with control-fed cows. Mineral source and feeding method had no effect on cow BW, cow BCS, and calf BW at weaning. Young cows (3 and 4 yr of age) consuming organic minerals had a greater pregnancy rate during yr 2 ($P < 0.05$) and 3 ($P = 0.15$) and a lesser ($P < 0.05$) calving interval in yr 1 and 3, compared to cows consuming inorganic minerals. The supplementation of organic minerals (Cu, Zn, Mn, and Co) appears to increase the reproductive performance of young, but not mature, grazing Braford beef cows consuming molasses-based supplements.

**Key Words:** Cattle, Mineral, Molasses

**468 Effects of Tri-Basic Copper Chloride Vs Copper Sulfate on Measures of Copper Status and Forage Intake in Growing Beef Heifers.** J. D. Arthington* and F. M. Pate, *Range Cattle Research and Education Center, University of Florida, Ona*.

Previous research indicates that growing beef cattle may experience increased DMI when supplemented with tri-basic copper chloride (TBCC) vs an organic Cu source. The objective of this study was to investigate the effect of supplemental TBCC vs Cu sulfate on the Cu status and DMI of growing heifers fed forage-based diets. Twenty-four crossbred heifers were stratified by BW (355 ±10.4 kg) and randomly allotted to individual pens. Heifers were provided free-choice access to ground grass hay (8.0 and 54.0% CP and TDN, respectively) and 1.75 kg/d of a corn-cottonseed meal supplement. Three treatments were randomly allocated to pens, providing; 1) 100 mg/d Cu from Cu sulfate, 2) 100 mg/d Cu from TBCC, or 3) 0 mg Cu/d (Control). Forage DMI was measured daily. Individual heifer BW, jugular blood, and liver biopsy samples were collected on d 0, 30, 60 and 90. Heifer ADG was not affected ($P = 0.83$) by Cu treatment (average = 0.22 ± 0.07 kg). Change in liver Cu and plasma ceruloplasmin (Cp) concentration did not differ ($P > 0.16$) among Cu sources (120 vs. 77 ppm liver Cu, and -6.0 vs. 3.5 mg/dL Cp for Cu sulfate and TBCC supplemented heifers, respectively; SEM = 20.6 and 3.1). Heifers fed no supplemental Cu experienced a lesser ($P < 0.001$) accumulation of liver Cu and a greater decrease ($P < 0.04$) in Cp concentration over the 90-d supplementation period (-34.4 ± 20.6 ppm liver Cu and -4.1± 3.1 mg/dL Cp) compared to both Cu sulfate and TBCC supplemented heifers. Forage DMI did not differ among Cu sources, however, heifers provided no supplemental Cu had lower ($P < 0.05$) forage DMI compared to both Cu sulfate and TBCC supplemented heifers (average forage DMI = 4.9 and 5.3 kg/d for Control and Cu supplemented heifers, respectively; SEM = 0.14). These data indicate that Cu sulfate and TBCC are of similar availability when offered to growing beef heifers in corn-cottonseed meal supplements. As well, these data indicate that the lack of supplemental Cu may decrease forage DMI in growing beef heifers.

**Key Words:** Copper, Forage, Cattle

**469 Effect of chromium supplementation and copper status on glucose metabolism in beef cows.** H. S. Stahlhut*, C. S. Whisnant, K. E. Lloyd, E. J. Baird, L. R. Legleiter, S. L. Hansen, and J. W. Spears, *North Carolina State University, Raleigh*.

Pregnant Angus (n=83) and Simmental (n=69) cows were blocked by age and assigned to one of two free choice mineral supplements to determine the effect of dietary Cr and Cu status on glucose metabolism. Supplements consisted of: 1) control (no supplemental Cr) and 2) 40 mg Cr /kg (from Cr picolinate). Mineral supplements were formulated to contain all minerals typically supplemented to cattle diets with the exception of Cu. At the beginning of the study ( 75 d prepartum) one-half of cows in each treatment received a 25 g Cu oxide needle bolus. Blood was collected from 35 cows on d 28, 58, 97 ( 20 d postpartum), and 155 for plasma glucose. Plasma glucose concentrations were affected by time ($P< 0.01$), breed x Cu bolus ($P< 0.05$), and Cr x time ($P< 0.05$). In non-Cu supplemented cows, plasma glucose was higher ($P< 0.05$) in Angus than in Simmental. In animals receiving a Cu bolus, plasma glucose was similar in both breeds. On d 97, plasma glucose levels were lower ($P< 0.01$) in cows receiving Cr relative to controls. Plasma glucose was not affected by Cr at other sampling d. At approximately 1 mo prepartum and 1 mo postpartum, 12 cows were cannulated and glucose tolerance tests (GTT) were conducted. Plasma glucose concentrations

following the GTT conducted prepartum were lower (P< 0.01) in Cr-supplemented than in control cows (86.3 vs 91.8 mg/dL), but glucose clearance rates were not significantly affected by treatment. In postpartum GTT, plasma glucose was affected by an interaction between Cr-supplementation and Cu status. Chromium-supplemented animals that received a Cu bolus had higher (P< 0.001) plasma glucose (92.2 vs 69.2 mg/dL) than cows not supplemented with Cu after glucose administration. No significant difference in plasma glucose was observed between control cows regardless of Cu status. Results of this study indicate that plasma glucose is lower in cows receiving supplemental Cr and that an interaction between Cr and Cu status may alter glucose metabolism.

**Key Words:** Chromium, Copper, Glucose, Cattle

**470 Growth, reproductive performance, and manganese status of heifers fed varying concentrations of manganese.** S. L. Hansen*, C. S. Whisnant, K. E. Lloyd, E. J. Baird, L. R. Legleiter, H. S. Stahlhut, and J. W. Spears, *Department of Animal Science, North Carolina State University, Raleigh*.

Eighty Angus (n = 40) and Simmental (n = 40) heifers, averaging 10 mo of age and 245 kg in BW, were used to determine the effects of dietary Mn on performance, reproduction, and Mn status of heifers. Heifers were stratified by age within a breed and randomly assigned to treatments consisting of a control diet (analyzed 20 mg Mn/kg DM) supplemented with 0, 10, 30 or 50 mg Mn/kg DM. Diets were offered ad libitum using Calan gate feeders. Blood samples were taken on d 0, 63, and 98 for plasma cholesterol and Mn analysis. Liver biopsies were taken on d 0 and 98. Average daily gain, DMI and G:F for the 140-d period were not affected by Mn. Initial liver Mn was not affected by breed. Liver Mn concentrations on d 98 were affected by a treatment by breed (P < 0.05) interaction. Simmental heifers supplemented with 30 or 50 mg Mn/kg diet had higher (P < 0.05) liver Mn than controls. Liver Mn in Angus heifers was not affected by dietary Mn. Plasma cholesterol was higher (P < 0.05) in Angus compared to Simmental heifers, especially on d 0. On d 63 control heifers had lower (P < 0.07) plasma cholesterol (151 vs 196 mg/dL) than heifers supplemented with 50 mg Mn/kg DM. Plasma cholesterol was not affected by Mn treatment on d 98. Cholesterol values across treatments increased (P < 0.01) over time. Based on serum progesterone concentrations at or greater than 1 ng/mL, 40% of control heifers were cycling at approximately 12 mo of age compared to 50% of Mn-supplemented heifers. At approximately 13 mo of age 40% of control heifers exhibited signs of estrus, in response to a two-shot Lutalyse synchronization protocol, compared to 50% of those supplemented with 50 mg Mn/kg DM. The percentage of heifers cycling at 12 or 13 mo of age was not significantly affected by treatment. Results of this study indicate that 20 mg Mn/kg diet DM is adequate for growth of heifers, but may be inadequate for maximum reproductive performance.

**Key Words:** Manganese, Heifers, Reproduction

**471 Influence of dietary manganese on performance and serum glucose concentrations in growing steers.** L. R. Legleiter*, K. E. Lloyd, and J. W. Spears, *Department of Animal Science, North Carolina State University, Raleigh*.

Manganese requirements of beef cattle are poorly defined. This study was conducted to determine the effect of dietary Mn on performance and serum glucose concentrations of growing cattle. One hundred twenty Angus cross steers were bunk fed a corn silage-based diet for 84 d in a confined feeding facility with slatted concrete floors. Steers were blocked by weight and randomly assigned to one of six treatments (four blocks, 24 pens, 5 head/pen) providing increasing levels of Mn in the form of manganese sulfate. The 12.9% CP basal diet, provided ad libitum, consisted of corn silage (78%), corn gluten feed (18%), urea, trace minerals and vitamins. Treatments consisted of 0, 10, 20, 30, 120 and 240 mg supplemental Mn/kg DM. The control diet without supplemental Mn analyzed at 30.2 mg Mn/kg DM. Steers were weighed every 28 d. Blood samples were taken 2 h post feeding from eight steers per treatment on day 56. Data were analyzed as a completely randomized block design using the GLM procedure of SAS. Initial weight (247.5±1.2 kg) and final weight (354.2±6.3 kg) were not different (P > 0.05) between treatments. Average daily gain was similar (P > 0.05) among all treatments and averaged 1.27 kg/d. Likewise, DMI and feed efficiency were similar (P > 0.05) across treatments averaging 6.68 kg/d and 0.19 (G:F, kg/kg), respectively. Additionally, serum glucose concentrations averaging 80 mg/dL were not different (P > 0.05) between treatments. These data suggest that a corn silage-based growing diet containing Mn at 30 mg/kg DM adequately meets the growing requirements of steers in confinement.

**Key Words:** Manganese, Cattle, Glucose

**472 Selenium in tissues of calves supplemented with selenium yeast.** C. J. Richards*, H. M. Blalock, L. C. Miller, and H. D. Loveday, *The University of Tennessee, Knoxville*.

An experiment was conducted to evaluate supplementation of Se yeast (Sel-Plex®; Alltech Inc, Nicholasville, KY) in a finishing diet balanced to contain adequate Se from feedstuffs. Forty Angus and Angus crossbred steers and heifers (20 steers, 20 heifers) were blocked by sex and randomly allotted to eight pens (5 hd/pen). Calves were acclimated to grain using common diets varying in Se concentration, but always supplemented with 0.2 mg Se/kg diet (DM) from sodium selenite. After adaptation, pens were randomly assigned, within sex, to a basal finishing diet containing adequate Se from cracked corn, alfalfa pellets, corn gluten pellets, molasses and a Se free vitamin/mineral supplement (CON) or the basal finishing diet plus 0.27 mg Se/kg diet (DM) from Se yeast (SUP). Two pens of each sex received each treatment for 130 d with weights and blood samples taken at 28 d intervals and prior to shipping. Calves were shipped overnight to a commercial harvesting facility where hot carcass weights were recorded and samples of each liver lobe collected. After a 48 hr chill, yield grade, quality grade, back fat, and KPH were determined and a loin muscle sample obtained. The CON and SUP diets contained an average of 0.15 and 0.43 mg Se/kg diet (DM), respectively. No difference ($P > 0.01$) in calf weights, ADG, feed intake, feed efficiency or any carcass measures were detected. Serum Se had a treatment by time interaction ($P < 0.01$) where initial serum Se concentrations were similar (0.09 mg/mL). Thereafter, CON calves had lower ($P < 0.01$; average = 0.08 mg/mL) serum Se concentrations than SUP calves (average = 0.11 mg/mL). Loin Se concentrations were lower ($P < 0.01$) for CON than SUP calves (0.135 and 0.258 mg Se/kg as-is tissue, respectively). Liver Se concentration increased ($P < 0.01$) from 0.426 to 0.831 mg Se/kg as-is tissue with SUP. Results of this experiment indicate that supplementing 0.27 mg Se/kg diet (DM) from Se yeast in a feedlot diet containing adequate Se does not increase animal performance, but does result in increased Se tissue concentrations that do not exceed the FDA limit.

**Key Words:** Ruminant, Selenium, Beef

**473 Determining the route and amount of P excreted from cattle consuming finishing diets.** B. G Geisert*, G. E Erickson, T. J. Klopfenstein, M. K. Luebbe, and J. C MacDonald, *University of Nebraska, Lincoln*.

Determining the amount and the route of phosphorus (P) excretion is important due to the increasing pressure to manage P in animal waste. This experiment was designed to determine the amount and the route of P excreted from cattle fed a high energy finishing diet with different amounts of P. Five ruminally fistulated crossbred steers were used in a 5x5 latin square design. Diets consisted of 3 brewers grit based diets formulated for 0.12% P (LOWP) with monosodium phosphate added to increase P level to 0.27 (MEDP) and 0.42% P (HIGHP). They consisted of 50% course brewers grits, 20% dry rolled corn (DRC), 15% corn bran, 5% grass hay, 5% molasses, and 5% supplement. The other 2 diets were a DRC based diet (CORN), and a dry distillers grain diet (DDGS, 57% DRC, 30% DDGS, 5% grass hay, 5% molasses, and 3% supplement). Diets contained 0.12, 0.27, 0.42, 0.30, 0.36 % P (DM basis) for LOWP, MEDP, HIGHP, CORN, DDGS, respectively. Steers were adapted to diets for 16 days with a 5-day collection period. Chromic oxide was dosed at 5 grams every 12 hours for the last 8 days of each period. Total urine was collected and analyzed for P concentration. Fecal samples were taken 3 times daily, composited by day and analyzed for P and chromium concentrations. There were no significant differences in DMI (P>0.05). P intakes were 10.5, 26.7, 37.9, 29.5, 34.6 g/d for LOWP, MEDP, HIGHP, CORN, DDGS, respectively. P excretion was related to P intake and was lower (P<0.05) for LOWP. Route of excretion whether feces or urine, was also affected by dietary P intake. Steers fed LOWP excreted very little P in urine (0.50 g/d). However, if diet P was > 0.20% more P was excreted in urine (2.1 g/d), but was not different across diets and was variable among animals. P retention

was lower (2.0 vs. 13.8 g/d) for LOWP than other diets, suggesting that cattle fed 0.12% P were deficient and excreting 85.3 % of the P fed.

**Key Words:** Excretion, Phosphorus, Cattle

**474 Effects of dietary supplemental vitamin A concentration on growth, intake, and marbling in yearling feedlot steers.** T. C. Bryant*[1,3], J. J. Wagner[2], T. E. Engle[3], K. L. Dorton[3], P. D. Burns[3], and M. L. Galyean[4], [1]*ContiBeef LLC, Boulder, CO,* [2]*Continental Beef Research, Lamar, CO,* [3]*Colorado State University, Fort Collins,* [4]*Texas Tech University, Lubbock.*

Recent research has shown a negative correlation between marbling and serum retinol concentration in Japanese Black cattle. Three hundred sixty single-source black, yearling steers (average initial BW = 316 ± 9.1 kg) fed a 91 % concentrate (steam-flaked corn base) diet were used to evaluate the effects of supplemental vitamin A concentration on performance, DMI, and carcass traits. Steers were blocked into eight weight replicates and assigned randomly to pens (n = 9/pen) and to diets containing 0, 1,103, 2,205 4,410, or 8,820 IU of supplemental vitamin A/kg DM. Daily DMI, ADG, and feed:gain ratio were determined for each 28-d period and for the overall 142-d trial. Final BW (586, 580, 590, 584, and 584 kg for 0, 1,103, 2,205 4,410, and 8,820 IU vitamin A/kg DM, respectively) did not differ ($P > 0.10$) among treatments. Feed efficiency, ADG, and daily DMI also did not differ ($P > 0.10$) among treatments within each 28-d period or for the overall trial. From d57 to harvest, average DMI (10.33, 10.28, 10.57, 9.75, and 10.22 kg/steer daily for 0, 1,103, 2,205, 4,410, and 8,820 IU vitamin A/kg DM, respectively) was lower ($P < 0.02$) for steers receiving 4,410 IU vitamin A/kg DM than for steers in other treatments, and DMI was greater ($P = 0.06$) for the 2,205 IU vitamin A/kg DM treatment than for the 8,810 IU/kg DM treatment. Marbling score, hot carcass weight, longissimus muscle area, and 12th rib fat thickness did not differ ($P > 0.10$) among treatments. Similarly, the number of carcasses grading ≥ Choice (62.6, 52.8, 64.0, 58.4, and 58.4 % for 0, 1,103, 2,205, 4,410, and 8,820 IU vitamin A/kg DM, respectively), Select, or ≤ Standard did not differ ($P > 0.10$) among treatments. Results of this trial suggest that vitamin A supplementation up to twice the NRC-suggested concentration has little effect on performance or marbling in typical yearling feedlot steers.

**Key Words:** Cattle, Marbling, Vitamin A

**475 Effects of feeding a polyclonal antibody preparation against *Streptococcus bovis* or *Fusobacterium necrophorum* on performance and carcass characteristics of feedlot steers.** C. R. Dahlen[2], N. DiLorenzo*[1], A. DiCostanzo[1], G. C. Lamb[2], and L. J. Smith[1], [1]*Department of Animal Science, University of Minnesota, St. Paul,* [2]*North West Research and Outreach Center, Crookston, MN,* [3]*North Central Research and Outreach Center, Grand Rapids, MN.*

Steer calves (n = 226; 272 kg), stratified by weight and housed in 16 pens, were used to evaluate effects of feeding a polyclonal antibody preparation (Ab; sprayed onto a soyhull pellet) against *Streptococcus bovis* (AbSb) or *Fusobacterium necrophorum* (AbFn) on performance and carcass characteristics for 153 d. Pens were randomly assigned to one of four dietary treatments resulting from a 2 X 2 factorial arrangement that included AbSb or AbFn. Diets (1.39 Mcal NEg/kg DM, 12.5% CP, 0.7% Ca, and 0.35% P) were formulated with high-moisture corn and dry ground corn (50:50 mix, DM basis), corn silage, and supplement. Interaction terms for final and carcass-adjusted final weight, gain and carcass-adjusted gain were significant ($P < 0.05$). Steers receiving AbSb or AbFn had heavier ($P < 0.05$) final BW resulting from faster ($P < 0.05$) daily gains. Adjusted-final weights of steers fed AbSb were heavier ($P < 0.05$) than those fed both or no Ab. Only AbSb was effective ($P = 0.08$) at enhancing carcass-adjusted daily gain. Interestingly, steers receiving both Ab gained similarly ($P > 0.05$) as steers fed no Ab. Interaction terms were significant ($P < 0.05$) for feed efficiency (analyzed as gain-to-feed), and tended ($P < 0.08$) to be significant for carcass-adjusted feed efficiency. Steers receiving AbSb were more efficient ($P < 0.06$) than those receiving both or no Ab. Steers receiving AbSb were more efficient (carcass-adjusted; $P < 0.09$) than those receiving both or no Ab. Steers supplemented with AbSb had heavier carcasses ($P < 0.05$), which accounted for greater ($P < 0.05$) subcutaneous fat, and greater ($P < 0.05$) yield grades than those of steers fed both or no Ab. These results demonstrate that feeding a polyclonal antibody preparation against Streptococcus bovis or Fusobacterium necrophorum influences performance and carcass characteristics of feedlot cattle fed high-grain diets.

**Key Words:** *Streptococcus bovis*, *Fusobacterium necrophorum*, Steers

## Ruminant Nutrition: Dairy - Lactation, Health & Gut Physiology

**476 Effect of dietary cation-anion difference and crude protein on milk yield and blood metabolites of lactating dairy cows.** C. D. Wildman*, J. W. West, and J. K. Bernard, *The University of Georgia, Tifton.*

Eight ruminally cannulated lactating Holstein cows averaging 47 ± 10 DIM were used in a 12 wk replicated 4 x 4 Latin Square trial to determine the relationship between dietary cation-anion difference (DCAD) and dietary crude protein (CP) concentration. The study was conducted from March 28 through June 19. Treatments were arranged as a 2 x 2 factorial to provide 15 or 17% CP and DCAD of 25 or 50 meq/100 g DM (Na+K-Cl). As DCAD increased from 25 to 50, increases ($P < 0.01$) in DMI (17.8 to 19.1 kg/d), yield of 3.5% fat-corrected milk (20.2 to 23.7 kg/d), energy-corrected milk (20.5 to 23.8 kg/d), fat (0.6 to 0.8 kg/d) and protein (0.7 to 0.8 kg/d) were observed. Blood Na and bicarbonate ($P < 0.05$, $P < 0.01$) were greater for DCAD 50 (144 and 24.5 mmol/L) compared with 25 (143 and 22.3 mmol/L). Blood Mg decreased ($P < 0.01$) as DCAD increased from 25 to 50 (2.5 to 2.2 mg/dl). An increase ($P < 0.01$) in blood pH (7.46 to 7.50) was also noted with increasing DCAD . Urinary bicarbonate:creatinine ratio was higher ($P < 0.01$) for DCAD 50 (2.6) versus 25 (0.6). Greater microbial crude protein production, indicated by uric acid:creatinine ratio, was noted with increasing DCAD at low CP compared to that observed with high CP, resulting in an interaction ($P < 0.05$). Fractional excretion of K was greater ($P < 0.01$) for DCAD 50 (78.8) compared to DCAD 25 (38.3) whereas fractional excretion of Mg ($P < 0.05$) was reduced for high DCAD (9.6) relative to low DCAD (13.0). A DCAD x CP interaction ($P < 0.05$) was observed for fractional excretion of Na with an increase in DCAD resulting in increased excretion of Na at both high and low CP. The magnitude of the increase was greater at low CP compared to that observed at high CP. Results indicate that increasing DCAD improves intake and performance, which suggests improved N utilization on lower CP diets.

**Key Words:** Dietary Cation-Anion Difference, Dietary Crude Protein

**477 Effect of dietary cation-anion difference and dietary crude protein degradability on milk yield and blood metabolites of lactating dairy cows.** C. D. Wildman*, J. W. West, and J. K. Bernard, *The University of Georgia, Tifton.*

Eight ruminally cannulated lactating Holstein cows averaging 180 ± 10 DIM were used in a 12 wk replicated 4 x 4 Latin Square trial to determine the relationship between dietary cation-anion difference (DCAD) and protein degradability (UIP). The study was conducted from August 8 through November 6. Diets were formulated to provide 15% dietary crude protein (CP) across all treatments. Treatments were arranged as a 2 x 2 factorial to provide DCAD of 25 or 50 meq/100 g DM (Na+K-Cl) and 33 or 42% of CP as UIP. Increasing DCAD from 25 to 50 increased ($P < 0.01$) DMI (17.0 to 18.0 kg/d), 3.5% fat-corrected milk (19.1 to 20.0 kg/d), fat (0.6 to 0.7 kg/d), and energy-corrected milk (19.5 to 20.4 kg/d) yield. A significant DCAD x degradability interaction ($P < 0.01$) was observed for each of these parameters with the magnitude of the DCAD effect much greater at 42% UIP compared with 33% UIP, where no difference was observed. Blood bicarbonate (22.5 to 24.4 mmol/L) and pH (7.41 to 7.43) increased ($P < 0.01$) as DCAD increased from 25 to 50, respectively. Urinary bicarbonate increased ($P < 0.01$) at DCAD 50 (69.1 mmol/L) over that observed at DCAD 25 (20.3 mmol/L). A DCAD x UIP interaction ($P < 0.05$) was observed for uric acid:creatinine ratio, an indicator of microbial crude protein production, because a decrease was observed with DCAD 50 versus 25 at 33%UIP (0.5 to 0.4) but no differences were observed between DCAD for 42%