# Production, Management and the Environment: Diet and Forage I

**235 Effect of dried distillers grains with solubles on nitrogen emissions from soil-applied beef manure.** J. Roth* and W. Powers, *Michigan State University, East Lansing.*

Dried distillers grains with solubles (DDGs) is an important feed in cattle diets but may affect emissions of ammonia ($NH_3$) and nitrous oxide ($N_2O$), an important greenhouse gas. The objective of this study was to determine the effect of feeding steers diets containing DDGs on $NH_3$ and $N_2O$ emissions following manure application to soil. Angus steers (n = 4; initial BW = 414 kg) were fed diets containing 20% DDGs (12.2% crude protein) or 40% DDGs (16.6% crude protein) for 23 d. During the last 2 d, steers were housed in metabolism crates for a manure collection period. Steers were fed twice daily (0600 and 1800) during the collection period. Twice daily urine and feces were collected, separately, and mixed by treatment. Manure N content was determined (6.7% and 9.3% N for the 20% and 40% manures). Manure was stored frozen until the land application phase began. Thawed manure (570 g) was surface applied to 25 cm-deep soil over a sand base in 208-L tubs (6 replicates per treatment). Continuous $NH_3$ and $N_2O$ headspace concentrations were measured for 26 d and daily emissions calculated. Data were analyzed using mixed model procedures. Average daily concentration of $NH_3$ (ppm) and average daily $NH_3$ emission (mg/d) were lower as a result of feeding the 20% treatment (6.4 versus 12.0 ppm ($P < 0.01$; SEM = 0.35); 52.4 versus 99.1 mg/d ($P < 0.01$; SEM = 3.14), for 20% and 40% tubs, respectively). Manure N-adjusted average daily $NH_3$ emission was less from tubs where the 20% manure was applied (13.4 versus 15.1 mg $NH_3$/g manure N; $P = 0.02$; SEM = 0.52). Average daily $N_2O$ concentration (ppm) and average daily $N_2O$ emission (mg/d) were lower from the 20% treatment (0.80 versus 0.92 ppm ($P < 0.01$; SEM = 0.02); 2.50 versus 5.25 mg/d ($P < 0.01$; SEM = 0.48) for 20% and 40% tubs, respectively). Manure N-adjusted average daily $N_2O$ emission was not different between treatments (0.72 mg $N_2O$/g manure N; $P = 0.28$; SEM = 0.11) suggesting that differences in manure N content explained differences in $N_2O$ emissions. Overall, feeding increased dietary protein resulting from high DDGs diets increases both $NH_3$ and $N_2O$ emissions when manure is land applied.

**Key Words:** air emission, beef, dried distillers grains

**236 Effects of PN Beef supplements and exogenous growth promotants on feedlot performance and carcass characteristics.** K. J. Phelps*[1], K. A. Miller[1], C. L. Van Bibber-Krueger[1], C. A. Alvarado-Gilis[1], A. K. Sexten[1], J. S. Jennings[2], J. M. Gonzalez[1], and J. S. Drouillard[1], *[1]Kansas State University, Manhattan, [2]Alltech Inc., Nicholasville, KY.*

The experimental objective was to evaluate feedlot performance and carcass traits of beef steers fed alternative diets. Beef steers (initial BW 383 kg ± 30; 64 pens; 8 steers/pen) were used in a randomized complete block design with a 2 × 2 factorial treatment arrangement. For factor 1 (feed amendments), diets that combined inorganic trace mineral supplement, vitamins A and E, Rumensin, and Tylan (C) were compared with diets with PN Beef supplement (PN; Alltech, Inc.). PN treatments were fed a basal diet with PN Beef Receiver from d 1–20, and PN Beef Finisher from d 21 to harvest. Factor 2 consisted of the presence or absence of exogenous growth promotants (+GP vs. –GP). Steers in the +GP treatments were implanted with Component E–S, reimplanted with Component TE–S, and fed 400 mg/steer daily of ractopamine–HCl (Elanco Animal Health) for 28 d before harvest. The basal diet consisted of steam-flaked corn, wet corn gluten feed, wheat straw, and supplement. Steers were fed once daily ad libitum in partially covered, concrete-surfaced pens for 175 d then shipped to a commercial abattoir for harvest. Final BW, HCW, incidence of liver abscesses, marbling score, LM area, 12th rib fat thickness, and KPH were measured. There were no interactions between GP and feed amendments for performance or carcass traits ($P > 0.10$). Gain efficiency, DMI, ADG, HCW, and carcass traits were not different for C and PN ($P > 0.05$), but liver abscess incidence was greater for PN than for C (19.0 vs. 12.6%; $P < 0.05$). Gain, efficiency, and DMI were greater for +GP compared with –GP ($P < 0.05$). HCW were 432 and 376 kg for +GP and –GP, respectively ($P < 0.01$). Percentages of USDA Select were not affected by GP, but fewer carcasses were classified as premium Choice or Prime with +GP compared with –GP (42.8 vs. 58.4%; $P < 0.01$). Implants and β agonists increased carcass mass, but also decreased carcass quality grade. Inorganic trace elements, vitamins A and E, and in-feed antimicrobials were effectively replaced with PN Beef supplements, yielding comparable feedlot performance and carcass quality.

**Key Words:** growth promotant, antimicrobial, liver abscess

**237 Effect of dietary nitrate supplementation on dairy cattle enteric methane and nitrous oxide emissions.** Q. Wang[1], C. J. Neumeier*[1], G. Getachew[2], D. H. Putnam[2], A. R. Castillo[3], and F. M. Mitloehner[1], *[1]Department of Animal Science, University of California, Davis, Davis, [2]Department of Plant Science, University of California, Davis, Davis, [3]University of California Cooperative Extension, Merced.*

Nitrate acts as alternative hydrogen sink in the rumen to inhibit methanogenesis and therefore ruminal methane production. However, under anaerobic conditions, such as in the rumen, nitrate might be reduced to nitrous oxide, which may offset the greenhouse gas reduction benefit of nitrate feeding on methane mitigation. The present study investigated the effects of varying concentrations of nitrate supplementation (1, 2, and 3% nitrate ion on a dry matter basis) versus isonitrogenous concentrations of urea on enteric greenhouse gas emissions with an in vitro gas production system. Gas samples were collected from the in vitro systems at 2, 4, 6, 8, and 12 h incubation times and analyzed for carbon dioxide, methane, and nitrous oxide concentrations. Liquid samples were collected at 0, 3, 6, and 12 h incubation times and analyzed for nitrate, nitrite, and ammonium concentrations. All data was analyzed using the Proc Mixed Model in SAS. Nitrate vs. urea treatments at 2 and 3% decreased ($P < 0.001$) methane production during the early (0 to 8 h) and overall (0 to 12 h) incubation periods. Nitrous oxide production was observed only in the nitrate treatments. Nitrate feeding at 3% decreased ruminal methane by 3.2 mg/g dry matter feed and produced 0.018 mg nitrous oxide/g dry matter feed, respectively, equivalent to a decrease of 61.8 mg carbon dioxide equivalents/g dry matter feed. To maximize the inhibitory effect of nitrate on enteric methane production, nitrate would have to be supplemented at least 3 times daily. This study indicates that nitrate supplementation may be an effective strategy to mitigate enteric greenhouse gas emissions. Further research is necessary to evaluate methane and nitrous oxide emissions in vivo with nitrate supplementation.

**Key Words:** greenhouse gas, hydrogen sink, methanogenesis

**238 Effect of dietary protein concentration on utilization of dairy manure nitrogen for plant growth, leachate nitrate-N losses, and ammonia emissions from lysimeters.** C. Lee[1], G. W. Feyereisen[2], A. N. Hristov*[1], C. J. Dell[3], J. P. Kaye[4], and D. B. Beegle[4], *[1]Department of Animal Sciences, The Pennsylvania State University, University Park, [2]USDA-ARS-SWMRU, St. Paul, MN, [3]USDA-ARS-PSWMRU, University Park, PA, [4]Department of Crop and Soil Sciences, The Pennsylvania State University, University Park.*

Animal diet can have a significant effect on manure composition and nutrient losses during storage and following application to soil. This lysimeter experiment was designed to investigate the effects of dietary protein concentration on nitrate-N ($NO_3$-N) and ammonia ($NH_3$) losses from dairy manure applied to soil and manure N use for plant growth. Lactating dairy cows were fed diets with 16.7 (HighCP) or 14.8% (LowCP) crude protein content. Feces and urine were labeled with $^{15}N$ by ruminal pulse-doses of $^{15}NH_4Cl$. Unlabeled and $^{15}N$-labeled feces and urine were used to produce manure for a study with 21 lysimeters (Hagerstown silt loam; fine, mixed, mesic Typic Hapludalf) in a greenhouse. Manure application rate was 277 kg N/ha. $NH_3$ emissions were measured at 3, 8, 23, 28, 54, and 100 h after manure application. Manure was incorporated into the soil and a leaching event was simulated. Spring barley was planted (387 plants/$m^2$) 7 d after the leaching event and harvested at senescence, 86 d after planting. There was no difference in whole-crop barley dry matter and N yields ($P = 0.11$ and 0.41, respectively) between LowCP and HighCP manures. The leachate $NO_3$-N concentration was also not different ($P = 0.08$) between manures, but urinary N had a greater ($P < 0.001$) contribution to $NO_3$-N than did fecal N. $NH_3$ emission rates were on average about 100% greater ($P < 0.001$) for HighCP vs. LowCP manures. Delta $^{15}N$ of $NH_3$-N was markedly greater ($P < 0.05$) for manures containing $^{15}N$-labeled urine compared with manure with $^{15}N$-labeled feces. In this study, similar plant yields and $NO_3$-N leaching losses were obtained by fertilizing with manures from cows fed low- vs. high-protein diets (deficient or adequate in metabolizable protein supply, respectively). Nitrogen from HighCP urine had the highest recovery rate in whole barley plants, barley kernels, and leachate $NO_3$-N. Applied at equal N soil application rates, HighCP manure resulted in markedly greater $NH_3$ emissions than LowCP manure with urine N being the primary source of the emitted $NH_3$.

**Key Words:** dietary protein, ammonia emission, nitrate leaching

**239 Effect of abomasal ferrous lactate infusion on phosphorus digestion and absorption in lactating dairy cows.** X. Feng*, K. F. Knowlton, A. D. Dietrich, and S. Duncan, *Virginia Polytechnic Institute and State University, Blacksburg.*

The objective of this study was to evaluate the effect of ferrous lactate infusion on phosphorus (P) digestion and absorption from the intestinal tract of lactating dairy cows. Four ruminally cannulated lactating cows were used in a 4 × 4 Latin square with 14 d in each period. Cows were fed a TMR diet containing 0.39% P, providing 100% of the cows' calculated P requirement. On d 8 to d 14 of each period, each cow was infused daily with 0, 200, 500, or 1250 mg Fe in the form of ferrous lactate solution (ferrous lactate in 1 L double distilled water) into the abomasum. Treatments were calculated to approximate 0, 2, 5, or 12.5 mg Fe/L in drinking water assuming cows drinking 100 L water per day. Total fecal collection was conducted in the last 4 d of each period and fecal samples were analyzed for total P and inorganic phosphorus (Pi) using the molybdovanadate yellow method and blue method, respectively. The phytate P content of feed and fecal samples was determined with high performance ion chromatography (HPIC). Milk samples were collected from d 11 to d 14 and coccygeal venous blood samples were collected in the last 2 d of each period. All data were analyzed using PROC GLIMMIX in SAS 9.2 and polynomial contrasts were used to evaluate linear and quadratic effects of treatment. Dry matter intake was not affected by treatment ($P > 0.05$) but the digestibility of dry matter, NDF, and nitrogen decreased linearly with increasing ferrous lactate infusion ($P < 0.01$; 68.5% to 67.0%, 38.3% to 36.2% and 66.4% to 64.1%). Milk yield, content of milk protein, lactose, and SNF, and SCC were unaffected by treatment ($P > 0.05$). A quadratic effect on milk fat percent was observed ($P = 0.04$) with the lowest milk fat at 500mg Fe/d infusion. Treatment effects on intake and digestibility of total P, Pi, and phytate P were not observed ($P > 0.05$). In the short-term, water iron up to 12.5 mg/L did not affect production or P status of lactating cows.

**Key Words:** dairy cow, ferrous lactate, phosphorus digestion and absorption

**240 Effects of supplemented chromium propionate on milk performance and disease occurrence status in transition cows.** C. Wang*[1,3], K. Wang[1], Z. Y. Duan[2], Y. Lao[2], D. M. Wang[1], and J. X. Liu[1], *[1]Institute of Dairy Science, Zhejiang University, Hangzhou, China, [2]Kemin Industries (Zhuhai) Co. Ltd., Zhuhai, China, [3]Zhejiang Agriculture & Forestry University, Lin'an, China.*

The objective of the study was to investigate the effects of supplemented chromium propionate on milk performance, blood parameters and disease occurrence status in transition cows. Seventy-five cows were blocked based on previous milk production, parity, estimated calving date and body weight, and were randomly assigned to one of 5 treatments and supplemented with 0, 25, 50, 100 and 150 g chromium propionate (KemTRACE Chromium Propionate 0.4% Dry containing 0.4% chromium) per ton of concentrate. The experiment lasted from one month before calving to 2 mo after calving. The Cr source was supplemented throughout the whole experiment. Milk yields were recorded and milk compositions were analyzed for 2 consecutive days every 10 d. Blood parameters and the content of chromium in milk, urine and feces were analyzed before trial, one week before calving, one week after calving, one month after calving and 2 mo after calving. All data except for disease occurrence status were analyzed by Mixed procedure of SAS. Disease occurrence status data were analyzed for treatment effects using the FREQ procedure of SAS. Milk yield increased as the dosage of supplemented chromium increased ($P = 0.02$) and then leveled off at a level higher than 50 g/ton. Supplementation of chromium decreased the disease rates and plasma NEFA of cows ($P = 0.05$) during the transition period. Chromium level in milk did not change in all treatments ($P > 0.05$), and the chromium in blood and urine did not increase ($P > 0.05$) at levels lower than 50 g/ton, indicating that chromium propionate can be safely fed to dairy cows at lower dosages. In conclusion, supplementation of chromium propionate at 50 g/ton can increase milk yield and is beneficial to dairy cow's health in transition period.

**Key Words:** chromium propionate, milk performance, health status

**241 Transfer of dietary aflatoxin B1 to milk aflatoxin M1 and effect of adding absorbent on the transfer and lactation performance of dairy cows.** J. L. Xiong*[1], Y. M. Wang[2], Y. Li[1,3], and J. X. Liu[1], *[1]Institute of Dairy Science, Zhejiang University, Hangzhou, China, [2]Novus International Trading (Shanghai) Co., Ltd., Shanghai, China, [3]Department of Animal Science, Zhoukou Vocational and Technical College, Zhoukou, China.*

The objectives of the study were to investigate the transfer rate of aflatoxin from feed to milk and to evaluate the efficacy of adsorbent in

reducing aflatoxin M1 (AFM1) in milk of dairy cows fed different doses of aflatoxin B1 (AFB1). Twenty-four Holstein cows in late lactation (271 ± 29 DIM, 21.6 ± 3.1 kg milk/d) were blocked by DIM, body weight, and milk yield in a 2 × 3 crossover design. Cows were added with aflatoxin B1 at 0, 20 or 40 μg/kg DM, with or without adsorbent (Solis Mos, Novus International Inc.), respectively. The experiment consisted of 2 consecutive periods with AFB1 challenging for 7 d and clearing for 5 d each period. In the second period cows were switched to different Solis Mos treatments without changing AFB1 level. Variables of data were analyzed using the mixed procedure of SAS. Dry matter intake, milk yield, contents of milk protein and milk fat, and somatic cell count were not affected by either AFB1 dosage or Solis Mos. Cows fed aflatoxin B1 at a level of 20 or 40 μg/kg excreted significantly higher AFM1 ($P < 0.01$) in milk than the 0 μg/kgDM, irrespective of Solis Mos, with significant difference between 20 and 40 μg/kg-added treatments ($P < 0.01$). Solis Mos numerically reduced the excretion of AFM1 ($P > 0.05$). Amount of AFB1 added to the diet and addition of Solis Mos did not have influence on the rate at which dietary AFB1 was transferred to AFM1 in milk. It is inferred that addition of Solis Mos and AFB1 in the diet has no effect on lactation performance of cows, while the milk AFM1 concentration linearly increased with the adding level of dietary AFB1 but was not influenced by the addition of Solis Mos.

**Key Words:** aflatoxin, adsorbent, transfer

**242 Effect of stocking density in the prepartum period on health and productive parameters of Jersey cows.** A. Dresch*[1], P. Silva[2], H. Hooper[1], C. Spies[1], P. Lau[1], K. Lobeck[2], K. Machado[1], M. Endres[2], and R. Chebel[1], *[1]Department of Veterinary Population Medicine, University of Minnesota, St Paul, [2]Department of Animal Science, University of Minnesota, St Paul.*

Objectives were to evaluate the effect of different stocking densities during the prepartum period on incidence of diseases and milk yield of Jersey cows. Within each replicate (n = 4), 2 pens were assigned to 80% stocking density (80D, n = 38) and 2 pens were assigned to 100% stocking density (100D, n = 48). Nulliparous and parous animals were housed separately pre and postpartum. Animals were scored for body condition and locomotion at enrollment, within 1 d postpartum (DIM), and at 35 and 56 DIM. Cows were examined within 1 DIM for retained placenta; 4, 7, 10, and 14 DIM for metritis; and, 35 DIM for endometritis. Data regarding displacement of abomasum, mastitis, and culling were recorded up to 60 DIM. Cows were milked thrice daily. Data regarding energy-corrected milk yield in the first month postpartum is reported. Pen was considered the experimental unit (n = 8/treatment). Dichotomous data were analyzed by logistic regression using the GLIMMIX procedure and continuous data were analyzed by ANOVA using the MIXED procedure for repeated measures. Pen was included as the random effect. Treatment was nested within pen and replicate and cows were nested within treatment. Stocking densities were 74.0 and 94.3% (±0.3) of headlocks and 80.7 and 102.8% (±0.4) of stalls for 80D and 100D, respectively. There was no effect of treatment on incidence of stillbirth (80D = 3.9 vs. 100D = 3.4%; $P = 0.50$), retained placenta (80D = 4.4 vs. 100D = 7.4%; $P = 0.13$), and endometritis (80D = 7.4 vs. 100D = 7.1%; $P = 0.65$). There was a tendency ($P = 0.10$) for incidence of metritis to be greater for 80D (21.5%) than 100D (13.9%). Treatment did not affect percentages of cows with locomotion score >2 at 35 ($P = 0.94$) and 56 ($P = 0.77$) DIM. Body condition score was not affected by treatment (80D = 2.97 ± 0.02 vs. 100D = 2.97 ± 0.01; $P = 0.91$). Percentage of cows removed from the herd within 60 DIM (80D = 4.4 vs. 100D = 3.0%; $P = 0.42$) and yield of energy corrected milk (80D = 27.56 ± 1.52 vs. 100D = 27.98 ± 1.50 kg/d; $P = 0.85$) were not affected by treatment. In conclusion, reducing stocking density did not improve health and productive parameters and unexpectedly tended to increase incidence of metritis.

**Key Words:** stocking density, prepartum, health

**243 Supranutritional doses of selenium and vitamin E reduce the negative effects of heat stress in sheep by reducing systemic and respiratory oxidative stress.** S. S. Chauhan*[1,2], P. Celi[3,2], B. J. Leury[2], F. Liu[2], and F. R. Dunshea[2], *[1]Department of Animal Husbandry, Himachal Pradesh, Shimla (HP), India, [2]Melbourne School of Land and Environment, The University of Melbourne, Parkville, VIC, Australia, [3]Faculty of Veterinary Science, University of Sydney, Narellan, NSW, Australia.*

The aim of the study was to elucidate the role of supranutritional dietary doses of selenium and vitamin E to ameliorate the effect of heat stress (HS) either individually or synergistically by reducing oxidative stress in sheep. Thirty-two Merino × Poll Dorset ewes were housed in one of 2 climatic chambers maintained at either thermoneutral (TN) (18- 21°C and 40–50% relative humidity (RH)) or HS (28–40°C and 30–40% RH) conditions. Sheep were allocated in 2 × 2 factorial design to different levels of selenium (0.24 (LS) and 1.20 (HS) mg Se (as SelPlex) $kg^{-1}$ DM) and vitamin E (10 (LV) and 100 (HV) I.U. of vitamin E $kg^{-1}$ DM). Respiration rate and rectal temperature were recorded at 0900, 1300 and 1700 h each day and blood samples were collected on d 1 and 7. Data were analyzed by multivariate linear mixed models using Genstat 14th edition. Average respiration rate (169 v. 78 breaths/min) and rectal temperature (40.10 v. 39.47°C) were increased ($P < 0.001$) during HS, particularly at 1700 h. Although there were no overall effects of vitamin E on physiological parameters, there were interactions ($P < 0.001$) between vitamin E and temperature such that vitamin E decreased respiration rate (157 vs. 182 breaths/min) and rectal temperature (40.26 vs. 40.54°C) during HS but not TN conditions. Se decreased respiration rate (165 vs. 174 breaths /min) during HS but not TN. Plasma reactive oxygen metabolites concentration were reduced by 20% ($P < 0.05$), while biological antioxidant potential was increased by 10% ($P < 0.05$) in sheep on the HSHV diet compared to those that received the LSLV diet. The ratio of daily water intake to feed intake was reduced by 22 % ($P < 0.05$) in sheep fed the HSHV diet compared to those fed the LSLV diet. Exhaled breath condensate hydrogen peroxide concentration was reduced by 40% ($P < 0.05$) in sheep fed the HSHV diet compared to sheep fed the LSLV diet. These data suggest that the negative effects of heat stress can be ameliorated by supranutritional doses of selenium and vitamin E through improved redox homeostasis

**Key Words:** heat stress, oxidative stress, sheep