

## Production, Management and the Environment: Environment

**W316 Stocking rate and botanical composition effects on the physical characteristics of the streamside zones of pastures.** D. A. Bear<sup>\*1</sup>, J. R. Russell<sup>1</sup>, D. G. Morrical<sup>1</sup>, M. Tufekcioglu<sup>1</sup>, T. M. Isenhardt<sup>1</sup>, and J. L. Kovar<sup>2</sup>, <sup>1</sup>Iowa State University, Ames, <sup>2</sup>USDA-ARS National Laboratory for Agriculture and the Environment, Ames, IA.

Grazing management that allow cattle to congregate near pasture streams may increase sediment, phosphorus, and pathogen loading of the streams by removing vegetation and depositing manure near the streams. To assess stocking rate and pasture characteristics effects on the risk of pollution of pasture streams, forage sward height (SH), bare and manure-covered soil, and forage species were measured within 15.2 m of the stream along each bank at up to 30 locations separated by 30.5 m in 13 pastures on 12 beef cow-calf farms in southern Iowa bimonthly from May through November for 3 yr. Stream bank erosion measurements were collected during spring, summer, and fall seasons by 1.6 × 76.2 cm fiberglass pins inserted perpendicular to the bank at 1 m intervals from the base to the top of each bank at 10 transects located at 32 m intervals along the stream. Cattle stocking records were maintained year-round by farm operators. The REG procedure of SAS analyzed bare and manure-covered ground proportions and erosion by stocking rates. Bare ground was weakly related ( $r^2 = 0.15$ ) to annual stocking rate per stream m (cow-d/m), whereas manure-covered ground was more highly related ( $r^2 = 0.35$ ) to period cow-d/m. In stepwise multiple regressions, forage SH decreased as tall fescue, legumes, bluegrass, and period stocking rate of cow-d/m increased ( $r^2 = 0.56$ ). Proportions of bare soil increased as proportion of reed canarygrass decreased and legumes increased ( $r^2 = 0.35$ ). Proportions of manure-covered ground increased as the cow-d/m per sampling period and the proportions of tall fescue and bluegrass in the vegetation increased, and decreased as proportions of broadleaf weeds and sedge increased ( $r^2 = 0.47$ ). Annual stream bank erosion rates were not correlated ( $r^2 = 0.001$ ) to annual cow-d/m or cow-d/ha. Erosion occurred primarily during the spring season, indicative of the freeze-thaw cycle and hydrological effects. Grazing management that alter temporal/spatial distribution of cattle may decrease nonpoint source pollution risks of pasture streams by maintaining forage SH and decreasing manure deposition within the streamside zones of pastures.

**Key Words:** hydrology, management, riparian areas

**W317 Incidence of bovine Enterovirus, Coronavirus, and group A rotavirus, and concentration of total coliforms in Midwestern pasture streams.** D. A. Bear<sup>\*</sup>, Y. I. Cho, J. R. Russell, S. M. Ensley, and K. J. Yoon, Iowa State University, Ames.

The occurrence of bovine enteric pathogens and total coliform (TC) contamination in streams of 13 Midwestern cow/calf pastures was studied during the 2007-2009 grazing seasons. Water samples ( $n = 1274$ ) were collected biweekly at upstream (UP) and downstream (DOWN) locations on each stream. Incidence of bovine Enterovirus (BEV), Coronavirus (BCV), and group A Rotavirus (BRV), and concentrations of TC were evaluated. Cattle presence in pastures on the day of sampling, and 2, 3, 4, 5, 6, and 7 d prior were evaluated for association of virus detection and TC. Cattle presence in pastures were analyzed for BEV, BCV, and BRV incidence by the FREQ procedure of SAS, Proc GLM analyzed TC differences by farm and UP and DOWN sites, and Proc REG regressed TC by stocking densities. Mean incidences of BEV, BCV, and BRV in all samples were 3.91, 1.12, and 0.49%, respectively, over the three grazing seasons. There were no differences ( $P > 0.10$ ) for BEV, BCV,

and BRV incidences between farms or samples collected from UP or DOWN locations. Incidence of BEV in combined samples were related ( $P < 0.05$ ) to cattle presence in pastures on the day of sampling and 3 and 4 d prior to sampling, and tended ( $P < 0.10$ ) to be related to cattle presence in pastures 2, 5 and 6 d prior to sampling. BCV or BRV incidences were not related ( $P > 0.10$ ) to cattle presence in pastures at any time throughout the grazing seasons. In UP samples, BEV tended ( $P < 0.10$ ) to be related to cattle presence in pastures on the day, and 2 and 4 d prior to sampling. Whereas, in DOWN samples, cattle presence in pastures on the day of sampling only tended ( $P < 0.10$ ) to be related to BEV incidence. Mean TC were 1269 and 1417 colony-forming units (CFU)/100ml, respectively, for UP and DOWN samples. Differences ( $P = 0.02$ ) were observed between farms, but not between sites on farms ( $P = 0.31$ ), for concentrations of TC and were not related to cattle stocking rates of pastures. Preliminary results indicate that while BEV incidence may be related to cattle presence, but BCV and BRV incidences and TC were not related to cattle presence in pastures.

**Key Words:** enteric viruses, nonpoint source pollution, water quality

**W318 Borax and Octabor treatment of stored swine manure: Reduction in hydrogen sulfide emissions and phytotoxicity to agronomic crops.** M. Yokoyama<sup>\*1</sup>, S. Hengemuehle<sup>1</sup>, D. Penner<sup>1</sup>, J. Michael<sup>1</sup>, C. Spence<sup>2</sup>, T. Whitehead<sup>2</sup>, R. von Bernuth<sup>1</sup>, D. Rozeboom<sup>1</sup>, and M. Cotta<sup>2</sup>, <sup>1</sup>Michigan State University, East Lansing, <sup>2</sup>USDA, Agricultural Research Service, Peoria, IL.

Gaseous emissions from stored manure have become environmental and health issues for humans and animals as the livestock industry becomes more specialized and concentrated. Of particular concern is hydrogen sulfide, which is being targeted for regulatory control in concentrated animal farm operations. There are few technologies to control hydrogen sulfide emissions which are cost effective, safe for farmers and animals, and environmentally sustainable. Borax treatment (1%) is effective in reducing hydrogen sulfide emissions from stored swine manure. The objective of this study was to treat stored swine manure with lower amounts to reduce hydrogen sulfide emissions and determine the phytotoxicity of the treated manure as a fertilizer for crops. Ten treatments (0.1, 0.25, 0.5, 1.0% borax and 0.05, 0.1, 0.125, 0.25 and 0.5% Octabor and negative control, 0.0%) were evaluated in plastic carboys (19 L) with swine manure and monitored for hydrogen sulfide emissions for 30 d. 16S and PCR was used to quantify total bacteria and sulfate reducing bacteria. Treated manures were used as fertilizer for growing corn, wheat, soybean, alfalfa and dry beans for 42 d in a greenhouse. Hydrogen sulfide emissions decreased (25-50%) with borax and Octabor treatment and the decrease was dose dependent. Significant interactions ( $P \leq 0.05$ ) between plant injury vs. plant boron content, plant boron content vs dry wt yield, and plant injury vs. dry wt yield was observed. The ranking of crop tolerance to borax and Octabor treated swine manure was: alfalfa, corn, wheat, soybean, dry beans. Borax and Octabor were bioavailable for plants with no soil accumulation. A significant reduction in total bacteria ( $P \leq 0.01$ ) and sulfate reducing bacteria ( $P \leq 0.05$ ) was observed for higher treatments. Borax and Octabor treatment (0.1-0.25%) of stored swine manure was tolerated by crops without injurious effects.

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**Key Words:** borax, octabor, swine manure, hydrogen sulfide

**W319 Effect of dietary adipic acid and dried distillers grains plus solubles in combination with post-excretion amendment with sodium bisulfite on nitrogen loss from stored laying hen excreta.** T. J. Applegate<sup>\*1</sup>, C. Romero<sup>2</sup>, M. E. B. Abdallh<sup>3</sup>, R. Angel<sup>4</sup>, and W. Powers<sup>5</sup>, <sup>1</sup>Purdue University, W Lafayette, IN, <sup>2</sup>Universidad Politécnica de Madrid, Madrid, Spain, <sup>3</sup>University of Khartoum, Khartoum, Sudan, <sup>4</sup>University of Maryland, College Park, <sup>5</sup>Michigan State University, E Lansing.

Effects of dietary adipic acid (AA; 0 or 1%) or dried distillers grains plus solubles (DDGS; 0 or 20%) was determined on laying hen (Hyline W36) performance and egg characteristics from 26 to 34 wk of age (2 × 2 factorial arrangement of diets; 36 cages/diet; 2 hens/cage). All data were analyzed as a factorial experiment utilizing PROC MIXED procedure of SAS. Egg production, feed intake, and egg specific gravity were unaffected by diet. Hens fed diets with 20% DDGS produced 1.4% heavier eggs ( $P < 0.02$ ), but was unaffected by AA. Egg shell percentage was reduced by 2.4 or 1.8% with either dietary AA or DDGS, respectively ( $P < 0.02$ ). To determine the influence of diet and manure amendment on N loss during storage, excreta was collected during 2, 2-d collections by pooling 6 pens/diet (n=6 pools/collection), mixing and dividing into 2 equal portions for 14-d storage experiments with or without 8.8 kg/100 m<sup>2</sup> of PLT (sodium bisulfite). Initial excreta pH was reduced by 0.2 pH units when hens were fed 1% AA or 20% DDGS ( $P < 0.05$ ). The effect of feeding hens AA on manure pH was maintained for 7 d, but was lost by 14 d of storage; whereas the effect of feeding 20% DDGS on manure pH was maintained for 14 d of storage ( $P < 0.01$ ). These dietary influences on manure pH during storage however were unrelated to N loss. While diet supplementation with adipic acid had no influence on manure N loss during storage, manure from hens fed 20% DDGS lost 32% more N during the first 7 d of storage vs. manure from hens eating no DDGS ( $P < 0.02$ ). Surface amendment of manure with PLT resulted in a 41% reduction in manure N loss during the first 7 d of storage and a 14.7% reduction from 7 to 14 d of storage ( $P < 0.05$ ). In conclusion, manure amendment with PLT resulted in a 26% reduction in N loss during manure storage for 14 d. Conversely, feeding hens diets containing 20% DDGS resulted in a 16.5% greater manure N loss during the same time period.

**Key Words:** sodium bisulfite, dry distillers grains plus solubles, nitrogen loss

**W320 Evaluation of a silvopastoral system with *Alnus acuminata* on pasture productivity, milk production and economic returns in a high tropical ecosystem.** A. Conde<sup>\*1</sup>, R. Hernandez<sup>1</sup>, L. L. Betancourt<sup>1</sup>, D. A. Castañeda<sup>1</sup>, J. A. Umaña<sup>1</sup>, T. Carvajal<sup>2</sup>, and L. Sanchez<sup>3</sup>, <sup>1</sup>Universidad de La Salle, Bogotá, Colombia, <sup>2</sup>Universidad UDCA, Bogotá, Colombia, <sup>3</sup>CORPOICA, Bogotá, Colombia.

The effect of introducing alders *Alnus acuminata* in pastures with a spatial distribution of 10 × 5 m was assessed in terms of on forage yield and quality, milk production and composition and economic efficiency. The study was carried out in a farm located in Usme Colombia (74°06' W, 4°28' N), with an elevation of 2650 m.a.s.l, ambient temperature between 6 to 12 °C and mean rainfall of 900 mm/yr. When the study began, the alders were five years old, with an average height of 2.5 m and a mean shade diameter of 3.5 m. A total of 12 Holstein cows in the third year of lactation were distributed randomly into two pasture treatments: T1-trees in the pasture and T2- pasture without trees, in a simple crossover design. All paddocks in the rotation were grazed every 60 d. Dry matter (DM) yield and botanical composition of grazed pastures were estimated using the double sampling and dry weight rank method, respectively. Milk production was recorded daily and fat, protein and

lactose were analyzed weekly. The two pastures treatments were composed of *Pennisetum clandestinum* H. (68%), *Holcus lanatus* L. (8%), *Trifolium pratense* L. (6%), and weeds (18%). Forage on offer was higher in pastures with trees (2687 kg DM/ha) than in pastures without trees (1702 kg DM/ha). Forage on offer in the pastures with trees had higher crude protein (14%) than in pastures without trees (11%). There were no differences ( $P > 0.05$ ) in daily milk yield and in milk composition (fat, protein and lactose) due to treatments. However, milk production per ha in pastures with trees (10163 kg/ha/yr) was higher ( $P < 0.05$ ) than in pastures without trees (5081 kg/ha/yr), due to higher carrying capacity (1108 versus 569 kg LW/ha). The investment made on the silvopastoral system with alders was recovered in the fifth year after establishing the trees and the annual rate of return was 55% higher than in the pasture without trees.

**Key Words:** forage yield, forage quality, stocking rate

**W321 Feeding native laying hens diets containing palm kernel meal with or without enzyme supplementations: 2. Manure nitrogen and microbial counts.** Adrizal<sup>\*1</sup>, Yusrizal<sup>1</sup>, S. Fakhri<sup>1</sup>, Yatno<sup>1</sup>, and C. R. Angel<sup>2</sup>, <sup>1</sup>Faculty of Animal Husbandry, University of Jambi, Jambi 36361, Jambi, Indonesia, <sup>2</sup>Department of Animal and Avian Sciences, University of Maryland, College Park.

The objectives of this study were to evaluate effects of feeding native laying hens diets containing palm kernel meal (PKM) on nitrogen (N) excretion, excreta ammonia (NH<sub>3</sub>), and excreta microbial counts. Hens (180, 48 wk old) were assigned to 180 cages (one bird per cage). Each of 12 diets was assigned at random to 15 cages. The 12 diets were the results of a factorial arrangement of 3 levels of PKM (0, 15, and 30%), 2 levels of fiber enzyme (0 and 0.03%), and 2 levels of a phytase-protease mixture (0 and 0.035%). Diets contained 2,753 to 2,758 kcal ME/kg and 17.5 to 18.4% CP and were fed for 10 wk. A 16L:8D lighting program was used. The results showed that at wk 4, excreta DM (but not N), increased as dietary PKM levels increased (19.4 vs. 21.9 vs. 23.0% for 0, 15, and 30% PKM, respectively;  $P \leq 0.005$ ). There were no effects of enzyme supplementation on excreta DM and N. Lower excreta NH<sub>3</sub> due to increased PKM was observed at wk 4 and 10 ( $P \leq 0.0001$ ). Ammonia reduction was also caused by fiber enzyme supplementation at wk 4 (197.9 vs. 161.7 ppm, at 0 and 0.03%, respectively) ( $P \leq 0.05$ ). Interaction effect of fiber enzyme with PKM on NH<sub>3</sub> was observed at 4 and 10 wk ( $P \leq 0.005$ ). Interactions were also observed on NH<sub>3</sub> between the phytase-protease mixture and PKM at 10 wk, between the fiber enzyme and PKM at 4 and 10 wk, and between the phytase-protease mixture and the fiber enzyme at 4 wk. Increasing dietary levels PKM from 0 to 15 to 30% resulted in increased *Lactobacillus* counts (107.8 vs. 106.8 vs. 169.8 × 10<sup>8</sup> cfu, respectively) at wk 4. At 10 wk, dietary PKM levels did not clearly affect *Lactobacillus* counts, but reduced enteric bacteria (4.2 vs. 2.6 vs. 2.8 × 10<sup>8</sup> cfu, respectively) ( $P \leq 0.005$ ). Although enzyme had no clear effect on microbial growth, interaction effects of PKM and fiber enzyme on *Lactobacillus* and enteric bacteria or PKM with phytase-protease mixture on *Lactobacillus* counts were seen. Dietary PKM helped reduce N excretion, NH<sub>3</sub> emission, and favored nonpathogenic microbial growth.

**Key Words:** palm kernel meal, native laying hen, enzyme supplementation, excreta nitrogen, ammonia, excreta microbial count

**W322 Effect of dietary protein concentration on ammonia emission from dairy manure.** C. Lee<sup>\*1</sup>, A. N. Hristov<sup>1</sup>, C. Dell<sup>2</sup>, G. Feyereisen<sup>3</sup>, J. Kaye<sup>1</sup>, and D. Beegle<sup>1</sup>, <sup>1</sup>Pennsylvania State University, PA, <sup>2</sup>USDA-ARS, PA, <sup>3</sup>USDA-ARS, MN.

The objective of this experiment was to investigate the effect of dietary crude protein concentration on ammonia (NH<sub>3</sub>) volatilization from dairy cow manure. Two types of manure were prepared by feeding lactating dairy cows diets with 16% (DM basis; HighCP) or 14% CP (LowCP). The manure was used in 2 experiments. In Exp. 1, 400 g of each manure (1.7:1.0, feces:urine) was placed in sealed steady-state flux chambers connected to a photoacoustic infrared gas analyzer and incubated for 5 d at 25°C to measure the NH<sub>3</sub> emitting potential of manure. Ammonia emission rates were 202 and 132 (mg/h;  $P < 0.001$ ) for HighCP and LowCP manure, respectively. Cumulative NH<sub>3</sub> emission was 45% less ( $P < 0.001$ ) for LowCP compared with HighCP manure. In Exp. 2, LowCP and HighCP manure was applied to 61 × 61 × 61 cm lysimeters collected from a Hagerstown silt loam (fine, mixed, mesic Typic Hapludalf) in a complete randomized design. Manure was applied to each lysimeter immediately after mixing feces and urine (same ratio as in Exp. 1). The manure application rate was 9.3 g of N/lysimeter, corresponding to a field application rate of 300 kg N/ha. The HighCP manure had higher N content (4.4 vs. 2.8%, DM basis) and proportion of ammonium and urea-N in total manure N (51.4 vs. 30.5%) than the LowCP manure. As a result, more LowCP than HighCP manure (2.36 vs. 1.65 kg) was applied to each lysimeter. After manure application, NH<sub>3</sub> emissions were measured using a photoacoustic infrared gas analyzer at 3, 8, 23, 28, 50 and 100 h. Ammonia emission was greater ( $P < 0.05$ ) from HighCP- than from LowCP-manure amended soil. The area under the cumulative (100 h) NH<sub>3</sub> emission curve for LowCP was smaller than the area for HighCP manure (56.8 and 114.8 mg NH<sub>3</sub>/m<sup>2</sup>/min × h, respectively;  $P < 0.05$ ). In conclusion, manure from dairy cows fed a 14% CP diet had decreased NH<sub>3</sub> emitting potential and resulted in 50% lower NH<sub>3</sub> emission when applied to soil, compared to manure from cows fed a 16% CP diet.

**Key Words:** dietary protein, ammonia emission, dairy manure

### **W323 Origin of ammonia nitrogen volatilized from dairy manure.** C. Lee\* and A. N. Hristov, *Pennsylvania State University.*

The objective of this experiment was to trace the origin of ammonia-N (NH<sub>3</sub>-N) volatilized from dairy manure during storage. The experiment was conducted with <sup>15</sup>N-labeled or unlabeled feces and urine collected from dairy cows fed a 16% crude protein, 32% NDF diet. Ruminal microbes and consequently feces and urine were labeled with <sup>15</sup>N by dosing <sup>15</sup>NH<sub>4</sub>Cl into the rumen. Two types of manure were prepared: FLM, <sup>15</sup>N-labeled feces and unlabeled urine; ULM, unlabeled feces and <sup>15</sup>N-labeled urine. Feces and urine were mixed in a 1:1 ratio (as-is basis) and incubated for 10 d at room temperature in a closed chamber system (n=4). Volatilized NH<sub>3</sub> was trapped in 0.5M sulfuric acid. The source of NH<sub>3</sub>-N was estimated as: <sup>15</sup>N-enrichment (atom % excess) of NH<sub>3</sub>-N ÷ <sup>15</sup>N-enrichment of <sup>15</sup>N-labeled urine or feces. Labeled and unlabeled feces or urine had similar N concentration (0.48 ± 0.01 and 1.01 ± 0.02%, respectively), but differed in <sup>15</sup>N-enrichment (0.090 vs. 0.005 and 0.133 vs. 0.0007 atom % excess, respectively). Total N, NH<sub>3</sub>-N, and urea-N concentrations were similar between FLM and ULM. Cumulative NH<sub>3</sub> emissions were also similar between FLM and ULM (1,371 vs. 1,328 mg,  $P = 0.51$ ). On average, 89% of the manure N lost during the incubation was recovered as ammonium in the acid trap. The proportion of NH<sub>3</sub>-N originating from fecal N (FLM) was negligible in the first 48 h of the incubation, represented 0.04 ± 0.006 by d 5, and then gradually increased to 0.11 ± 0.019 of the emitted NH<sub>3</sub>-N by d 10 (logistic regression model; adjusted R<sup>2</sup> = 0.91,  $P < 0.001$ ). The proportion of NH<sub>3</sub>-N originating from urinary N (ULM) represented 0.94 ± 0.027 at 24 h, 0.97 ± 0.002 at 48 h, 0.91 ± 0.004 at 72 h, and gradually decreased to 0.87 ± 0.005 at d 10 (exponential decay model; adjusted R<sup>2</sup>

= 0.92,  $P < 0.001$ ). This experiment demonstrated that the main source of NH<sub>3</sub>-N volatilized from cattle manure during the initial 10 d of storage is urinary N, representing on average 90% of the emitted NH<sub>3</sub>-N. The contribution of fecal N was relatively low, but gradually increased to about 10% by d 10, as mineralization of fecal N progressed.

**Key Words:** nitrogen-15, urine and feces, ammonia

### **W324 Air velocities in poultry houses raising large broilers.** D. G. Overhults<sup>1</sup>, A. J. Pescatore\*<sup>1</sup>, I. Lopes<sup>1</sup>, G. Morello<sup>1</sup>, J. P. Jacob<sup>1</sup>, M. Miller<sup>2</sup>, J. Earnest Jr.<sup>1</sup>, and R. S. Gates<sup>3</sup>, <sup>1</sup>University of Kentucky, Lexington, <sup>2</sup>Kentucky Poultry Federation, Winchester, <sup>3</sup>University of Illinois, Champaign.

As part of a Kentucky poultry house energy efficiency project, bird level air velocities were measured in tunnel ventilated broiler houses used by three commercial broiler complexes. Although tunnel fans consume a considerable amount of energy, they also can generate significant airflow over the flock, creating a wind chill effect that mitigates heat stress related problems. Air velocities were recorded in 21 houses (9, 5, and 7 from complexes A, B, and C, respectively) raising 2.8-kg broilers. All but one house had a dropped cathedral ceiling. Velocity measurements were taken at four equally spaced locations across the house about 50 cm above the litter and 21 m upstream from the tunnel fans. Velocities were measured with no birds in the houses. Overall velocities averaged 2.50 m/s and ranged from 1.81 to 3.19 m/s. All but one house had velocities greater than 2.0 m/s (400 fpm), with eight houses exceeding 2.5 m/s (500 fpm) and two exceeding 3.0 m/s (600 fpm). In Complex A, the nine 12.2 × 152.4 m houses each had eight 1.22 m diameter exhaust fans with discharge cones. Three of the houses had an additional 1.32 or 1.37 m diameter exhaust fan, again with discharge cones. The additional fan produced higher air velocities in two of the three houses. Four houses (13.1 × 155.4 m) producing for Complex B each had ten 1.22 m diameter exhaust fans. A fifth shorter house (13.1 × 140.2 m) had only nine 1.22 m fans but had the lowest air velocity due to poor performing fans. The seven houses raising for Complex C (12.8 × 128m) all had at least eight exhaust fans of 1.22 m or greater in diameter. The presence of discharge cones, as well as the size and number of fans, did not consistently impact velocities which ranged from 2.05 to 2.82 m/s, with an average of 2.42 m/s for Complex C.

**Key Words:** air velocity, tunnel ventilation, broilers

### **W325 Effect of LED lights on growth performance of broiler chicks.** R. D. Rierson\*, C. M. Rude, M. A. Barrios, and R. S. Beyer, *Kansas State University, Manhattan.*

Light emitting diode (LED) light sources are relatively new and potentially beneficial to poultry producers due to lower energy cost. To test the efficacy of LEDs as a light source for growing broilers, the following experiment was completed, utilizing 5 treatments with different light intensities. Light intensities varied from 5 to 25 lx, in increments of 5 lx. There were 4 replications of each treatment, with 20 birds per pen for a total of 400 d old male Cobb 500 broiler chicks. Experiments were carried out in a single building using pens that were 5 × 12 feet in area. Pens were separated using black plastic to keep stray light from interfering with neighboring pens. Chicks were grown on the floor on used litter. The chicks were fed a standard NRC corn soy starter diet and were grown to 21 d of age. The light source for the experiment were white LEDs that were bunched into clusters and hung at 24 inches above the floor litter. Dimmers were installed in each pen to allow ease of adjusting lux intensities. Birds were raised for the first 3 d using incandescent ceiling bulbs, and on d 4 the LED lights were lowered to

treatment intensities and the overhead lights were turned off. The LED lights were left on a 24 h light schedule, but during daylight hours the curtains were occasionally dropped to prevent birds from overheating. All pens were given ad libitum access to feed and water. BWG and feed consumption was collected at 21 d. BWG under 5 to 25 lx was 1472g, 1480g, 1481g, 1536g, and 1541g, respectively, and the differences were not statistically significant when analyzed with the GLM procedure in SAS with an  $\alpha$  of 0.05. Feed to gain ratios were not affected. It was observed that birds raised under higher intensities of light exhibited more physical activity than those raised under lower light intensity. No cannibalism was documented. The data concluded that it is possible to raise broilers under as low as 5 lx of light, from LED sources.

**W326 Comparison of nutrient and microbial profiles in foaming and non-foaming swine manure pits.** J. Rehberger\*, E. Davis, A. Veldkamp, T. Parrott, and T. Rehberger, *Danisco, Waukesha, WI*.

Swine manure samples were collected from foaming and non-foaming deep pit storage units from three production systems and the nutrient and microbial compositions of these samples were assessed. Manure samples were obtained by sampling the entire depth of the manure storage pit with a 3 m-long PVC sampling rod and classified as having none (less than 2.5 cm of foam on the manure surface, n = 30), low (2.5 to 15.2 cm of foam on the manure surface, n = 25), or high (greater than 15.2 cm of foam on the manure surface, n = 14) levels of foam. Terminal restriction fragment length polymorphism (TRFLP) analysis was performed to assess microbial communities using four restriction enzymes; *Bfa* I, *Hae* III, *Msp* I, and *Bst*U I. Manure samples obtained from deep-pit storage systems with a high degree of foaming had greater ( $P < 0.05$ ) concentrations of fiber-bound protein compared to manure samples from non-foaming pits and those with a low degree of foam. Foaming pit samples also had a greater abundance ( $P < 0.05$ ) of *Alphaproteobacteria*, *Betaproteobacteria*, *Deltaproteobacteria*, and *Actinobacteria* compared to non-foaming pit samples. Additionally, liquid and foam phases from three deep-pit swine manure storage systems experiencing foaming were sampled to compare differences in nutrient and microbial compositions between the liquid and foam portions. The concentration of crude fat was greater ( $P < 0.05$ ) in foam samples compared to samples of the liquid portion, as were concentrations of copper, iron, and zinc. The liquid portions had a greater abundance ( $P < 0.05$ ) of *Actinobacteria* and *Alphaproteobacteria* compared to foaming portions, and there was a greater abundance ( $P < 0.05$ ) of *Flexibacter* in the foam as compared to the liquid portions. The divergent microbial communities present in foaming and non-foaming deep-pit swine manure systems coupled with greater fiber-bound nitrogen content in foaming pits suggests that differences in nutrient abundance and subsequent changes in the microbial environment may be factors associated with the foaming phenomenon.

**Key Words:** manure, pit, foam

**W327 The effect of dietary alfalfa silage to corn silage ratios on cow performance and ammonia nitrogen emission.** C. Arndt\*<sup>1</sup>, M. A. Wattiaux<sup>1</sup>, and J. M. Powell<sup>2</sup>, <sup>1</sup>University of Wisconsin, Madison, <sup>2</sup>US Dairy Forage Research Center, Madison, WI.

The objective was to determine the effect of varying alfalfa silage (AS) to corn silage (CS) ratio in a 55:45 forage:concentrate ratio (% DM) total mixed ration on performance of lactating cows and ammonia nitrogen (NH<sub>3</sub>-N) emission. Sixteen multiparous Holstein cows (mean  $\pm$  SD) 77  $\pm$  35 DIM and 640  $\pm$  84 kg of BW were blocked by DIM and randomly assigned to balanced 4 x 4 Latin squares. Cows were housed in modified

tie-stall barns with 4 chambers designed to house 4 cows per chamber. Air samples were collected for about 17 h/d, on 3 consecutive days of each period and analyzed for NH<sub>3</sub> with a Photo-acoustic Multi-gas Monitor (Innova Model 1412). Dietary treatments were 20:80 (AS20), 40:60 (AS40), 60:40 (AS60), and 80:20 (AS80). As AS increased, expeller soybean meal substituted for soybean meal to maintain RUP above 6%. Dietary CP content of the diets increased with an increased proportion of AS in the diet and averaged 16.8, 17.2, 17.5, and 18.2% of diet DM for AS20, AS40, AS60, and AS80, respectively. No difference was observed for DMI (26.7 kg/d), milk yield (40.8 kg/d), milk efficiency (milk yield/DMI; 1.53), fat content (3.85%), protein yield (1.20 kg/d) and MUN (16.2 mg/dL). A linear and quadratic response was observed for fat yield which averaged 1.51, 1.59, 1.60 and 1.57 kg/d for AS20, AS40, AS60 and AS80, respectively, with the AS20 diet being lower than the other diets ( $P < 0.05$ ). True milk protein content decreased ( $P < 0.05$ ) from 3.01% in AS20 to 2.96% in AS40 and AS60, and was further reduced to 2.88% in AS80 compared to other treatments. Nitrogen intake increased linearly (701 to 791 g/d) with increasing proportion of AS in the diet whereas milk N decreased linearly (190 to 183g/d). No difference was observed in NH<sub>3</sub>-N emission rate among treatments (averaging 0.70  $\pm$  0.16g N/cow/h). Similarly, there was no difference in NH<sub>3</sub>-N emission per unit of N intake (0.023  $\pm$  0.006g NH<sub>3</sub>-N/g N intake) or per unit of milk N (0.089  $\pm$  0.020g NH<sub>3</sub>-N/g milk N). Despite higher N intakes with increasing proportion of AS in the diet, no difference in ammonia emission was observed from cows fed and managed in a tie stall barn.

**Key Words:** forage, ammonia, emission

**W328 Effect of inoculant and molasses on silage fermentation quality, protein fractions, nutritive value and aerobic stability in high dry matter alfalfa.** M. Khorvash\*<sup>1</sup>, F. Hashemzadeh Cigari<sup>1</sup>, G.-R. Ghorbani<sup>1</sup>, and A. Taghizadeh<sup>2</sup>, <sup>1</sup>Isfahan University of Technology, Isfahan, Isfahan, Iran, <sup>2</sup>Tabriz University, Tabriz, East Azarbaijan, Iran.

Microbial inoculants, containing lactobacillus plantarum and Propionibacterium acidipropionici (Lalsil) and molasses (0 and 50 g/kg) as a 2 x 2 factorial arrangement were studied on ensiled alfalfa fermentation indices, N fractions (Cornell net carbohydrate and protein system), in vitro degradability and aerobic stability. Forth cut of Alfalfa was wilted to 370 g/kg DM, chopped and ensiled for 90 days. Lalsil decreased pH, NDF, ADF and acetate but increased water soluble carbohydrate (WSC) and lactate: acetate ( $P < 0.05$ ). Molasses addition also decreased pH, lactate: acetate and crude protein, but increased NDF and ADF. Ammonia-N content of the silages were decreased when treated with Lalsil but increased with molasses addition ( $P < 0.05$ ). Lactate, butyrate and propionate were the same between treatments ( $P > 0.05$ ). Inoculation without molasses improved silage fermentation quality more effective than other treatments. Protein fractions evaluation by CNCPS system showed that molasses decreased fraction A in the ensiled forage ( $P < 0.05$ ). Both additives increased fraction B1 content of silages ( $P < 0.05$ ). Fraction B2 was higher in inoculated silages than uninoculated silages ( $P < 0.05$ ). No difference was observed for fraction B3 content among treatments. Fraction C was lower in inoculated silage than uninoculated, but was increased with molasses addition ( $P < 0.05$ ). In vitro 12 h DM degradability assessed with Ankom DaisyII incubator, were highest in silages treated with Lalsil and not added with molasses. However, in vitro 48 h DM degradability were the same among treatments. All the silages treated with additives had better fermentation characteristics and remained more stable than control, after aeration. Silage treated with molasses or inoculant had the lowest rate of mold and yeast growth and pH value was increased rapidly in control but not in treated silages.

In conclusion, molasses and microbial inoculation improved silage fermentation parameters, decreased proteolysis and aerobic stability of high dry matter alfalfa.

**Key Words:** alfalfa silage, inoculant, CNCPS

**W329 The effect of feed management software on whole farm nutrient balance.** B. A. Stewart\*, B. E. Cox, R. E. James, K. F. Knowlton, M. L. McGilliard, and C. C. Stallings, *Virginia Polytechnic Institute and State University, Blacksburg.*

Feeding nutrients more closely to a cow's nutrient requirements will reduce excretion of nitrogen and phosphorus by dairy cattle. The impact of improved feeding accuracy on whole farm nutrient balance through the use of feed management software was studied on 18 dairy herds located in Virginia. Nine herds began using the TMR Tracker feed management software in 2006 and were compared to 9 control herds not using feed management software. Each of the treatment herds was visited on a monthly basis. Annual inputs of nitrogen and phosphorus from purchased feed, fertilizer and animals were recorded from 2005 through 2008. Nitrogen and phosphorus exported from the farm as milk, animals, sold manure and feed were recorded. Whole farm nutrient balance was calculated using University of Nebraska software. After 2008, eight treatment herds and four control herds remained. Herd sizes averaged 290 and 325 for treatment and control farms. Milk production averaged 29.4 and 26.1 kg/d per cow respectively. Crop hectares averaged 326 and 284 respectively. Data were analyzed using proc mixed of SAS with repeated years, using 2005 data as a covariate. Measures of surplus (input-output) and ratio (input/output) were analyzed per farm and per cow. Measures on a per farm basis did not differ between treatment and control herds. Annual phosphorus ratios averaged  $1.9 \pm 0.9$  (SD) and annual nitrogen ratios averaged  $3.0 \pm 1.5$  (SD). On a per cow basis, annual phosphorus surplus averaged  $16.1 \pm 2.6$  (SD) kg/yr and annual nitrogen surplus averaged  $138.4 \pm 12.7$  (SD) kg/yr. Due to the large variation observed the use of feed management software did not have an effect on whole farm nutrient balance.

**Key Words:** whole farm nutrient balance, phosphorus, nitrogen

**W330 Determining water usage on dairies.** J. C. Potts\*, B. J. Bradford, J. F. Smith, and M. J. Brouk, *Kansas State, Manhattan.*

A meta-analysis was performed on 65 studies that recorded water intake by dairy cattle. The meta-analysis was utilized to develop a prediction equation for water intake in lactating dairy cattle. Studies were selected based on quantitative measurements of DMI, water intake (WI), and milk yield. Published papers were selected throughout the world but they mainly came from the *Journal of Dairy Science*. Many of the studies used more than one parameter to determine WI values leading to 137 data points from the 65 studies. With the addition of Na in the meta-analysis, 41 data points were available from the studies to examine the effects of Na on WI. The effects of DMI, diet DM%, dietary Na, and levels of milk production on WI were evaluated. Including data from cows with higher levels of milk production ( $>30$ kg/d) improved the correlation ( $R^2$  0.725) between WI and milk production. The meta-analysis results were then compared to on-farm measurements. Fresh water and waste water data from 11 freestall (FS) and 12 dry lot (DL) Kansas dairies were collected over a 9-year period (2000-2008). Fresh water usage was recorded from water pumping records. Data were first summarized annually by operation and then converted to a per cow per day basis prior to analysis. Data were then analyzed by using the proc mixed procedures of SAS. Fixed effects included in the model were dairy type (FS or DL) and year was considered a random effect. The DL dairies

averaged 186 L/cow/day and were lower ( $P < 0.05$ ) than the FS dairies which averaged 237 L/cow/day. Differences between DL and FS dairies may have been due to differences in waste management or cow cooling systems. Estimated drinking water accounted for 70% of the total water usage on DL dairies and 55% on FS dairies. Based on this data facility type may influence total water usage in dairy facilities.

**Key Words:** water intake, facilities, meta-analysis

**W331 Dietary CP and tannin extracts impact ammonia emissions from manure deposited on dairy barn floors.** J. M. Powell<sup>1</sup>, M. J. Aguerre\*<sup>2</sup>, and M. A. Wattiaux<sup>2</sup>, <sup>1</sup>*US Dairy Forage Research Center, Madison, WI*, <sup>2</sup>*University of Wisconsin, Madison.*

The impact of dietary CP and Quebracho-Chestnut tannin extracts on dairy cow performance and N partitioning are reported elsewhere at this meeting. Mixtures of feces/urine from these studies were applied to lab-scale ventilated chambers to measure ammonia-N emissions (ANE) from simulated concrete barn floors. Feces and urine were collected separately from lactating Holstein cows fed 2 levels of dietary CP (%DM): low protein, LP=15.5 and high protein, HP=16.8; each at 4 levels (%DM) of dietary tannin: T1=0, T2=0.45, T3=0.90 and T4=1.80. Feces and urine having a total weight of 16g were mixed in their excreted mass ratios (g/g) and applied to chambers. ANE were measured 1, 3, 6, 12, 24, 36 and 48h after application. Although patterns of ANE were similar over time, the 48h cumulative ANE (CANE, mg) was lower ( $P < 0.05$ ) for manure from the LP diets (12.1) than from the HP diets (24.7). As a percent of total N (%TN) and urinary N (%UN) applied, losses from the LP diets (16.9 and 46.2) were lower than from the HP diets (27.7 and 56.3). Tannins impacted CANE, %TN and %UN for both the LP and HP diets. For the LP diets, the non-tannin ration (T1) had CANE, %TN and %UN of 14.6, 19.6 and 48.0, respectively vs. 11.2, 16.1 and 45.7, respectively for the tannin-containing rations (average of T2, T3 and T4). Results were similar for the HP diets, except for %UN. Average CANE and %TN for manure from the HP non-tannin ration were 27.5 and 29.1, respectively vs. 23.7 and 27.2 for the HP tannin-containing rations. %UN was lower however for manure from the HP non-tannin ration (52.4) compared to the HP tannin-containing rations (57.5). These differences were likely due to overall higher excretions of urinary N by cows fed HP diets, and therefore higher amounts of urine N applied. For the LP diets, lowest CANE, %TN and %UN occurred at T2 and T4. For the HP diets, lowest CANE, %TN also occurred at T2 and T4, but %UN was lowest at T1 and T2 due to reasons mentioned above. The addition of tannin extracts to dairy rations can reduce ammonia emissions from dairy barns, but relative reductions depend on the amount of CP fed and therefore urinary N excretion.

**Key Words:** tannins, CP, ammonia emissions

**W332 Emissions from a dairy waste management system in south-central Idaho.** M. E. de Haro Martí\*<sup>1</sup>, R. E. Sheffield<sup>2</sup>, and M. Chahine<sup>3</sup>, <sup>1</sup>*University of Idaho, Gooding*, <sup>2</sup>*Louisiana State University, Baton Rouge*, <sup>3</sup>*University of Idaho, Twin Falls.*

This study evaluated the concentrations and emission rates of ammonia and hydrogen sulfide from a wastewater storage pond, manure processing area, and composting area from a 5,000 cow freestall scrape dairy located in south-central Idaho over a six months period. Pollutant concentrations were measured using an Ultraviolet Differential Optical Absorbance Spectrometer and emission rates were calculated using backward Lagrangian modeling via the WindTrax model. Measurements were collected continuously at a final 15-minute integration time. Average summertime concentrations adjacent to a 9.8-ha wastewater

storage pond were found to be 556.3 ppb for ammonia and 33.4 ppb for hydrogen sulfide, with emission rates averaging 28.5  $\mu\text{g}/\text{m}^2/\text{s}$  and 4.3  $\mu\text{g}/\text{m}^2/\text{s}$ , respectively. During the cold period, concentrations were found to average 366.3 ppb for ammonia and 310 ppb for hydrogen sulfide, with emission rates averaging 18.4  $\mu\text{g}/\text{m}^2/\text{s}$  and 41.5  $\mu\text{g}/\text{m}^2/\text{s}$ , respectively. Average concentrations downwind of a 13.3 hectare composting area during the warm period were found to be 472.2 ppb for ammonia and 83.1 ppb for hydrogen sulfide, with average emission rates of 33.4  $\mu\text{g}/$

$\text{m}^2/\text{s}$  and 15.9  $\mu\text{g}/\text{m}^2/\text{s}$ , respectively. During the cold season, average downwind concentrations were 270.7 ppb for ammonia and 461.7 ppb for hydrogen sulfide, and emission rates averaged 17.3  $\mu\text{g}/\text{m}^2/\text{s}$  and 81.6  $\mu\text{g}/\text{m}^2/\text{s}$ , respectively. Significant seasonal variability in both concentrations and emission rates of all pollutants were observed between warm and cold periods.

**Key Words:** ammonia, hydrogen sulfide, emissions