

## Environment and Management Posters

**436 The effect of cage design on feed efficiency and egg weight of white leghorn hens: An epidemiological study.** P. Y. Hester<sup>\*1</sup>, A. S. Kiess<sup>2</sup>, J. A. Mench<sup>3</sup>, R. C. Newberry<sup>4</sup>, and J. P. Garner<sup>1</sup>, <sup>1</sup>*Purdue University, W. Lafayette, IN*, <sup>2</sup>*Mississippi State University, Mississippi State, MS*, <sup>3</sup>*University of California at Davis, Davis*, <sup>4</sup>*Washington State University, Pullman*.

The influences of cage design features, including feeder design and space, cage depth, cage area, stocking density, and the placement of resources, on production parameters of White Leghorns have not been fully assessed under commercial conditions. Assessing all these variables in a traditional experimental study would be difficult. An epidemiological approach, using variability in cage design among producers, is a useful tool to assess the impact of a multitude of variables on hen productivity. The objective of the current study was to identify aspects of cage design that affect feed efficiency and egg weight. A universal cage measurement system and an industry survey were developed. Out of 179 houses visited, a total of 167 yielded data suitable for analysis. Feed efficiency and egg weight outcomes were assessed from placement to 60 wk of age. Using GLM, a statistical model was identified that best described the variance in feed efficiency and egg weight. The analysis explicitly controlled for the effects of all other variables to avoid confounding effects. Among producers, the model explained 56% and 67% of the variation in feed efficiency and egg weight, respectively. Feed efficiency was not affected by cage or feeder design. Variation in feed efficiency among producers was small. Feed efficiency improved as caloric content of the feed increased up to 196 kcal/hen per d after which feed efficiency decreased with increasing caloric content. Egg weight was greater in A-frame houses where manure was removed regularly instead of being left in the house; with increasing cage floor slope; in cages where drinkers were placed either toward the front or the back of the cage rather than the middle; with more space per hen; and with feed with higher caloric intake. Perhaps because of its strong negative correlation with egg production, egg weight increased with less feeder space allocation and with shorter cage heights. These results show that cage design did not affect feed efficiency, but egg weight was influenced by several factors.

**Key Words:** cage design, egg weight, feed efficiency, White Leghorn, epidemiology

**437 The effect of cage design on egg production of white leghorn hens: An epidemiological study.** A. S. Kiess<sup>\*1</sup>, P. Y. Hester<sup>2</sup>, J. A. Mench<sup>3</sup>, R. C. Newberry<sup>4</sup>, and J. P. Garner<sup>2</sup>, <sup>1</sup>*Mississippi State University, Mississippi State, MS*, <sup>2</sup>*Purdue University, Lafayette, IN*, <sup>3</sup>*University of California at Davis, Davis*, <sup>4</sup>*Washington State University, Pullman*.

The influence of critical aspects of cage design, such as cage height and shape, on hen productivity has not been fully assessed in the commercial systems commonly used in the US. Different aspects of cage design may interact in critical ways and assessing all of these variables in a traditional experiment would be impossible. Therefore, an epidemiological approach was used to examine the impact of a multitude of cage design variables on hen productivity, to identify features of cage design that optimize egg production. A survey was developed in consultation with industry. A total of 179 houses were visited, and egg production outcomes for each house were assessed from placement to 60 wk of age. Out of the 179 houses visited, 167 were used for the analysis. Using GLM, a statistical model was identified that best

described, the variance in egg production of white egg laying strains. The analysis explicitly controlled for the effects of all other variables to avoid confounding effects. Among producers, the model explained 60% of the variation in hen-housed egg production. Eggs/hen housed increased with more feeder space allocation, with maximum egg production noted at 10.7 cm (4.2 in) of feeder space/hen ( $P = 0.031$ ). Taller cages ( $P = 0.029$ ), rear (vs front) drinker location ( $P = 0.026$ ), and regular removal of manure from the house ( $P = 0.005$ ) were associated with increased eggs/hen housed. These results indicate that cage design features such as feeder space, cage height, position of the drinkers, and waste management systems affect egg production under commercial conditions.

**Key Words:** cage design, egg production, white leghorn, epidemiology, well-being

**438 Effect of daily and skipped organic acid oral regimens on final weight of Broiler chickens.** G. Guzman<sup>\*1,2</sup> and A. Garcia<sup>1</sup>, <sup>1</sup>*Viator, Guadalajara, Jal. Mexico*, <sup>2</sup>*Universidad de Guadalajara, Zapopan, Jal., Mexico*.

Purpose: To analyze the effect of 2 organic acid oral regimens, daily and skipped, and 3 doses with 2 commercial formulations on broiler final weight. Experimental design: Multifactorial  $2 \times 3$  experimental design, six experimental groups (A to F) with two replicates of 15,000 Ross male chicks each, were treated with two different organic acid oral formulations. Controlled factors were the oral regimen and the oral doses, while dependent variable measured was chick weight at 49 days old. The doses were 0.3 ml/L, 0.5 ml/L and 1 ml/L, and the regimens were daily for 49 days and skipped in each diet change for three days (starter, growth and finisher). Groups A, B and C were treated with a product of anonymous provider (product A), consisting of 33% formic, acetic, citric, picric and glutamic acid plus copper and zinc. Regimen and dose of group A was 0.5 ml/L of product A daily, group B 0.3 ml/L of product A daily and group C 1 ml/L of product A skipped. Groups D, E, and F were treated with Spacid, a product provided by Viator (product B), consisting of 40% acetic and citric acid. Regimen and dose of group D was 1 ml/L of product B skipped, group E 0.3 ml/L of product B daily and group F 0.5 ml/L of product B daily. Chick's weights were obtained at 49 days old and statistically compared among groups. Group D (1ml/Lt skipped) was statistically different ( $P < 0.05$ ) of the rest of the groups, while groups A, B, C and F were different to group E. Poultry weights at 49 days old in decreased order were for group D 3,064 Kg, group C 2,803 Kg, group F 2,725 kg, group A 2,631 Kg, group B 2,552 Kg and group E 2,549 Kg. Group C and D (skipped oral regimen) were different between them, therefore the effect of skipped regimen could be product dependent. Organic acid skipped oral regimens should be considered in contrast to daily regimens. Each organic acid commercial product should be evaluated previously to avoid ineffective regimens and doses, because of the effect of differences in product formulations.

**Key Words:** acid, broiler, growth, citric, acetic

**439 Durability testing of incandescent, cold cathode, compact fluorescent and LED lamps under poultry conditions.** E. Benson<sup>\*</sup>, D. Hougantogler, J. McGurk, E. Herrman, and R. Alphin, *University of Delaware, Newark*.

As part of the Energy Independence and Security Act (2007), general purpose incandescent lamps in many common sizes are being phased out by 2012 – 2014. For the poultry industry, this will result in replacement of the primary lighting technology. Three practical alternatives include cold cathode (CCFL), compact fluorescent (CFL), and LED lamps. A durability test was conducted to evaluate the use of the lights in a poultry environment. A 16 chamber light apparatus was constructed and placed in a layer house to evaluate 4 lamps each for 4 lighting technologies (incandescent, CCFL, CFL, LED). Each light was cycled in a 15 min On and 45 min Off pattern 16 times per day. Illumination sensors with a vacuum based clearing system were used to record light output. Every 2 weeks, each bulb was removed, cleaned, an intensity pattern developed, and returned to the lighting apparatus. Incandescent lamps failed at 2176 h (136 d), 2500 h (150 d), 2624 h (164 d), and 3520 h (220 d). One CCFL lamp failed at 4640 h (290 d), well less than the typical 10,000 to 25,000 h expected. Two CFL lamps failed at 2400 h (150 d) and 3296 h (206 d), again, well before the 10,000 h lifespan expected. No LED lamps failed during testing. Incandescent lamps decreased in intensity an average 30% over the lifespan of the lamp. CCFL lamps decreased an average of 28% over the duration of the trial. CFL lamps decreased at an average of 49% with 2 lamps having over a 60% decrease in illumination during the trial. LED lamps decreased an average of 47%, with significant lamp to lamp decreases in intensity. Two of the 4 lamp technologies failed outside the expected range and all 4 technologies had material lumen depreciation during the test.

**Key Words:** lighting, LED, cold cathode, compact fluorescent, incandescent

**440 The impact of peat moss amendments on the microbial load in used pine shavings poultry litter.** D. L. Everett<sup>\*1</sup>, Y. Vizzier-Thaxton<sup>2</sup>, C. D. McDaniel<sup>1</sup>, and A. S. Kiess<sup>1</sup>, <sup>1</sup>Mississippi State University, Mississippi State, MS, <sup>2</sup>University of Arkansas, Center for Animal Well-being, Fayetteville.

In addition to pine shavings, alternative litter sources for poultry bedding include sand, pine straw, or even peat moss. Peat moss has a high absorptive capacity and is naturally acidic, possibly making it a potentially good poultry litter amendment. The objective of this study was to determine if microbial populations changed when different levels of peat moss were added to poultry litter. Experimental treatments included 0%, 13% and 20% peat moss, which were added to used pine shaving. A total of 216 broilers (42 d) were separated into 18 pens (6 pens/3 treatment). Control litter samples (100 g) were collected before the addition of peat moss and birds (0 d); then litter samples from each pen were collected weekly thereafter for 3 wk. From each litter sample, 10 g was diluted in 90 mL of Buttersfields Phosphate, and then serially diluted. For tryptic soy agar, MacConkey agar, and Sabouraud Dextrose agar, 100  $\mu$ L were plated in duplicate to detect aerobic bacteria, total coliforms, and yeasts/molds, respectively. Plates were incubated aerobically for 24 h at 37°C and then counted. Data was analyzed using a randomized complete block design with a split plot over weeks. An interaction between week and peat moss treatment ( $P = 0.028$ ) indicated that during Week 1 pine shavings alone contained fewer coliforms and yeast/molds (3.54 mean log cfu/g vs 4.7 mean log cfu/g for coliforms, respectively; 4.68 mean log cfu/g vs 5.55 mean log cfu/g for yeasts/molds, respectively). However, by wk 2 peat moss treatments yielded less coliforms and yeast/molds than that of used pine shavings (3.75 mean log cfu/g vs 4.97 mean log cfu/g for coliforms, respectively; 4.08 mean log cfu/g vs. 4.81 mean log cfu/g for yeasts/molds, respectively). In conclusion, the data demonstrates

that the addition of peat moss may be a useful amendment for reducing bacteria, yeasts, and molds in poultry litter. Overall, future studies should test the absorptive capacity of peat moss for trapping ammonia and changing the litter pH, which could demonstrate how peat moss is actually reducing bacteria and yeast/mold growth in poultry litter.

**Key Words:** litter, peat moss, pine shaving, microflora, litter amendment

**441 Hematology and serum metabolites profile of egg-type chickens in different intensive housing systems in humid tropics.** O. M. Alabi<sup>\*1</sup>, D. O. Adejumo<sup>2,1</sup>, and A. O. Ladokun<sup>3</sup>, <sup>1</sup>Bowen University, Iwo, Osun state, Nigeria, <sup>2</sup>University of Ibadan, Ibadan, Oyo state, Nigeria, <sup>3</sup>University of Agriculture, Abeokuta, Ogun state, Nigeria.

Chickens meant for commercial table egg production are usually confined inside battery cages or deep litter for maximum productivity, automation of devices, and ease of handling. However, housing egg-type chickens inside battery cages is receiving strong opposition from a welfare point of view and there has been a shift to alternative housing systems. Blood parameters of 2 strains of commercial egg-type chickens housed on 3 different intensive housing systems were investigated. 108 17-week-old Super Black and 108 17-week-old Super Brown hens were randomly allotted to 3 intensive housing systems of Partitioned Battery Cage (conventional and control), Extended Battery Cage and Deep Litter System in a randomized complete block design with 36 hens per housing system each with 3 replicates. The experiment lasted 37 weeks. Hematological parameters measured were packed cell volume, hemoglobin concentration, red blood cells, and white blood cells. Serum metabolites measured were total protein, albumin, uric acid, cholesterol, glucose, bilirubin, and creatinine. All hematological parameters and serum metabolites investigated were not significantly ( $P > 0.05$ ) affected by the housing system and strain. Adoption of housing systems other than battery cages will not negatively affect the blood parameters and health status of egg-type chickens in humid tropics.

**Key Words:** blood parameters, housing systems, layers, strain

**442 Evaluation of feeding spray-dried bovine plasma protein on production performance of laying hens exposed to acute heat stress temperature.** S. A. dePersio<sup>\*1</sup>, K. W. Koelkebeck<sup>1</sup>, J.M. Campbell<sup>2</sup>, K. Lima<sup>1</sup>, P. C. Harrison<sup>1</sup>, C. W. Utterback<sup>1</sup>, P. L. Utterback<sup>1</sup>, A. Green<sup>1</sup>, and R. Gates<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, <sup>2</sup>APC Inc., Ankeny, IA.

An experiment was conducted to evaluate feeding 2 levels of bovine spray-dried plasma protein on production performance of laying hens subjected to acute heat stress (HS). Two groups of 96 Hy-Line W-98 hens (38 wk of age) were housed in each of 2 environmentally-controlled chambers (529 cm<sup>2</sup>/hen, 4 hens per cage). All hens were fed a 16% CP layer mash with water provided. At 40 wk of age, all hens were then fed 3 treatment diets consisting of 1) a control diet (0% plasma); 2) the control diet supplemented with 0.75% plasma; and 3) the control diet supplemented with 1.50% plasma. Thus, 8 replicate cages per chamber were fed one of each diet (64 hens per diet) for 5 wk (40 to 44 wk of age). The HS chamber was maintained at 21°C (wk 1); 29°C (wk 2); and 35°C (wk 3 to 5), while the thermoneutral chamber (TN) was maintained at 21°C from wk 1 to 5. There was a significant decrease in egg production by wk 4 and 5 for hens exposed to 35°C. A significant environment by diet interaction occurred during wk 5, in

which production was not different between hens fed the 1.5% plasma in either chamber. Heat stress caused a reduction in egg weights for hens fed all diets during wk 3 to 5. Egg mass was reduced for hens exposed to HS during wk 4 and 5. There was a numerical trend for hens fed the 1.5% plasma diet in the HS chamber to produce more egg mass than those fed the 0.75% plasma or control diet. Hens exposed to the HS temperature consumed less feed than those in the TN chamber regardless of diet during wk 3 to 5. However, feed efficiency was greater for hens exposed to HS during wk 3 and 4 vs. those in the TN chamber. The overall results indicate that HS negatively effects short-term production, and supplementation of a control diet with 1.5% bovine plasma protein may positively affect performance during short-term HS exposure.

**Key Words:** laying hens, spray-dried bovine plasma, heat stress

**443 Variations in preenrichment pH of poultry feed and feed ingredients after incubation periods up to 48 hours.** N. A. Cox<sup>\*1</sup>, R. J. Buhr<sup>1</sup>, J. A. Cason<sup>1</sup>, K. E. Richardson<sup>2</sup>, L. J. Richardson<sup>3</sup>, L. L. Rigsby<sup>1</sup>, and P. J. Fedorka-Cray<sup>1</sup>, <sup>1</sup>USDA/ARS Russell Research Center, Athens, GA, <sup>2</sup>Anitox Corp., Atlanta, GA, <sup>3</sup>The Coca-Cola Company, Atlanta, GA.

Human salmonellosis outbreaks have been linked to contaminated animal feed. The literature indicates that *Salmonella* sustains acid injury at about pH 4.0, so we determined the pH of various preenrichment media during incubation of feed and feed ingredient samples. Five poultry finished feeds were individually added to 45 mL of 4 different preenrichment broths: buffered peptone water (BPW), lactose broth (LB), minimal salts medium (M-9) and universal preenrichment (UP) and incubated at 37°C for 18, 24, and 48 h. In addition to the finished feeds, ground feed ingredients were tested following the protocol for finished feeds. After each incubation period the pH was determined using a calibrated (at pH 4 and 7) pH meter and the entire experiment was replicated 3 times with very little variation among reps. With finished feeds, longer incubation time did not alter pH greatly, although a slightly lower pH was observed at 48h compared to 18h and 24h. With the broiler, broiler breeder and layer feeds, the pH ranged from 3.9 - 4.7 with all the media except UP. For UP the range was 4.7 - 5.3. Overall the lowest pH values were with LB and BPW broths with the lowest pH values of 3.9 with LB for broiler breeder feed. The pH's were slightly higher for turkey grower and turkey breeder feeds ranging from 4.4 - 5.5. With feed ingredients, a similar pattern was observed with LB and BPW producing the lowest pH's with ground corn (3.7 - 4.7), wheat middlings (3.8 - 4.2), DDG (3.8 - 4.1), sorghum (3.9 - 4.5) and soybean meals (4.4 - 4.6); moderate to slight drop in pH with fish meal, beef or pork meal and bone meal, poultry byproduct and canola meals. Overall, UP and M-9 broths were more resistant to a drop in pH than LB and BPW broths. Low pH can impair ability of the organism to metabolize certain biochemicals that are critical in the identification process for this organism. If this injury and lack of biochemical utilization is occurring during the analysis of feed, *Salmonella* may be present within the sample and go undetected.

**Key Words:** acid, feed, feed ingredients, preenrichment media, pH

**444 National Air Quality Site Assessment Tool for poultry and livestock producers.** C. W. Ritz<sup>\*1</sup>, D. M. Karcher<sup>2</sup>, C. R. Angel<sup>3</sup>, T. J. Applegate<sup>4</sup>, and B. D. Fairchild<sup>1</sup>, <sup>1</sup>University of Georgia, Athens, <sup>2</sup>Michigan State University, East Lansing, <sup>3</sup>University of Maryland, College Park, <sup>4</sup>Purdue University, West Lafayette, IN.

The National Air Quality Site Assessment Tool (NAQSAT) was developed to assist poultry and livestock producers in determining the areas of their operations where opportunities exist to make changes resulting in reduced air emissions. NAQSAT is appropriate for all livestock species and has been designed in cooperation with more than 20 university professionals and 15 partnering agencies to be applicable across the diversity of enterprises. The tool provides a free, voluntary, non-threatening, on-line, user friendly format. When used in concert with consultants, NRCS personnel and published emission mitigation resources, livestock and poultry producers will identify air emissions challenges and make appropriate decisions for mitigation strategies to best improve air quality from all aspects of their production systems. The on-line tool addresses 8 constituents of concern that relate to air emissions: animals and housing, feed and water, collection and transfer of manure, manure storage, land application, mortality, on-farm records and public perception. Use of the tool estimates the degree to which current management has incorporated practices to manage air emission given the current understanding of how production practices impact emissions and the opportunity for additional changes to mitigate air emissions. The tool provides the opportunity to run scenarios with proposed changes to determine the impact a new practice would have on emissions. The NAQSAT assessment tool evaluates management practices and control technologies that are in place or under consideration relative to the potential for managing emissions from the given facility and associated infrastructure. The tool is unique in that multiple gaseous emissions, including odor, particulates, hydrogen sulfide, ammonia, methane, and VOCs will be considered during a single assessment. The tool does not provide emissions data or regulatory guidance; rather it is designed to provide producers with opportunities to make on-farm changes to reduce air emissions. The tool is now archived at: <http://naqsat.tamu.edu/>

**Key Words:** air quality, assessment, poultry, ammonia

**445 Effect of environmental and drinking water sanitation on respiratory post-vaccine mortality of broiler chickens.** G. Guzman<sup>\*1,2</sup> and A. Garcia<sup>1</sup>, <sup>1</sup>Viator, Guadalajara, Jal., Mexico, <sup>2</sup>Universidad de Guadalajara, Zapopan, Jal., Mexico.

**Purpose:** To analyze the effect of environmental sanitation of air and drinking water during 14 d post-vaccine chick mortality vaccinated with attenuated Newcastle disease and Infectious Bronchitis virus. Unifactorial experimental design conformed of four experimental groups, one treated with benzalkonium chloride, other with citric extract and two untreated. All groups had two replicates of 18,000 Ross chicks each. The variable dependent was the post-vaccine chick mortality during 14 days (10 days old to 24 days old). The trial started on middle March (spring season). Group A was treated with commercial product Biodda provided by Viator with 400 ppm of benzalkonium chloride sprayed in the air twice daily and 25 ppm in the drinking water for 14 days post-vaccine. Group B was treated with 1,000 ppm of commercial citric extract sprayed in the air twice daily and 40 ppm in the drinking water for 14 days post-vaccine. Group C and group D were untreated control groups. All groups were vaccinated with commercial attenuated Newcastle disease virus and Infectious Bronchitis disease virus at nine days old, and medicated three days post-vaccine with thiamphenicol and bromhexine. The post-vaccine mortality was measured 14 days, from 10 days old to 24 days old. To analyze the post-vaccine mortality by respiratory causes, all death birds were evaluated by necropsy, seeking serosal tracheitis with fibrillar mucus accumulation in the trachea bifurcation. Group A (benzalkonium chloride) had effect on post-vaccine mortality ( $P < 0.05$ ) while Group B (citric extract) had

not. Post-vaccine mortality results in increasing order were for group A 1.2% ( $\pm$  0.2%), group D 4.5% ( $\pm$  0.8%), group C 7.7% ( $\pm$  0.4%) and group B 8.3% ( $\pm$  0.6%). Environmental sanitation for the reduction of post-vaccine mortality during broiler production may be considered in contrast with or without the use of antibiotics in the preventive medicine program.

**Key Words:** respiratory, environmental, quaternary ammonium compound, sanitizing, citric extract

**446 The role of an early paratyphoid *Salmonella* infection in a necrotic enteritis challenge model in broilers.** S. Shivaramaiah<sup>\*1</sup>, J. R. Barta<sup>2</sup>, M. J. Morgan<sup>1</sup>, R. E. Wolfenden<sup>1</sup>, B. M. Hargis<sup>1</sup>, and G. Téllez<sup>1</sup>, <sup>1</sup>University of Arkansas, Fayetteville, <sup>2</sup>University of Guelph, Guelph, ON, Canada.

Necrotic enteritis (NE) caused by *Clostridium perfringens* (CP) is an economically important disease in poultry. An *Eimeria* infection is considered as an absolute pre-requisite to cause NE. Preliminary data from our studies have indicated that a *Salmonella typhimurium* (ST) infection early in age followed by an *Eimeria maxima* (EM) and CP challenge accentuates clinical signs of NE. In these experiments, we investigated whether an early *Salmonella enteritidis* (SE) infection would cause the same effect as that of an early ST infection. Day-old broiler chicks (n = 25/trt) were randomly allocated to treatment groups and  $1 \times 10^7$  cfu of either SE or ST was administered at hatch. EM and CP challenge was performed at d 18 and 22–23 respectively. Body weight was recorded before EM challenge and at termination to determine weight gain. In addition, total mortality and lesion scores were evaluated. Data were analyzed using GLM procedure of SAS. Mortality and lesion scores were higher while weight gain was lower ( $P < 0.05$ ) in chicks challenged with ST as compared with those challenged with SE or controls. These preliminary studies indicate distinct differences in the ability of different paratyphoid *Salmonella* to accentuate NE. Further studies will evaluate possible reasons associated with these observations.

**Key Words:** *Salmonella*, *Eimeria*, necrotic enteritis, paratyphoid, *Clostridium*

**447 Evaluation of a lignite-coal water additive designed to reduce ammonia emissions on broiler performance, carcass attributes, selected welfare measures and ammonia emissions.** C. Bench<sup>1</sup>, B. Chmilar<sup>1</sup>, M. Oryschak<sup>2</sup>, and D. Korver<sup>\*1</sup>, <sup>1</sup>University of Alberta, Edmonton, AB, Canada, <sup>2</sup>Alberta Agriculture and Rural Development, Edmonton, AB, Canada.

A 35-d trial was conducted to determine the effect of a commercially-available lignite-coal water additive on ammonia gas emissions from broilers reared on softwood shavings. At 1 d of age, Ross 308 broiler chicks (n = 2000) were divided equally among 8 test rooms controlled for humidity, ventilation and temperature. Each test room received either untreated water (CON) or water containing the lignite-coal additive (LIGN) through nipple drinkers for the 35-d trial in a randomized complete block design with 4 replicate rooms per treatment. Water consumption, ADFI, ADG, and G:F ratios were determined for each growth phase. Ammonia emission rate at 5 sites within each test room was determined using a static chamber system on d 27 and 34. Litter samples corresponding to each ammonia measurement site in each pen on d 27 and 34 were collected and analyzed for chemical composition. Birds were scored for respiratory distress on d 27 and 34. On d 35, 36 broilers were randomly selected from each test room and slaugh-

tered to determine carcass attributes. Feet from slaughtered birds were scored for foot pad lesions. No differences in ammonia emissions or litter composition were detected between CON and LIGN treatments, though significant differences were observed between sampling sites and sampling days. Overall water consumption, ADG, ADFI, G:F were not different between CON and LIGN groups. No significant differences due to treatment were observed for carcass weight, yield of carcass components, mortality, cull rates, respiratory distress scores or foot pad lesion scores. In conclusion, the LIGN additive did not reduce ammonia emission rates for broilers raised on litter to 35 d, but also did not appear to adversely impact broiler performance, carcass attributes or selected measures of bird welfare.

**Key Words:** ammonia, broilers, carcass, water supplement, footpad lesions

**448 Evaluation of a fermented rice/soy product on broiler performance, litter characteristics, ammonia and odorant volatilization when applied to used broiler litter.** M. P. Williams<sup>\*1</sup>, C. Coufal<sup>1</sup>, E. Caraway<sup>2</sup>, R. Carpenter<sup>3</sup>, I. Smith<sup>3</sup>, and J. T. Lee<sup>1</sup>, <sup>1</sup>Poultry Science Department, AgriLife Research, Texas A&M Systems, College Station, <sup>2</sup>Olfactory Laboratory, West Texas A&M University, Canyon, <sup>3</sup>BiOWiSH Technologies, Chicago, IL.

A study was conducted to evaluate the use of a fermented rice/soy product (BiOWiSH-Aqua) applied to used broiler litter and the observed effect on broiler performance, ammonia and odorant volatilization, caked litter weight, litter moisture, and litter pH. The study consisted of 2 experimental treatments (control vs. treated) with each treatment consisting of 6 replicate pens containing 135 d old broilers per pen at a placement density of 0.8 sq. ft./bird for a 46 d grow out. The fermented rice/soy product was activated for a 12 h period before litter application and was applied to the litter 48 h before chick placement. The activation process consisted of dilution of 2 kg of product into 60 gallons of water with aeration. The activated solution was applied at a rate of 22.7 mLs/sq. ft. Used litter (6 previous flocks) was acquired and placed in all pens at a depth of 12 cm at the initiation of the study. Body weights and feed consumptions were determined on d 1, 14, and 46 of age and daily mortality was recorded. Litter samples were collected before litter treatment, at chick placement, and on a weekly basis throughout the experiment. Litter odor volatiles were sampled using a dynamic flux chamber placed directly on the litter between the feed and water lines on d 14 and 28. No differences were observed in body weight, feed conversion ratio, feed consumption, litter moisture and pH, cake weight, or ammonia and odorant volatilization.; however, a significant decrease ( $P < 0.05$ ) in mortality was observed throughout the trial in broilers reared on litter treated with the fermented rice/soy product as compared with the control pens. The data indicate that application of BiOWiSH-Aqua may increase broiler flock livability.

**Key Words:** litter, broiler, ammonia, performance, odor

**449 Tomato pomace as an ingredient in diets of laying hens.** A. J. King<sup>\*</sup> and J. K. Griffin, University of California, Davis.

In California, where over 90% of the processed tomatoes in the U.S. are produced, there is an abundance of the inexpensive agricultural by-product, tomato pomace (TP), containing cores, culls, trimmings, seeds, peels, liquor and unprocessed green tomatoes picked by harvest machinery. Although used to a limited extent in diets of animals and livestock, many tons of TP are added to landfills yearly. While high in fiber, TP contains  $\alpha$ -tocopherol,  $\beta$ -carotene, lutein and lyco-

pene. Though fiber content limits the quantity of TP that can be fed to layers, it is important to determine how much can be substituted for more costly commercial diets during a limited amount of time without detrimental effects as previously observed. Invert sugar (IS), another agricultural by-product, is produced in many parts of the world from refining of commercial white sugar. It has been suggested that IS could be added to diets of layers to enhance palatability when TP is also an ingredient. Two experiments were conducted to evaluate the use of TP and IS in layer diets. In Experiment 1, hens received course meal diets containing 100% Layena (a commercial feed source, L), 90% L + 10% TP (L90TP) or 80% L + 10% TP + 10% IS (L80TPIS) for two weeks. In Experiment 2, diets from Experiment 1 were fed as pellets for the same period. Weight gain, feed consumption, egg (520) production, egg shell thickness and egg yolk color were measured. Results of Experiment 1 showed no effect of diet on any measurements except for egg color, scored as orange for all hens receiving TP as compared to yellow for hens fed L alone. Visual observations revealed a slight increase in diarrhea for hens fed TP and a preference for IS particles for hens fed L80TPIS. In Experiment 2, diarrhea was observed for hens fed TP and egg yolk color scores were similar to those from Experiment 1. No selective feeding was observed. Overall, results suggested that up to 20% of commercial layer hen diets could be substituted with abundant and inexpensive TP and IS without detrimental effects on the selected measurements and to change the color of egg yolk. It seems that, where abundant, these two ingredients could be used to offset the cost of feed substantially.

**Key Words:** tomato pomace, invert sugar, laying hens, weight gain, yolk color

**450 Effects of mycotoxin contaminated diets on early performance in replacement layer pullets.** S. Iselt\*<sup>1</sup>, J. Lee<sup>1</sup>, M. Farnell<sup>1</sup>, M. Williams<sup>1</sup>, M. Ross<sup>1</sup>, K. Stringfellow<sup>1</sup>, S. Anderson<sup>1</sup>, U. Hofstetter<sup>2</sup>, R. Beltran<sup>2</sup>, G. Schatzmayr<sup>2</sup>, and D. Caldwell<sup>1</sup>, <sup>1</sup>*Poultry Science Department, Texas A&M University, College Station*, <sup>2</sup>*Biomim GmbH, Herzogenburg, Austria*.

Compared with broilers, fewer studies in recent years have focused upon the negative impact of mycotoxin consumption in replacement layer stock. The objective of the current trial was to evaluate layer pullet body weight when fed diets contaminated with deoxyvinalenol (DON) and aflatoxin B1 (AFLA) with or without the inclusion of a mycotoxin deactivating compound (Mycofix Select) during rearing in floor pens. On day of hatch, Lohmann LSL-LITE female chicks were obtained from a local commercial hatchery and transported to our research facility for randomization and placement. Toxin levels in diets were separated into low (1.0 ppm DON + 1.0 ppm AFLA) or high (2.0 ppm DON + 2.0 ppm AFLA) experimental groups. Chicks in low or high toxin administration groups began receiving contaminated diets at placement. Body weights between 2 and 5 weeks of age were reduced ( $P < 0.05$ ) in high, but not low ( $P > 0.05$ ) toxin groups. At 5 weeks of age a subset ( $n = 8$ ) of pullets from each group was subjected to necropsy to determine relative liver, kidney, bursa, spleen, and thymus weights. Relative liver weights were increased ( $P < 0.05$ ) in high, but not low ( $P > 0.05$ ) toxin groups. Regarding mycotoxin deactivating compound inclusion, an interaction was detected with 3 and 4 week body weights as improved body weight ( $P < 0.05$ ) was observed in the non-toxin administered group. Additional measurements to be obtained from this trial include parameters of histopathology and immune status. These data suggest that early replacement layer pullet body weight and relative liver weight were negatively impacted by

high level (2.0 ppm DON + 2.0 ppm AFLA), but not low level (1.0 ppm DON + 1.0 ppm AFLA) experimental mycotoxin challenge.

**Key Words:** mycotoxins, layers, deoxyvinalenol, aflatoxin, performance

**451 Initial life cycle assessment for conventional broiler production on the farm: Carbon footprint.** E. J. Van Loo\*<sup>1,3</sup>, E. G. Killeen<sup>2</sup>, S. C. Ricke<sup>1</sup>, and G. J. Thoma<sup>2</sup>, <sup>1</sup>*Department of Food Science and Center for Food Safety, University of Arkansas, Fayetteville*, <sup>2</sup>*Ralph E. Martin Department of Chemical Engineering, University of Arkansas, Fayetteville*, <sup>3</sup>*New Organic Solutions, Fayetteville, AR*.

In recent years, the popularity of sustainable food production has grown tremendously. Sustainability has become a mainstream value to current shareholders and is a key factor in product branding. Green consumerism is an influential driver of innovation and product change in the food sector. Manufacturers, retailers and importers are seeing an increasing number of requests for verifiable data on their product's environmental performance. The US has an enormous poultry production sector: 35.5 billion lbs in 2009, valued at \$21.8 billion. Sustainability of the US poultry industry is vital to maintain a secure food supply and to preserve hundreds of rural economies in many states. To identify the environmental impact of poultry production, we conducted a high level life cycle assessment (LCA) of the conventional poultry production supply chain including feed/grain production and feed processing and live bird production. The first goal of this LCA was to evaluate the carbon footprint (CF) of poultry production. The CF refers to the cumulative greenhouse gas (GHG) emissions, expressed as CO<sub>2</sub> equivalents emitted to the atmosphere resulting from these activities. Our model was based on LC Inventory data from literature and assumptions made for a few unknown parameters. The production of one live weight chicken (6 lbs) at farm gate is responsible for 2.39 kg CO<sub>2</sub> eq distributed among feed (71%), energy (20%) and manure management methane emissions (9%). With this model established, more data can be collected from farms and processors to improve our estimates. With an improved model, we can identify points where innovation can lead to a reduction in the consumption of fossil fuel, and where potential for reduction of GHG emissions exists. In conclusion, our initial estimates indicate that LCA is an effective tool to evaluate the sustainability of the poultry production and holds the promise of identifying inefficiencies in the system which can be addressed to foster the long-term health of the industry.

**Key Words:** LCA, carbon footprint, broiler production, sustainability

**452 Microbiological effects of *Bacillus*-based DFM supplementation in broilers raised on used litter from commercial farms with different disease histories.** A. P. Neumann\*<sup>1</sup>, J. A. Benson<sup>1</sup>, K. W. Lee<sup>2</sup>, G. D. Ritter<sup>3</sup>, D. A. Bautista<sup>4</sup>, H. S. Lillehoj<sup>2</sup>, and G. R. Sira-gusa<sup>1</sup>, <sup>1</sup>*Danisco USA Inc., Waukesha, WI*, <sup>2</sup>*Animal Parasitic Diseases Laboratory, Animal and Natural Resources Institute, Agricultural Research Service, USDA, Beltsville, MD*, <sup>3</sup>*Mountaire Farms Inc., Millsboro, DE*, <sup>4</sup>*Lasher Poultry Diagnostic Laboratory, University of Delaware, Georgetown*.

In recent years *Bacillus* probiotics have increasingly been applied as feed additive direct-fed microbials (DFMs) for livestock due to their ability to form heat stable endospores. These products have generally recognized as safe (GRAS) status. Supplementation with *Bacillus* spp. in poultry has identified several benefits that include disease prophylaxis and enhanced performance. The purpose of this study was to

examine gastrointestinal (GI) levels of aerobic spore-forming bacteria, litter spore levels of *Clostridium perfringens* (Cp), and GI microbial ecology in broiler chickens fed a *Bacillus* based DFM and raised on used litter from farms with and without a history of clostridial gangrenous disease (GD). Four dietary treatments were included; 1) basal corn-soy diet, 2) basal diet plus DFM, 3) basal diet plus salinomycin, and 4) basal diet plus DFM and salinomycin. Three different types of litter were utilized; 1) used GD positive, 2) used GD negative, and 3) unused fresh pine shavings. Intestines were sampled from broiler chickens representative of the 4 dietary and 3 litter treatments at d 14, 28, and 45 post-hatch. Aerobic spore-forming bacteria and Cp levels were determined by agar plate counts and GI microbial community profiles generated by bacterial tag-encoded FLX amplicon pyrosequencing. Examination of pre-trial and post trial litter identified a numeric reduction in Cp spore levels in both DFM and ionophore treatments, alone or combined, regardless of disease association. No significant differences in the levels of GI aerobic spore-formers were observed during the study. Microbial community analysis of small intestinal mucosa revealed higher proportions of *Lactobacillus* sequences at d 14 in broilers receiving the *Bacillus* DFM compared with treatments receiving the basal diet alone or supplemented with ionophore only. *Clostridiaceae*, consisting primarily of segmented filamentous bacteria, dominated GI mucosal populations in younger broilers but were largely replaced with *Lactobacillus spp.* as the birds aged.

**Key Words:** *Bacillus*, direct-fed microbials, GI microbiota, *Clostridium*, *Lactobacillus*

**453 Testicular development of breeder males reared on accelerated growth schedules.** W. Berry\*, S. Oates, L. Stevenson, and J. Hess, *Auburn University Poultry Science, Auburn, AL.*

The objective of this study was to determine how rearing on a relatively accelerated growth schedule affects broiler breeder testicular development. In this study, male breeder chicks reared using a conventional feeding/growth schedule (CON) were compared with males reared on a growth schedule accelerated by 4 (ACCEL4) or 6 weeks (ACCEL6). The ACCEL males were grown on a linear growth line designed to reach the recommended (CON) 22-week body weight at 18 or 16 weeks of age. Male broiler breeder chicks in all treatments were started on a standard starter diet and full fed for 2 weeks. ACCEL4 male chicks were started 4 weeks after CON and ACCEL6 started 6 weeks after CON. Both treatments were then fed 15% protein grower diet for the remainder of the rearing period. The birds received 8 h light/day during rearing. The birds were transferred to breeder housing at 22 weeks of age (CON), 18 weeks of age (ACCEL 6), or 16 weeks of age (ACCEL 6). Light was increased to 12 h/day to stimulate sexual maturation. Birds in all treatments were then fed to maintain the same body weight until termination of the experiment. Body and testes weights were recorded throughout the experiment. Testes samples were formalin fixed, sectioned, and stained for morphology. Testes areas and cell numbers were obtained from photomicrographs

using Image J software. Body weights did not differ at photostimulation. Body weight uniformity was the same for the 3 treatments at photostimulation. However, ACCEL birds tended to be less uniform. Testes weight at initial sexual maturity was higher for ACCEL4 vs. CON or ACCEL6 ( $7.87 \pm 0.67$  vs.  $7.16 \pm 0.62$  vs  $7.15 \pm 0.65$ ). Sertoli cell numbers/testes area and interstitial cell numbers/testes area were not different between the treatments.

**Key Words:** breeder, male, testes, reproduction, growth

**454 Expressed sequence tag profiling of the guinea fowl pancreatic functions.** C. Darris\*, A. Tinnon, and S. Nahashon, *Department of Agricultural Sciences, Tennessee State University, Nashville.* The demand for guinea fowl (GF) as alternative poultry in the US has continued to increase. However, their production potential lags that of other commercial poultry. There have been sustained efforts to improve production performance of the GF, however, there is paucity of genetic resource information to facilitate such efforts. The aim of this study was to construct a complementary DNA (cDNA) library and to generate expressed sequence tags (ESTs) from the pancreas of the Pearl Gray GF. mRNA was isolated from the pancreas of adult GF. Following reverse transcription, cDNAs were cloned into the pBlue-script plasmid vector using the Stratagene pBluescript II XR cDNA Library Construction kit. Transformation efficiency was  $8 \times 10^4$  cfu/ug with an average insert length of 175 base pairs. Approximately 500 clones were selectively screened via blue-white selection, restriction digestion and PCR. Positive clones were cycle-sequenced by PCR and analyzed with the ABI PRISM 3100-Avant Genetic Analyzer. Three hundred individual ESTs with sizes ranging from 50 to 700 bp were analyzed. Percent homology of the GF ESTs against other avian species ranged from 80 to 100. Functional profile of 50 randomly selected putative ESTs uncovered sequences of proteins associated with metabolism, cell structure, enzymatic activity, cell cycle, and immunity. These include aromatase, an enzyme that aids in the production of estrogens, and Toll-like receptor 7, an immune gene that plays a vital role in the recognition of pathogens and the activation of innate immune system. These and other genes derived from the GF cDNA library provide an invaluable resource in comparative mapping of avian species and the understanding of the molecular processes associated with avian performance in growth, production and reproduction.

**Key Words:** guinea fowl, cDNA Library, genome, pancreas

**455 South Carolina Ag-Watch Program—An awareness and response program for food & agriculture producers, processors and responders.** J. Helm\*, C. A. Krugler, and C. F. Harden, *Clemson University Livestock-Poultry Health Division, Columbia, SC.*

AAAP abstract†

†This abstract from the American Association of Avian Pathologists (AAAP) is available in the AVMA Convention Notes at [www.avmaconvention.org](http://www.avmaconvention.org) and at [www.aaap.info/2011meeting](http://www.aaap.info/2011meeting).