Environment and Management II

88 Effect of litter conditions on broiler chicken intestinal microbiome as revealed by a poultry intestinal tract chip (PITChip). S. Wei,* M. Cressman, M. Lilburn, and Z. Yu, The Ohio State University, Columbus.

The complex microbiome present in poultry litter could affect the intestinal microbiome of birds, yet the relationship between the microbiomes remains poorly defined. The objective of this study was to use a recently developed poultry intestinal tract chip (PITChip) to examine the relationship between the litter and the gut microbiomes in broiler chickens. Chicks were randomly placed on fresh pine shavings (fresh litter) or reused litter that had been used for 6 previous flocks. Samples of ileal mucosa and cecal content were collected from 10 randomly sampled birds from both litter treatments at 7, 14, 21, and 42 d of age. Litter samples were also collected on each sampling day. Metagenomic DNA extracted from the samples was subjected to microarray analysis using the PITChip, which was designed based on the global diversity of the intestinal microbiome of poultry (turkeys and chickens) and allows simultaneous detection and semi-quantification of 1848 bacteria and 105 bacterial genera. Collectively, Anaerofilum, Porphyromonadaceae, Roseburia, Bifidobacteriaceae, Clostridiales, Lachnospiraceae, Shigella, Coprococcus and Salmonella appeared to be common and predominant in the samples. Differences in microbiome structure and diversity were detected with respect to age and litter conditions. As expected, more bacteria were found in the cecal content with increasing age. Surprisingly, however, more bacteria were detected in the ileal mucosa of younger chicks than older birds. Compared with the fresh litter, the reused litter led to significant decreases in Pseudomonas, Salmonella, Roseburia, Lachnospiraceae, Oribacterium, Ruminococcaceae, Shigella, Clostridiales, Lactobacillaceae, and Barnesiella. In summary, litter management can modulate the intestinal microbiome of broiler chickens and may have a profound effect on bird health and performance. The PITChip may be used in future integrated studies to investigate the relationships between the intestinal microbiome and diet, feed additives, litter management, flock health and performance.

Key Words: well-being, body condition, feather condition, foot pads, eye conditions

89 Influence of raised plastic floors compared to pine shaving litter on environment and Pekin Duck condition during the summer months. G. S. Fraley*1, S. M. Fraley1,2, D. M. Karcher1, M. M. Makagon1, and M. S. Lilburn1, 1Biology Department & Neuroscience Program, Hope College, Holland, MI, 2South Crossing Veterinary Center, Kentwood, MI, 3Dept. of Animal Science, Michigan State Univ., Lansing, 4Dept. of Animal Science, The Ohio State Univ., Columbus.

The overall welfare of commercial Pekin ducks has been studied in the EU where straw is the predominant litter source. The predominant litter source in the US is, however, wood shavings with a recent trend toward using raised plastic flooring. A previous study evaluated the relationship between flooring type and duck condition during winter months and found very few differences between the 2 in terms of overall duck well-being. The purpose of the current study was to re-evaluate the 2 flooring systems during the hottest of the summer months to determine if the additional required ventilation has an impact on duck well-being. The condition of 100 ducks per barn from 18 commercial barns that produce ducks for Maple Leaf Farms (Milford, IN) located in northern Indiana and southern Wisconsin (n = 9 litter; n = 9 raised plastic floor) was assessed at 7, 21, and 35 d of age. The ducks were randomly selected from 5 predetermined areas within each barn and scored for eye condition, nostril condition, feather cleanliness and quality, and foot pad quality. At 7 d, mean eye scores were slightly worse among ducklings on raised plastic versus litter; however, average nostril scores were better among ducks raised on plastic floors compared with litter. Feather cleanliness scores were significantly (P < 0.05) better in ducks reared on raised plastic floors at 21 d. Similarly, at 21 d foot pad scores were significantly (P < 0.05) better among ducks raised on plastic floors compared with litter. What few differences were observed, the number of ducks with excellent condition scores was typically higher in barns with raised plastic flooring compared with litter flooring. In summary, although very few differences were noted between flooring types, raised plastic flooring may have a slight advantage toward improved duck body condition during the summer months.

Key Words: ammonia, paw quality, PLT, LG

90 Comparative study of poultry litter treatment (PLT) and litter guard (LG) in maintaining air and litter quality with microbiological fluctuations over three consecutive broiler flocks. D. B. Ghlopal,* K. S. Macklin, J. P. Blake, and S. F. Bilgili, Department of Poultry Science, Auburn University, Auburn, AL.

Six commercial broiler houses (12.2 × 152.4 m) were screened for 3 consecutive flocks. Three houses were treated with Litter Guard (LG) 7 d before bird placement; 18.9L in 378.5 L water. The other 3 houses were treated with PLT, 24 h before bird placement; applied in the central brooding area at the rate of 24.4 kg/100m2. For all 3 flocks litter samples were collected before application of treatments and at 1, 8, 15, 22, 29, 36 and 43 d of age at 4 equidistant locations in each house. Litter samples were analyzed for pH, water activity and microbiological analysis. Microbiological analysis included enumeration of total aerobic, anaerobic, enteric, Cl.perfringens and E.coli (cfu/gm). A Drager CMS analyzer was used for ammonia measurement. Five-hundred paws were collected at processing from each house and scored as score 0, 1 and 2 depending on lesions. Results show that PLT application significantly (P < 0.5) decreased ammonia levels on d 1 as compared with LG (37.9 vs. 59.4 ppm), but PLT was unable to maintain low levels after d 15. pH levels were significantly reduced (P < 0.10) by PLT on d 1 compared with LG (7.91 vs. 8.43). Whereas LG application gradually decreased pH until d 22, showing a gradual rise thereafter. Water activity was significantly lowered (P < 0.10) by PLT application on d 15 compared with LG (0.657 vs. 0.769) with constant low water activity for all other samplings. Aerobic bacterial counts were significantly decreased (P < 0.10) by PLT on d 22 compared with LG application (8.778 vs. 9.224). E.coli counts were consistently lower in PLT applied houses with no significant differences (P > 0.05) detected. Anaerobic bacterial counts were significantly reduced (P < 0.10) by PLT on d 22 compared with LG (6.762 vs. 6.960). Cl.perfringens and coliform counts showed random variations for the entire experiment. Paw quality was deteriorated in PLT treated houses as compared with LG treated houses. House 2 and 6 treated with PLT showed 2.4% and 28.4% score 1 paws respectively.

Key Words: ammonia, paw quality, PLT, LG
91 Prevalence and abundance of *Clostridium perfringens* in chickens as affected by Bacitracin and litter management. S. Wei,* A. Gutke, M. Lilburn, and Z. Yu, *The Ohio State University, Columbus.*

Necrotic enteritis and related subclinical diseases caused by *Clostridium perfringens* are costly to the broiler industry. The objective of this study was to investigate the interaction between litter management (fresh vs. reused) and dietary Bacitracin on prevalence and load of both generic and pathogenic *C. perfringens* in the gut of broiler chickens. Four flocks of chickens were randomly assigned to 2 treatments in a 2 × 2 factorial arrangement of treatments: diets with or without supplemental Bacitracin and litter management (fresh vs. reused). Samples of ileal mucosa and cecal content were collected at d 10 and 35. This experiment was repeated over 3 successive flocks. The populations of generic *C. perfringens*, α-toxin-producing *C. perfringens*, and NetB-toxin-producing *C. perfringens* were quantified using specific quantitative PCR assays. All the cecal content samples were found to carry generic *C. perfringens*, ranging from 10^2 to 10^5 16S rRNA gene copies/g sample. NetB-toxin-producing *C. perfringens* was found in 50% of the cecal content and 33% of the ileal mucosa samples, while α-toxin-producing *C. perfringens* was positive in 46% of the cecal content and 29% of the ileal mucosa samples. Both types of toxin-producing *C. perfringens* were found in 42% of the cecal content and 29% of the ileal mucosa samples. Chicken raised on the fresh litter with no supplemental Bacitracin had the greatest abundance of generic *C. perfringens* and toxin-producing *C. perfringens*, followed by the chickens raised on the reused litter fed no Bacitracin. NetB-toxin-producing *C. perfringens* and α-toxin-producing *C. perfringens* were mainly detected in the Bacitracin-free birds, which had a relatively higher generic *C. perfringens* population. A significant interaction was noted between litter treatment and Bacitracin in 2 of the 3 growth cycles with respect to reducing all the 3 types of *C. perfringens*. In conclusion, litter reuse tended to reduce generic and toxin-producing *C. perfringens*, while supplemental Bacitracin significantly reduced all the 3 types of *C. perfringens*.

**Key Words:** chicken, necrotic enteritis, *Clostridium perfringens*, toxin, qPCR

92 Comparison of litter quality parameters of crust-out and windrow litter. J. R. Timmons*1, G. Malone2, S. Mwangi2, J. Bower2, J. M. Harter-Dennis2, and W. Brown3, 1University of Maryland, College Park, 2Malone Poultry Consulting, Princess Anne, MD, 3Trinico Ag Inc, Greensboro, NC, 4University of Delaware, Georgetown, 4University of Maryland Eastern Shore, Princess Anne.

Windrowing litter between flocks has been adopted by some poultry producers as a means of recycling used litter and allows the litter to remain inside the house reducing the risk of exposure to the elements. Two experiments were conducted to compare ammonia levels and litter quality parameters of crust-out and windrowed litter in 2 560 X 60 ft chicken houses. The first experiment was conducted December–June and the second experiment was conducted July–January. The litter at the start of experiment one was one-flock old. The design of both trials was a Randomized Complete Block with a factorial arrangement of treatments and 3 replicates per treatment. The factors included 2 litter management techniques (crust-out and windrow) and 2 locations within the house (brood chamber, BC and tunnel fan end, TF). The dependent variables measured in both experiments were litter quality parameters (pH, moisture and litter nutrient content), cake score, and fuel usage. Ammonia levels were measured only in experiment 1. Statistical differences were determined at P ≤ 0.05. No significant interactions were detected therefore only main effects will be reported. In both experiments, no differences between litter pH and moisture were detected due to litter management techniques. However, location did effect litter pH in both experiments (Exp 1: 8.2 and 7.7; Exp 2: 8.2 and 6.8, TF and BC respectively). Litter moisture was lower in the BC (19.8%) compared with the litter moisture in TF (21.2%) in Exp 1. No differences were detected in ammonia levels (34.6 ppm/hour) in the house with crust-out treated litter compared with ammonia levels (36.9 ppm/hour) in the house with the windrowed treated litter. However, ammonia levels measured in the TF (40.1 ppm/hour) were higher compared with ammonia levels in the BC (31.4 ppm/hour). In both experiments litter management strategies did not have an effect on litter quality parameters, fuel usage and cake score. Results from these trials indicate that windrowing litter does not impact litter pH, moisture and house ammonia levels compared with traditional litter management strategies.

**Key Words:** windrow, litter, ammonia, moisture, pH


Gas emissions in animal production is becoming an important environmental issue. Carbon dioxide (CO₂) production from respiration is the major contribution for greenhouse effect in broiler operations. It was aimed with this work to determine the equations parameters of the carbon (C) flow curves and to estimate the respiration carbon flow and CO₂ in broilers of different strains, from 1 to 49 d of age. Three hundred and eighty four chicks of one day were used, assigned to 4 groups: fast growing male (M) and female (F) Cobb 500 and slow growing male and female Brazilian C-44 strain, with 6 replicates by treatment in a randomized complete experimental design. Birds were raised in 1 m² mini-pens, from 1 to 49 of age, fed corn-soybean based diets formulated to meet requirements. Weekly, average body weight (BW) and feed intake were measured and 16 birds were collected for evaluation of body composition. Carbon intake and retention was calculated based carbon content of feed and animal body, and the amount of expired C was estimated in a stoichiometric way by the equation: Expired C = digestible C intake – retained C – urinary C. The carbon flux curves were estimated fitting the data by non-linear regression using in the Gompertz function. Expired CO₂ was calculated from expired C. A good fit was found in the non-linear model used, with a R² > 0.99 in all growth and C flux responses. CO₂ production was highly correlated to growth rate, so that at 42d of age expired CO₂ (g/bird) was: Cobb M = 3216, Cobb F = 2789, C44 M = 2397, C44 F = 2079. However, age effect was also determinant in CO₂ production, so that, to reach the same body weight of 2.0 kg, expired CO₂ (g/bird) was: Cobb M = 1693, Cobb F = 1882, C44 M = 2503, C44 F = 2836. Multiple linear regression was applied to all data and the equation: expired CO₂ (g/bird) = 105.26 + 507.9*BW (kg) - 13.13*Age (d) + 17.393*BWxAge (P ≤ 0.0001, R² = 0.97) was a simple fitted model with high predictability to estimate individual broiler CO₂ emission at any weight, age or strain, from 1 to 49d of age.

**Key Words:** CO₂, gas emissions, Cobb, carbon flow, growth curves.
94 Use of foaming disinfectants and cleaners to reduce aerobic bacteria on poultry transport coops. C. Hinojosa,*, D. Caldwell, M. Ross, S. Iselt, J. Garcia, J. Hoffman, K. Stringfellow, R. Latham, J. Lee, J. Byrd, and M. Farnell, 1Texas A&M University, 2USDA Agricultural Research Service SPARC.

Poultry transport coops are rarely washed and have been demonstrated to be a major point of cross contamination of broiler carcasses. We hypothesized that foaming disinfectants and cleaners, commonly used within processing plants, can also be used to clean and disinfect poultry transport coops. Organic matter (homogenized fecal material) was evenly applied to the floors of 3 pre-cleaned transport coops and allowed to dry for one hour. Treatments consisted of a water rinse, a foaming agent alone, foaming cleaner (trial 1), or a foaming agent plus peracetic acid (PAA — trial 2). All foaming treatments were applied with a compressed air foam system using a 1 inch fire hose. Ten minutes post-treatment, all surfaces were lightly rinsed with water. Samples were collected from the transport coops before and following treatment utilizing a sterile 2 inch X 2 inch stainless steel template and a gauze swab pre-enriched with buffer peptone water. All swab samples were stomached, serially diluted, spread plated onto tryptic soy agar plates, incubated for 24 h at 37°C and enumerated. In trial 1, reductions ($P < 0.05$) in bacterial recovery were observed in the water rinse treatment (0.48 logs), foaming agent alone (1.00 logs) and the foaming cleaner (1.00 logs) when compared with the pre samples per respective coop. In trial 2, reductions ($P < 0.05$) in bacterial recovery were observed in the water rinse treatment (0.76 logs), foaming agent alone (2.09 logs) and the foaming agent plus PAA (4.08 logs) when compared with the pre samples per respective coop. These data indicate that a compressed air foam system may be used in combination with commercially available peracetic acid to reduce aerobic bacteria on the surfaces of commercial poultry transport coops.

Key Words: cleaning and disinfection, biosecurity, food safety, transport coops, poultry

95 Effect of range, cage-free, and cage environments on man-hours committed to bird care in three brown egg layer strains. K. E. Anderson,* North Carolina State University, Raleigh.

Growing public concern for layer welfare provided the incentive to study the physiological response of 2 commercial egg strains to 3 different husbandry practices. Two groups of 492 hens, Hy-Line W-98 (W98) and Dekalb White (DW), were randomly assigned to the treatments: non-molined (NM), non-anorexic (NA), and feed-restricted (FR). The laying facility was divided by an opaque curtain wall to keep the light- ing appropriate for the NM (16L:8D) and 9L:15D for NA and FR. Body component weights, were collected on d 0, 2, 4, 6, 8, 10, and 12 and on the final day the target of 25% weight loss. Body components included the whole keel, gizzard, liver, small intestine, ovary, and oviduct which were transformed to a percent body weight basis for analysis. The NM hens were heaviest ($P < 0.05$) at 1.88 kg and FR had an average weight of 1.56 kg. The W98 hens were significantly ($P < 0.0001$) heavier than the DW hens. Weight loss from d 0 through 12 of the molt was continuous with significant interactions ($P < 0.0001$) of strain by day as well as in treatment by day. The NM had larger ($P < 0.01$) liver, ovary, and oviduct weights in comparison to FR and NA, which indicates that these organs appear to be the most affected during the molt. The molt period of d 0 to 12 d shows a decrease ($P < 0.01$) in relative weight of the abdominal fat pad and liver, and a subsequent increase ($P < 0.05$) in percent whole keel. This indicates that muscle catabolism was not a component of the major weight loss. The interaction of treatment by strain, showed a significant difference ($P < 0.0001$) in the gizzard, liver, ovary, and oviduct percent weights, indicating a change in tissue re-structuring of these organs. From this it can be inferred that the ovary and oviduct are regressing due to nutrient allocations for body maintenance with a concurrent reduction in abdominal fat pad and liver weight attributed to fat and glycogen stores being catabolized to provide energy. The increased gizzard and whole keel weight may indicate that these organs are spared and remained relatively the same size throughout the molt. Thus the bird is not utilizing these muscles for energy.

Key Words: layer, molt, organ, egg, hen

96 Effects of strain and molt method on physiological organ weight changes in commercial layer hens. K. E. Anderson* and M. M. Evans, North Carolina State University, Raleigh.

97 LED versus CFL lamps on egg production parameters of SCWL laying hens. M. J. Darre* and A. Ritchie, University of Connecticut, Storrs.

A 180 d trial was conducted to determine the effect of LED lamps placed on top of each cage vs CFL lamps in ceiling sockets on egg production
Core and surface temperatures of turkeys exposed to different temperatures during the first 12 weeks of growth. S. L. Mayes,* M. L. Strawford, H. L. Classen, and T. G. Crowe, University of Saskatchewan, Saskatoon, SK, Canada.

In 2010, Canadian poultry and egg producers paid, on average over $900K per farm in operational costs. One method to reduce operational costs for meat producers may be to lower rearing temperatures. Over time, growth rate of turkeys has changed, resulting in increased heat production and possible changes to their thermal tolerances. The objective of this study was to use an infrared camera to sense surface temperatures of birds exposed to 2 temperature regimes. Twelve Hybrid Convectors turkeys, reared in common conditions, were exposed to one of 2 pre-set temperatures (n = 6) for a 2-h period once each week for 12 weeks. Exposure temperatures were control (T_{Con}), as defined by the Hybrid recommendations, and 4°C below the control (T_{Trt}). Temperatures of the breast (T_{breast}), thigh (T_{thigh}), wing (T_{wing}) and head (T_{head}) were recorded. Core body temperature (T_{core}) was measured using a medical-grade thermometer inserted in the cloaca. As the flock aged, both T_{core} and T_{con} were decreased, and T_{breast}, T_{thigh} and T_{wing} (P < 0.01 for each) followed the same trend. T_{Trt} caused T_{head} to be reduced by 2.13°C, 1.81°C and 1.82°C, respectively (P < 0.01), below surface temperatures recorded weekly at T_{Con}. T_{head} was less responsive to exposure temperature as T_{Trt} caused a reduction of only 0.60°C (P < 0.01). T_{core} was unaffected by the different exposure temperatures (P ≥ 0.05), suggesting the soft tissues and feathers provided adequate insulation and allowed turkeys to cope with the lower exposure temperatures. Insulation provided by feathers caused temperatures of the breast, thigh and wing to be more responsive to changes in exposure, while the absence of insulation around the head caused its temperature to be more closely linked to the stable core temperature.

Key Words: turkey, body temperature, infrared thermography, thermoregulation, temperature gradient

The effectiveness of using single comb White Leghorn laying hens for the integrated pest management of pole lima beans. A. F. Shelton* and B. A. McCrea, Delaware State University, Dover.

Pole Lima beans are a regionally valued commodity and the influx of stink bugs has caused decreased bean yields. The purpose of this study was to assess the effectiveness of using Single Comb White Leghorn (SCWL) hens for insect pest management in a pole lima bean plot. Since the hens in this study were in production, the similarities and differences in relation to functional properties of those free-range eggs and retail white-shelled eggs were determined. The site for this study was Delaware State University’s Outreach and Research Center. Thirty-one 18 mo old SCWL hens were obtained, given shelter and kept in a predator-proof pen with access to the pole lima bean crop. The plot consisted of a control section of pole lima beans and 2 treatment sections of pole limas. The control area was not sprayed and did not contain chickens. Treatment one contained the chickens and was not sprayed, while treatment 2 was sprayed, but did not contain chickens. The pests identified were Mexican bean beetles, stink bugs, and 2-spotted spider mites. The pests were counted weekly. The Haugh unit; shell thickness; weight of yolk, albumen, and shell; foam stability; and Roche color were measured for the retail-purchased white-shelled eggs and the free-range eggs from this flock. Coagulation, emulsification, and foam formation were also tested. Results indicate SCWLs were not as effective in managing stink bugs and Mexican bean beetles as the use of pesticides, but were
effective in managing 2-spotted spider mites. There were no significant differences between the functional properties of retail white-shelled eggs and the free-range eggs. The Roche color score for the yolks of the free-range eggs was higher numerically than those of the retail eggs. Future studies may show that SCWL hens are more effective for insect pest control in other vegetable cropping systems.

**Key Words:** Single Comb White Leghorn, integrated pest management, eggs, functional properties, sustainable agriculture

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101 Family poultry production system in Iran: A review. F. Mirzaei,* ASRI.

The global poultry meat production will increase to 130 million tons in 2030, (Simons, 2005). In Iran, the quantity of per capita protein went up from 73 to 80 g per day. About 90% of the population food requirements are covered by domestic production. Production of poultry meat and eggs has increased during the last decade by 11 and 5.5% annually, respectively. Traditionally, native breeds of poultry were reared in villages under extensive and mixed systems. The poultry were marketed live by the villagers and there was not organized commercial marketing and distribution. In 1975, the population of native chicken was estimated to be about 16 million birds. A project for increasing the number of native poultry breeds started in 1983. In this project, various native breeds were reared in 14 poultry centers in different parts of the country and the vaccinated pullets distributed to the villagers. One important feature for the native poultry sector is that, they do not rely on formulated feed, which the most ingredients of which are imported from abroad. The project caused the number of native poultry to increase rapidly, which was 66 million birds in year 2007. There are several indigenous poultry breeds in various regions of Iran which had adapted to the corresponding local climatic and environmental conditions through long-term natural selection. The most important native fowls of Iran, at least in respect to population size, are the Mazandarani, the Farsi, the Esfahani and the Azarbaijani. In this review through survey method, various works have been studied for different years and investigated some results regarding laying and meat production characteristics of indigenous chickens because of their adaptation to environment.

**Key Words:** native poultry, production system, egg, meat