168 Microbial communities present in the lower respiratory tract of clinically healthy birds in Pakistan. M. Z. Shabbir*, J. Park1, T. Malys1, Y. Ivanov1, M. Rabbani2, T. Yaqu1, and E. T. Harv1,1, Quality Operations Laboratory, University of Veterinary and Animal Sciences, Lahore, Punjab, Pakistan, 2University Diagnostic Laboratory, University of Veterinary and Animal Sciences, Lahore, Punjab, Pakistan, 3Department of Veterinary and Biomedical Sciences, Pennsylvania State University, State College, PA.

Commercial poultry is an important agricultural industry worldwide. Although dense living conditions and large flocks increase meat and egg production, they also increase the risk of disease outbreaks and zoonoses in different geographical areas. Current pathogen identification methods mostly rely on culture-dependent techniques and therefore are limited to a very small number of bacteria present in the environment. Next-generation sequencing (NGS) allows for culture-independent characterization of lower respiratory microbiome of birds and represents the first step toward culture-independent pathogen identification. In this study, we collected tracheo-bronchoalveolar lavage (T-BAL) of 14 birds raised at 3 different farms in the Punjab province of Pakistan. To characterize lower respiratory microbiomes of these birds, we sequenced V1-V5 hyper-variable regions of 6S ribosomal subunit. Though dominated by bacteria belonging to a small number of taxonomic classifications, the lower respiratory microbiome from each farm was far more diverse and novel than previously known. We also noted the presence of known pathogens. The differences in microbiome among farms were characterized. The data suggest that different farms affect microbiome of birds more than other factors such as: breed, geographic location, or management system. This study explores lower respiratory microbiome of poultry birds and gives new insights into (1) culture-independent identification of novel pathogens, (2) characterization of lower respiratory microbiome in healthy birds, and (iii) a more detailed understanding of an important reservoir of pathogen of public health concerns.

Key Words: microbiome, novel organism, lower respiratory tract, culture independent, poultry


The effect of light-emitting diode (LED), cold cathode fluorescent (CCFL), and incandescent lamps on broiler performance and stress was evaluated using 672 male Ross 708 broilers raised to 42 d of age in 8 light-tight modified large colony houses. The broilers were raised with identical intermittent lighting programs, using 4 unique types of lamps. One CCFL, and 2 different LED lamps were tested with incandescent lamps serving as the control. Each technology was tested in duplicate for each of the 4 trials (8 replications total per technology) during a 12 mo period to account for seasonal variance. Live performance for each technology was evaluated using live broiler body weight, feed conversion, and mortality. Broiler stress levels were also evaluated using heterophil to lymphocyte ratios (H:L). Birds were removed from each house at d 7, 14, 35, and 42 to be humanely euthanized and weighed. Left breast, heart, liver, and duodenum were harvested for allometric analysis. CCFL lamp body weights (2,871 ± 53 g) at 42 d were significantly lower than incandescent lamp body weights (3,000 ± 33 g; P = 0.03), and lower than LED A (2,966 ± 37 g; P = 0.12) and LED B lamps (2,986 ± 46 g; P = 0.06). Similar trends were seen with breast muscle.

No significant difference was found in feed conversion but CCFL (1.84 ± 0.04) and LED A (1.86 ± 0.02) were higher than incandescent (1.80 ± 0.04), and LED B (1.80 ± 0.02). No significant differences were seen in mortality or organ weights. Broilers raised under CCFL and LED A technologies exhibited significantly higher H:L ratios than incandescent and LED B. It is unclear why these technologies performed differently, but explaining the difference is critical if these technologies are to be fully implemented.

Key Words: broiler, light, growth, stress

170 Evaluation of light-emitting diode, cold cathode, and incandescent lighting under commercial broiler conditions. E. R. Benson*,1 W. Brown1, R. L. Alphin1, D. P. Hougentogler1, A. G. Rogers1, and D. C. Kuhns2, 1University of Delaware, Newark, DE, 2Delmarva Community Wellnet, Lewes, DE.

The objective of this project was to evaluate the use of light emitting diode (LED), cold cathode fluorescent (CCFL), and incandescent lamps under commercial broiler production conditions. A commercial poultry farm located in Delaware was selected for use in the study. House management followed typical integrator guidelines. Each house (18.7 × 152.3 m), was treated independently for live haul management including feed deliveries, electrical consumption, and processing. New commercially available, off the shelf, non-agriculture specific lamps were installed in one grower owned commercial broiler houses at the beginning of the project. Lamps were rotated between houses between flocks to control for house effects. For all 6 flocks monitored, alternative lighting technologies were more energy efficient than incandescent lamps. LED lamps were more efficient (μ = 94 kW, σ = 16 kW) than either incandescent (μ = 1997 kW, σ = 198 kW) or CCFL (μ = 238 kW, σ = 20 kW) lamps. The difference in electrical consumption between technologies were significant (P = 4 × 10^-6). Incandescent lamps consistently provided better performance than either lamp type, with incandescent lamps resulting in greater average weight moved (μ = 111,017 kg, σ = 5,243 kg) than CCFL (μ = 108,802 kg, σ = 6,553 kg) and LED (μ = 108,356 kg, σ = 7,174 kg). The differences were practically significant, but not statistically significant. Bird weight was a factor, with incandescent (μ = 2.90 kg, σ = 0.09 kg) greater than CCFL (μ = 2.85 kg, σ = 0.11 kg) or LED (μ = 2.84 kg, σ = 0.13 kg). The differences were not statistically significant. The results from this project contradict results from other research regarding the suitability of LED lamps for poultry and this may be due to the specific lamps used. For the lamps tested, the improved energy consumption did not economically counterbalance the loss in productivity from the alternative technology lamps.

Key Words: poultry, broiler, lighting, CCFL, LED

171 The effect of day length and sex on turkey productivity. C. Vernette*, K. Schwean-Lardner, S. Gomis, T. G. Crowe, and H. L. Classen, University of Saskatchewan, Saskatoon, SK, Canada.

The effect of graded levels of day length on productivity of hens and toms was studied in 2 experiments. Day length treatments (trts) were 14 (14L), 17 (17L), 20 (20L), and 23 (23L) h and were started at 10 d of age. Turkeys (720 hens and 480 toms) were randomly allocated to 8 rooms (2 rooms per lighting treatment) with 6 pens (3 hen and 3 tom) per room in each experiment. Body weight (BW) was assessed on d 10 and at 3, 6, 9, and 12 wk of age; feed consumption (FC) was measured for comparable time periods and feed efficiency (G:F; g of

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gain/(

) calculated from BW and FC values. Birds were checked daily for mortality and culls, and affected birds sent for necropsy. Data were analyzed for light trt, sex, and interaction effects using SAS 9.3 and a randomized complete block split plot design with experiments as blocks, lighting treatment as the main plot factor, and sex as the subplot factor. Regression analysis was used to study the relationship between dependent variables and day length. Significance was declared at \( P \leq 0.05 \). Body weight increased in a linear fashion with increasing day length at 3 and 6 wk of age and these differences coincided with a similar effect on feed intake from 10 d to 3 wk and from 3 to 6 wk of age. Feed efficiency (G:F) increased linearly with day length from 10 d to 3 wk. Body weight was not affected by lighting trt at 9 wk of age. At 12 wk of age, an interaction between day length and sex demonstrated that toms given 14L, 17L and 20L trts were heavier than those given 23L, but that hen weights were unaffected. Overall, FC and G:F (10 d to 12 wk) were not affected by day length. Mortality and culling were not affected by day length with values for 10 d to 12 wk of 6.8, 6.9, 6.8 and 10.0% for the 14L, 17L, 20L and 23L trts, respectively. Toms grew more quickly and efficiently than hens and also had a higher incidence of mortality and culls. In conclusion, toms grew faster to 12 wk of age when provided with more than 1 h of darkness.

**Key Words:** photoperiod, scotoperiod, light, tom, hen

**172 The effect of graded day length on 12-week turkey meat yield and tissue weights.** J. Fournier*, K. Schwean-Lardner, C. Vermette, S. Gomis, T. G. Crowe, and H. L. Classen, University of Saskatchewan, Saskatoon, SK, Canada.

Meat yield is an important aspect of turkey production and a systematic assessment of the effect of day length on this trait is lacking. Therefore, the primary objective of this research was to study the effect of 14 (14L), 17 (17L), 20 (20L) and 23 (23L) h of day length on the meat yield of Nicholas 85 × 700 turkeys raised to 12 wk of age. A second objective was to study the effect of day length on the size of the digestive tract and other major organs. Two identical experiments were completed with day length tested in 2 rooms in each experiment, resulting in a total of 4 replications per treatment. The rooms each contained 6 pens, 3 with 20 toms and 3 with 30 hens. At 12 wk, 3 randomly selected birds from each pen were slaughtered, eviscerated, and packed in ice until meat yield determination the following day; tissues were collected and weighed at the time of evisceration. Data were analyzed using SAS 9.3 based on a randomized complete block split-plot design with experiments blocked, lighting treatment as a main plot factor and sex as a subplot factor. Regression analysis established relationships between response criteria and day length. Means were considered different when \( P \leq 0.05 \). Meat yield and tissue data are expressed as a percentage of the live body weight and bracketed values are the means for 14L, 17L, 20L, and 23L, respectively. Breast (21.59, 21.95, 22.59, 22.43%) and thigh (5.07, 5.04, 5.16, 5.20%) meat yield increased, and whole drum (5.00, 4.89, 4.87 4.79%) and drum meat (3.73, 3.61, 3.61, 3.56%) decreased in a linear fashion with increasing day length. Gizzard weight showed a quadratic relationship with day length (1.27, 1.28, 1.23, 1.07%). Liver and duodenum weight, and the proportional length and weight of the jejunum and ileum decreased in a linear fashion with increasing day length. Sex affected many of the traits measured, but interactions between day length and sex were infrequent. Day length affects both meat yield and digestive tract weights and lengths in turkeys at 12 wk of age.

**Key Words:** lighting, sex, digestive tract, carcass, liver

**173 Assessment of density in enriched colony cages: Production and welfare quality.** D. M. Karcher*, M. M. Makagon2, C. I. Robison1, and R. J. Tempelman1, 1Michigan State University, East Lansing, MI, 2Purdue University, West Lafayette, IN.

The move toward enriched colony cages (ECC) in the US egg industry requires research to provide management, including stocking density, guidelines. Scientific information on ECC is limited with the majority of the literature originating from Europe. The difference in management styles, genetic strains, and European laws and mandates do not allow the data to be directly translated to US production systems. Therefore, this project investigated the performance of a single strain of laying hens housed at different stocking densities in ECC. Seventeen-week-old W-36 laying hens (5,106 total) were housed in 72 ECC (8 rooms; 9 ECC/room). The hens were housed at 6 different densities (464, 581, 652, 748, 800, and 929 cm² per bird; 12 cage replicates/density). Egg production was recorded daily, feed consumption and case weights weekly, BW and welfare quality measures monthly. The data were collected for 52 weeks (expressed as thirteen 28-d periods). Data were analyzed using the GLIMMIX statement in SAS. The overall hen day percentage was not different among treatments. Hens housed at 464 and 581 cm² had heavier case weights compared with all other treatments \( (P < 0.05) \). Hens housed at 464 cm² (1.40 kg) were, on average, lighter than hens housed at 652, 748, and 800 cm² (1.44, 1.43, and 1.43 kg, respectively; \( P < 0.05 \)). The Welfare Quality guide for poultry was used to assess various hen welfare parameters. Laying hens housed at 464 cm² had more keel deformities and were different from both 652 and 929 cm² during period 11 \( (P < 0.05) \). The feather cover assessed on 7 different areas showed similar patterns with larger amounts of skin exposed as the stocking density decreased. Overall, the production and welfare quality results suggest that W-36 hen densities at or above 581 cm² per bird may be appropriate.

**Key Words:** enriched colony cage, welfare quality, density, laying hen

**174 The effectiveness of a feed-sprinkled Astroturf pad as a resource in enriched colony cages.** R. A. Blatchford*, M. A. De Luz, and J. A. Mench, University of California, Davis, CA.

Enriched colony cages provide laying hens with a feed-sprinkled Astroturf pad to encourage foraging (pecking and scratching) and dust-bathing. As part of the Coalition for a Sustainable Egg Supply project, we investigated the effectiveness of this pad in encouraging the performance of these behaviors and in reducing feather lipids and claw length in hens housed in 60-hen enriched colony cages \( (n = 20) \) on a commercial farm. All hens had access to a pad from 19 – 52 wk of age. Pads were then removed from 10 cages (NOPAD) from 52 – 72 wk of age, although the auger still dispensed feed onto the shelf in the pad area. At 72 wk, breast and back feathers \( (n = 30 \) hens) were collected from the NOPAD and 10 neighboring cages with pads (PAD). The middle claw on the left foot was also measured on the same hens. Behavior was observed in a subsample of 7 cages per treatment both on the pads (PAD), and the corresponding area of the cages without a pad (NOPAD). Analysis of variance was used to determine the following day; tissues were collected and weighed

**Key Words:** enriched colony cage, welfare quality, density, laying hen

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Footnotes:

1. Data were analyzed using SAS 9.3.

2. Mean ± SE.

3. Body weight increased in a linear fashion with increasing day length at 3 and 6 wk of age.

4. Feed efficiency (G:F) increased linearly with day length from 10 d to 3 wk.

5. Body weight was not affected by lighting trt at 9 wk of age.

6. Toms grew more quickly and efficiently than hens and also had a higher incidence of mortality and culls.

7. In conclusion, toms grew faster to 12 wk of age when provided with more than 1 h of darkness.

8. Meat yield is an important aspect of turkey production and a systematic assessment of the effect of day length on this trait is lacking. Therefore, the primary objective of this research was to study the effect of 14 (14L), 17 (17L), 20 (20L) and 23 (23L) h of day length on the meat yield of Nicholas 85 × 700 turkeys raised to 12 wk of age. A second objective was to study the effect of day length on the size of the digestive tract and other major organs. Two identical experiments were completed with day length tested in 2 rooms in each experiment, resulting in a total of 4 replications per treatment. The rooms each contained 6 pens, 3 with 20 toms and 3 with 30 hens. At 12 wk, 3 randomly selected birds from each pen were slaughtered, eviscerated, and packed in ice until meat yield determination the following day; tissues were collected and weighed at the time of evisceration.

9. Data were analyzed using SAS 9.3 based on a randomized complete block split-plot design with experiments blocked, lighting treatment as a main plot factor and sex as a subplot factor. Regression analysis established relationships between response criteria and day length. Means were considered different when \( P \leq 0.05 \). Meat yield and tissue data are expressed as a percentage of the live body weight and bracketed values are the means for 14L, 17L, 20L, and 23L, respectively. Breast (21.59, 21.95, 22.59, 22.43%) and thigh (5.07, 5.04, 5.16, 5.20%) meat yield increased, and whole drum (5.00, 4.89, 4.87 4.79%) and drum meat (3.73, 3.61, 3.61, 3.56%) decreased in a linear fashion with increasing day length. Gizzard weight showed a quadratic relationship with day length (1.27, 1.28, 1.23, 1.07%). Liver and duodenum weight, and the proportional length and weight of the jejunum and ileum decreased in a linear fashion with increasing day length. Sex affected many of the traits measured, but interactions between day length and sex were infrequent. Day length affects both meat yield and digestive tract weights and lengths in turkeys at 12 wk of age.

10. Sex affected many of the traits measured, but interactions between day length and sex were infrequent. Day length affects both meat yield and digestive tract weights and lengths in turkeys at 12 wk of age.
bathing (NOPAD: 0.88 ± 0.16, PAD: 0.98 ± 0.16 hens/15 min, P = 0.67), or foraging (NOPAD: 0.94 ± 0.21, PAD: 1.18 ± 0.12 hens/15 min, P = 0.34). Hens used the Astroturf pad at a very low rate for dust-bathing and foraging, and performed foraging and dust-bathing at a similar rate in that area of the cage even when the mat was not present. The dispensing of feed may have been enough to encourage dust-bathing and foraging, even without the pad, and the presence of the pad was not effective at reducing feather lipids or claw length.

**Key Words:** enriched colony, hen, behavior, scratch pad, feather lipids

### 175 Comparison of hen preference for nesting substrate material, and performance in a free-range production system.

K. E. Anderson*†, R. D. Malheiro‡, and D. R. Jones§, 1North Carolina State University, Raleigh, NC, 2USDA Agricultural Research Service, Athens, GA.

This project consisted of 200 Hy-Line Brown hens and was conducted utilizing the brood-grow-lay range huts at the North Carolina Department of Agriculture and Consumer Services' Piedmont Research Station. Fifty hens were placed in each pen/paddock providing 1338 cm²/hen of floor space in the hut and 3.7 m²/hen on paddock rotated every 4 wk. Feed and water were provided ad libitum at all ages throughout the life of the flock from 17 to 45 wk of age. A single diet program was provided which met the daily nutrient needs and consumption requirements. Three nesting substrates were evaluated: Astroturf, wood shavings, and straw. The nest substrates were allocated as follows: (a) pen 1, hens were provided with the 12-hole numbered nest using 4 holes each of Astroturf, straw, and wood shavings as the nesting substrate. The substrates were randomly rearranged to the 12 nest holes each period; (b) pen 2, provided with the 12-hole nests using wood shavings as the nesting substrate; (c) pen 3, hens provided with the 12-hole nests using straw as the nesting substrate; and (d) pen 4, hens provided with the 12-hole nests using Astroturf. Egg data collection was conducted daily the frequency of use for each nest by the number of eggs per nest was determined. In pen 1, according to the eggs/substrate was used as the indicator of preference. The analysis for pen 1 was Proc Freq. to determine the nesting material preference. In the other pens, a χ² analysis was used to determine if the percent of floor eggs was more or less than the expected in each of the pens. In pen 1, the straw nesting substrate had the highest (P < 0.001) frequency of use with 137 eggs/nest/period compared with 60 and 42 for the Astroturf and wood shavings, respectively. In the other pens, shavings had a higher (P < 0.02) frequency of use with 271 eggs/nest/period compared with Astroturf at 221 eggs/nest/period. Astroturf had the highest (P < 0.0001) incidence of floor eggs. This indicates that straw was the preferred nesting substrate and Astroturf resulted in the highest (P < 0.001) incidence of floor eggs. This indicates that there were no significant differences in BW (mean 2.29 kg); however, subjective FPS were significantly greater for the MG birds at 4 and 6 wk compared with the PS treatment. Subjective FS were also significantly greater for the MG birds at 6 wk. Litter nutrient analysis indicated inorganic-nitrogen and ammonium-nitrogen levels were greater in pens bedded with MG compared with PS, however litter ammonia flux was significantly less for the MG vs. PS at 4 wk (0.0255 and 0.0506 g/m² per d, respectively). These results indicated that MG bedding did not influence bird body weight and improved nitrogen management in the bedding and atmosphere; however, there are concerns with greater litter nitrogen influencing foot pad and feather scores.

**Key Words:** broiler, Miscanthus gigantus, pine shavings, performance, environment

### 176 Miscanthus gigantus as a renewable bedding material for commercial broilers versus pine shavings.

P. H. Patterson*†, G. P. Martin1, H. K. Burley1, H. Li2, and C. Lin2, 1The Pennsylvania State University, University Park, PA, 2University of Delaware, Newark, DE.

The price and scarcity of broiler bedding materials has been increasing. This challenge has forced more cycles of birds on the same litter, increasing litter moisture, ammonia levels and issues for bird quality and health. Therefore, a field study was initiated to follow up on promising results of a university pen trial indicating broiler performance and quality of Miscanthus gigantus (MG) bedded birds was equal to or greater than birds bedded on pine shavings (PS). A commercial broiler house (152.4 × 15.2 m) was divided into 5 equal pens (30.4 × 15.2 m) with tunnel migration fences. Two end pens were bedded with chopped MG straw (94.0% DM), the other 2 end pens were bedded with PS, and the middle pen was a mixture of both bedding types. Bird body weight (BW), foot pad score (FPS), feather score (FS), and litter ammonia flux and nutrients (6 locations/treatment) were measured at 2, 4, and 6 wk of age in the replicate MG and PS pens. Data from each 2-wk period were analyzed using a one-way ANOVA. Tukey’s test was used for mean comparisons, and P ≤ 0.05 was deemed statistically significant. Results indicated there were no significant differences in BW (mean 2.29 kg); however, subjective FPS were significantly greater for the MG birds at 4 and 6 wk compared with the PS treatment. Subjective FS were also significantly greater for the MG birds at 6 wk. Litter nutrient analysis indicated inorganic-nitrogen and ammonium-nitrogen levels were greater in pens bedded with MG compared with PS, however litter ammonia flux was significantly less for the MG vs. PS at 4 wk (0.0255 and 0.0506 g/m² per d, respectively). These results indicated that MG bedding did not influence bird body weight and improved nitrogen management in the bedding and atmosphere; however, there are concerns with greater litter nitrogen influencing foot pad and feather scores.

**Key Words:** Miscanthus gigantus, pine shavings, performance, environment

### 177 Assessment of the prevalence of Salmonella within layer hen traditional and non-traditional housing environments.


Various Salmonella species in food-producing animals have become the main reservoir for human salmonellosis, accounting for 95% of all human cases annually. Human salmonellosis has been closely associated with the consumption of poultry and egg products, predominately originating at the poultry-production level with the horizontal or vertical transmission of salmonellosa from the environment or during oviposition, respectively. The aim of this collaborative study was to identify Salmonella serovars endemic within the egg and poultry industry by environmental, tissue, and egg sampling in cage and cage-free environments and how alterations in feed characteristics (coarse versus fine feed) may alter Salmonella colonization within layer hens. Two hundred twenty commercial hens were equally divided between cage and floor environments and fed a standard layer diet during an acclimation period between 17 and 22 wk of age. Baseline environmental and tissue samples were collected at 22 wk of age and layer hens were assigned either a coarse or fine textured mash layer diet for 6 wk. Egg and environmental (feed, water, drag swab, fecal) samples were collected weekly for microbial analysis. Egg production and feed intake were summarized weekly. At the termination of the study, all hens were euthanized and the spleens and reproductive tissues were collected for microbial analysis. Of the environmental samples collected, 22% of the feed samples (coarse and fine) collected from the caged environment were Salmonella positive, while absent in the cage-free environment. However, Escherichia coli was significantly greater in the reproductive tissues of cage-free birds (P < 0.0001), which correlated with E. coli found within the cage-free environmental and eggs samples. There were no significant effects of dietary treatments or housing environments on production parameters.
measured. In summary, this study demonstrates the need for similar studies to be conducted using alternative housing systems found within the egg production industry to evaluate the prevalence and transmission of Salmonella.

Key Words: Salmonella, layer hen, table egg, housing environment

178 Comparison of conventional and pasture production systems on broiler performance. R. C. Beckford1, K. M. Liles, J. R. Bartlett, and C. O. Bonsi, Tuskegee University, Tuskegee, AL.

Currently, broiler production is highly intensive. This is in response to the high market demand for quality chicken products. However, with consumers exploring a healthier lifestyle, there has been an increase in the demand for meat from birds reared in a more natural environment. Some consumers are of the impression that birds raised in alternative production systems are healthier and produce meat of a better quality. However, valid scientific information supporting this point of view is limited. This study was conducted to evaluate the growth rate, feed intake, dressing percentage, and organ weights of broilers raised on pasture versus those raised in a conventional (intensive) system. Three hundred sixty 1-d-old Cornish Rock male broilers were randomly assigned to 1 of 2 treatments (PPS = pasture production system, CPS = conventional production system). Each treatment consisted of 180 birds with 3 replications of 60 birds each. Both groups were offered a nonmedicated commercial broiler ration and water ad libitum. Body weights and feed intake were recorded weekly. After 49 d, birds were fasted overnight and slaughtered on d 50. Noncarcass components (viscera, feet, neck) and lymphoid organs (thymus, bursa of Fabricius) were harvested and weighed. Results showed no differences between treatments for final BW, total weight gain, ADG, ADI, total intake, feed efficiency, fasted weight, carcass weight, dressing percentage, and lymphoid organ weights. There were no differences for noncarcass components except the intestines which were higher (P < 0.05) in CPS birds (3.70%) than PPS birds (3.50%). Ceca weights were higher (P < 0.05) in PPS birds compared with CPS birds with 0.44% and 0.32%, respectively. Based on these results, broilers raised on pasture performed similarly to those raised conventionally. Further evaluation of the carcass is being assessed comparing the 2 production systems.

Key Words: pasture production system, conventional production system, performance, broiler, lymphoid organs

179 Comparative effects of in ovo versus subcutaneous vaccination and pre-placement holding time on early post-hatch broiler chick quality. E. D. Peebles1, T. M. Barbosa2, T. S. Cummings2, J. Dickson2, and S. K. Womack1, 1Department of Poultry Science, Mississippi State University, Mississippi State, MS, 2Zoetis, Research Triangle Park, NC.

Main and interactive effects of the in ovo or subcutaneous (sc) vaccination of HVT vaccine (trt) and 4- and 18-h pre-placement holding times (pht) on the quality of male broiler chicks through 7 d of age were investigated. A total of 3,900 Aviagen 708 broiler hatching eggs were randomly set in each of 15 replicate flats (blocks) for each of the following 4 pre-assigned trt and pht combinations in a single stage Jamesway incubator. Eggs were in ovo-vaccinated at 18 d of incubation or chicks from eggs that were not in ovo-injected were vaccinated sc at hatch, and chicks from each vaccination trt group were held for 1 of the 2 pht. In ovo injections (50 µL) were delivered by a commercial multi-egg injector and sc injections (0.2 mL) were delivered by an automatic pneumatic sc injector. At hatch and placement, chick BW and length, yolk-free chick BW, yolk sac weight, and yolk and chick moisture concentrations were determined. Chick BW was determined at 7 d of age. All data were analyzed by a repeated measures mixed model with trt, pht, and sampling time as fixed factors and block as a random factor. Yolk weight and body moisture were greater in the 4-h than in the 18-h pht chicks, whereas the reverse was true for yolk moisture (P < 0.0001). Furthermore, body length was increased at hatch by in ovo injection (P = 0.0284) and was greater for the 18-h than for the 4-h pht chicks (P < 0.0001). Mean hatching body lengths in non-injected and in ovo-injected groups were 17.13 and 17.36 cm, respectively (pooled SEM = 0.074). The 7 d BW of 4-h pht chicks was greater than that of 18-h pht chicks (P < 0.0001). Chick BW on d 7 was 170.4 and 162.2 g for the 4- and 18-h pht, respectively (pooled SEM = 1.56). In conclusion, in ovo injection did not negatively affect chick quality through 7 d of age whether or not they were held for 4 or 18 h before placement. Therefore, in ovo and sc injections were equally safe for the administration of the HVT vaccine. Performance data through processing age will be included in subsequent reports.

Key Words: broiler, holding time, in ovo injection, subcutaneous injection, vaccination

180 Effects of broiler hatching egg storage period and storage heating on hatchability, hatching time, and subsequent broiler live performance. R. Shiranjang1, S. Özli1, M. Güçbilmez1, O. Elibol1, and J. Brake2, 1Department of Animal Science, Faculty of Agriculture, University of Ankara, Ankara, Turkey, 2Prestage Department of Poultry Science, North Carolina State University, Raleigh, NC.

Hatching eggs from 28- and 29-wk-old broiler breeder flocks were collected from mechanical nests and stored for 1 d in a hatchery egg storage room at 17°C and 75% RH. The eggs then either remained in storage (control) or were subjected to a heating regimen of 26°C for 2 h, 37.8°C for 3 h, and 26°C for 2 h in a Petersime setter before returning to storage. Half of the eggs were stored for 3 d more (Heat 1–4d) while half of the eggs were stored for 10 d more (Heat 1–11d). Control eggs stored for 4 d or 11 d without heating were co-incubated in each experiment. There were 10 trays of 150 eggs each per treatment in each storage period (6,000 eggs total) in both experiments. Chicks that had hatched at 468–480 h, 481–492 h, and 493–510 h of incubation were identified per heating treatment from each storage period. At 510 h of incubation, chicks were removed from the trays, feather sexed, permanently identified with neck tags, weighed, and placed in floor pens on new wood litter shavings. There were 768 day-old male chicks assigned to 48 pens in a 2 (storage period) x 2 (storage heating) factorial design with 12 replicates of 16 birds each. BW and feed consumption were determined at 7, 14, and 21 d of age. Hatchability of fertile eggs decreased with longer egg storage due to increased early and late deaths. There was no benefit observed in Heat 1–4d eggs but hatchability of fertile Heat 1–11d eggs was increased because early deaths decreased as compared with control. As expected, the eggs stored for 4 d hatched earlier than those stored for 11 d and eggs heated at 1 d of storage hatched earlier than their control. Broiler BW and feed intake were significantly decreased at 7, 14, and 21 d by longer storage but were not affected by storage heating.

Key Words: hatching egg storage, heating hatching egg, hatchability, hatching time, broiler