

Body weight (BW) and cumulative feed:gain (cFCR) were determined at 4 and 11d of age. Ileum histomorphometry (8 villi/bird) were measured (10 poult/ TRT) at 1, 4 and 11d of age. Villus height (VH), crypt depth (CD), mucosal height (MH), Villus height-crypt depth ratio (V/C) and apparent villus surface area (VS) were determined. At hatch, there were no significant ( $P>0.05$ ) differences in BW between incubation TRT. One hour after placement, only 24% of IOF poult showed no activity compared with 46% of the controls (2.455 vs. 4.667 lethargic birds/pen,  $P<0.02$ ). At 1d, IOF poult had higher CD (1.251 vs 1.105  $\mu\text{m/g}$ ,  $P<0.01$ ) and MH (5.00 vs 4.436  $\mu\text{m/g}$ ,  $P<0.1$ ) than controls. At 4d, dietary HMB significantly reduced CD (1.317 vs 1.661 $\mu\text{m/g}$ ,  $P<0.1$ ), ML

(5.808 vs 6.349  $\mu\text{m/g}$ ,  $P<0.05$ ), and VS (380.6 vs 418.6  $\mu\text{m}^2/\text{g}$ ,  $P<0.01$ ). At 11d, only VS was significantly lower ( $P<0.05$ ) in IOF poult (309.3 vs 386.9  $\mu\text{m}^2/\text{g}$ ,  $P=0.05$ ) as compared to controls. But by then, IOF-treated poult had 5% higher body weights (240 vs. 228 g,  $P=0.05$ ) and 6% lower cFCR (1.266 vs 1.343 g:g,  $P<0.05$ ) than controls. *In-ovo* feeding enhanced eating activity and early enteric development (higher CD and VH) of poult, which may improve nutrient absorption and performance; although, these effects can be quenched by dietary HMB (0.1% of diet) during the brooding phase

**Key Words:** Poult quality, Performance, Gut health

## Environment & Management I

**M29 Livestock activities among Peri-urban households in Ibadan metropolis, Nigeria.** E. O. Uwagboe\*, J. O. Oladeji, and L. A. Akinbile, *University of Ibadan, Ibadan, Oyo State, Nigeria.*

The inception of Peri-urban agriculture in Nigeria especially livestock rearing to supplement the grossly inadequate protein intake of citizens is a welcome development. This study examined livestock activities among Peri-urban households in Ibadan Metropolis of Oyo state, Nigeria. Systematic random sampling technique was used to select 120 respondents out of 400 registered livestock farmers and questionnaire was used to elicit information from the respondents. Descriptive statistics such as frequency counts, percentages, charts were used for data presentation while Chi-Square was used for the analysis. The result revealed that all (100%) of the respondents are literate with primary education (57%) secondary (29%) and tertiary (14%); and 60% take poultry farming as their primary farming occupation. Majority (57%) of the respondents were within the age range of (30-50 years) with a mean age of 37 years. It was also revealed that the type of livestock mostly reared by the respondents was poultry (76%). Respondents indicated that benefits derived from rearing of livestock include; serving as source of protein food for the family (35%) and source of income (65%). Chi-Square result revealed that the primary occupation ( $X^2=21.62$ ,  $P\leq 0.05$ ), Marital status ( $X^2=28.55$ ,  $P\leq 0.05$ ), and constraints faced by the respondents ( $X^2=35.55$ ,  $P\leq 0.05$ ) are significantly related to their livestock activities. In conclusion, most of the livestock reared by the respondents is poultry and it serves as their primary farming occupation. Hence concerted efforts should be geared towards improving livestock production through training of the Peri-urban dwellers on improved technologies in poultry production. This will increase animal protein intake, enhance income and improve food security.

**Key Words:** Livestock, Peri-Urban, Households, Ibadan, Nigeria

**M30 Genomic analysis of the impact of aflatoxin on hepatic function of male broiler chicks.** L. P. Yarru\*, R. S. Settivari, E. Antoniou, D. R. Ledoux, and G. E. Rottinghaus, *University of Missouri, Columbia.*

The objective of this study was to determine the effects of dietary aflatoxin (AF) on hepatic gene expression in male broiler chicks. Seventy five day-old male broiler chicks were assigned to three dietary treatments (5 replicates of 5 chicks each) from hatch to day 21. The diets contained 0, 1 and 2 mg AF/kg of feed. Aflatoxin reduced ( $P<0.05$ ) feed intake, body weight gain, serum total proteins, serum Ca and P but increased ( $P<0.01$ ) liver weights in a dose dependent manner. Microarray analysis was used to identify shifts in genetic expression associated with the affected physiological processes in chicks fed 0 and 2 mg AF/kg of feed to identify potential targets for pharmacological/toxicological intervention. A loop design was used for microarray experiments with 3 technical and 4 biological replicates per treatment group. RNA was extracted from liver tissue and its quality was determined using gel electrophoresis and spectrophotometry. High quality RNA was purified from DNA contamination, reverse transcribed, and hybridized to an oligonucleotide microarray chip. Microarray data were analyzed using a 2-step ANOVA model and validated by quantitative real-time PCR. Genes with false discovery rates less than 12.5% and fold change greater than 1.4% were considered as differentially expressed. Compared with controls, various genes associated with energy production and fatty acid metabolism (carnitine palmitoyl transferase), growth and development (insulin like growth factor), antioxidant

protection (glutathione S transferase), detoxification (epoxide hydrolase), and immune protection (interleukins) were down-regulated, whereas genes associated with cell proliferation (ornithine decarboxylase) were up-regulated in birds fed AF. This study demonstrates that AF exposure results in physiological responses associated with altered gene expression in chick livers.

**Key Words:** Gene expression, Aflatoxin, Chick liver, Microarray analysis

**M31 Effect of pellet quality and manufacturing method on fat distribution in a commercial feed system.** C. Hancock\*, R. S. Beyer, C.M. Rude, K. Dobbelleare, and J. Burden, *Kansas State University, Manhattan.*

In the poultry industry, flock uniformity is critical. This study was designed to determine the effects of an industry pan feeder system on the proportion of pellets to fines in pelleted broiler feed and to examine the distribution of nutrients. Previous work indicated that an incremental increase from 8.7% fines in the first pan to 33.7% fines in the last pan was observed in feed with a pellet durability index (PDI) of 79 while an increase from 8.2% to 27.7% fines was observed in feed with an 85 PDI. Even when feed is sifted, an increase from 3.2% to 20.18% fines was observed in 79 PDI feed while an increase from 2.64% to 15.25% fines was observed in 85 PDI feed. A Chore-Time Model C2 Plus feed line with Brock feed bin and Model 75 auger line with surge bin was constructed with 93 pans spanning a 240 foot line. For these studies, feed was added directly to the surge bin. Feed was collected at pre-determined pans. In this trial, we examined pellets coated with 4.85% soybean oil and conducted fat analysis to determine fat distribution in select pans along the line. The pellets were placed in a Davis S-3 mixer and then coated with soybean oil by mixing for two min. The feed was then placed in the surge bin, passed through the feed line and collected at 12 pre-selected pans. The results indicated fines increased along the line from 1.53% to 2.49% while pellets decreased from 98.47% to 97.51%. The samples were extracted with ether and the fat content was determined. The results indicate that the fat content increased from 6.96% to 7.31% in the pellets and decreased from 7.94% to 7.69% in the fines. The difference in fat content indicates that nutrient inconsistencies in the line could contribute to uniformity problems in a flock. Further examination may be necessary to determine if other nutrients differ when feed is passed through long feeder systems.

**Key Words:** Feeding systems, Fat, Distribution, Pellet quality, Fines

**M32 Embryonic incubation and post-hatch transportation effects on intestinal nutrient transporter expression during the perinatal period in broilers.** A. Barri\*<sup>1</sup>, E. Wong<sup>1</sup>, R. Dalloul<sup>1</sup>, M. Wineland<sup>2</sup>, and A. P. McElroy<sup>1</sup>, <sup>1</sup>*Virginia Polytechnic Institute And State University, Blacksburg,* <sup>2</sup>*North Carolina State University, Raleigh.*

Modern broilers are incubated and hatched under guidelines established for poultry not capable of the tremendous growth parameters that the current genetic lines have. Evidence suggests that failure to satisfy optimum incubation requirements has potential to result in poor chick quality and decreased performance. Compromised development of the intestine pre-hatch or at hatch can result in delayed mucosal development and subsequent detrimental broiler performance.

This study evaluated effects of embryonic incubation and post-hatch transportation temperatures on gene expression in the brush border of the small intestine of commercial broilers. 5200 Cobb 500 eggs were incubated at egg-shell temperatures of low (L, 36.7°C), standard (S, 37.5°C), and high (H, 39°C). All eggs were incubated at S during d8-17, with combinations of the other temperatures occurring on d1-7 and d18-21 to generate four treatments: SS, SH, LS, and LH. At d0, chicks were separated into two transportation groups: control (T1) and heat-stressed (T2). Resulting groups were: LS1, SS1, LH1, SH1, LS2, SS2, LH2, and SH2. On d0, 4 and 6 post-hatch, intestinal mucosal samples were collected for gene expression analysis of 5 nutrient transporters (SGLT1, GLUT2, GLUT5, PepT1, and EAAT3) in duodenum, jejunum and ileum. Real time PCR was performed using the relative quantification method. On d0, incubation temperature and temperature by transportation interactions influenced expression of PepT1 and EAAT3 in ileum and jejunum. PepT1 and EAAT3 were more highly expressed in ileum with SS incubation and in jejunum with LS incubation. On d0, higher levels of SGLT1 expression in ileum and jejunum were observed with T2, and in jejunum, transportation by temperature interactions were also observed. Expression of GLUT2 in duodenum was higher on D0 with T1. On d6, GLUT5 had higher expression in duodenum from LH chicks, T2 chicks, and temperature and transport interactions were also observed. Data suggests that expression of intestinal nutrient transporters is altered by embryonic incubation and post-hatch transport temperatures.

**Key Words:** Incubation, Transportation, Nutrient transport

**M33 Embryonic incubation and post-hatch transportation effects on organ development and performance in broiler chickens.** A. Barri<sup>\*1</sup>, S. Martin<sup>4</sup>, M. Wineland<sup>2</sup>, M. Farnell<sup>3</sup>, D. J. Caldwell<sup>3</sup>, and A. P. McElroy<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute And State University, Blacksburg, <sup>2</sup>North Carolina State University, Raleigh, <sup>3</sup>Texas A&M University, College Station, <sup>4</sup>Cobb-Vantress, Siloam Springs, AR.

Reports indicate *in ovo* and perinatal developmental stages as crucial periods in the chick's life, but few are available to demonstrate that temperature stressors at these early phases affect development of digestive and immune organs with subsequent impact on performance of commercial broilers. This study evaluated effects of embryonic incubation and post-hatch transportation temperatures on broiler performance and development of digestive and immune organs. 5200 Cobb 500 eggs were incubated at egg-shell temperatures of low (L, 36.7°C), standard (S, 37.5°C), and high (H, 39°C). All eggs were incubated at S for d8-17, with combinations of L and H on d1-7 and d18-21 to generate four treatments: SS, SH, LS, and LH. At hatch, chicks were separated into two transportation groups: control (T1) and heat-stressed (T2). The resulting groups were: LS1, SS1, LH1, SH1, LS2, SS2, LH2, and SH2. At d0 (pre and post transport), 2, 4, and 6 post-hatch, body and organ weights (yolk sac (YS), small intestine (SI), SI with gizzard & proventriculus (GI), spleen and bursa) were collected. Performance data was collected on d14, 28, and 42 corresponding with diet changes. Differences are significant at  $p < 0.05$ . On DOH pre-transport, LH had heavier and SS lighter YS as compared to LS and SH, while GI, SI and bursa were heavier from SS and SH chicks. At DOH post-transport, GI and SI were heavier in SS than LH, and chicks from T2 had heavier GI than those of T1. An interaction between incubation temperature and transport was observed for GI. On d2 and d4, SS, SH, and LH had higher BW than LS, and there was an interaction between temperature and transport on BW, YS, and GI. In birds reared for performance measurements, incubation temperature had an effect on post-hatch BW on d0, d14, and d28 and interactions were observed on d0, d14, and d28. Differences in BWG were observed on d14 (SH1 increased) and d42 (T1 increased BWG as compared to T2). Data indicate that embryonic incubation and post-hatch transportation temperature have significant impacts on organ development and post-hatch performance of commercial broilers.

**Key Words:** Incubation, Transportation, Performance

**M34 Effects of in ovo injection of metabolic compounds and stimulants, and of the volume of select salt solutions on broiler embryo livability and growth.** B. M. McGruder<sup>\*1</sup>, E. D. Peebles<sup>1</sup>, D. A. Braasch<sup>1</sup>, M. A. Dekich<sup>2</sup>, M. M. Keralapurath<sup>1</sup>, P. D. Gerard<sup>3</sup>, and R. W. Keirs<sup>1</sup>, <sup>1</sup>Mississippi State University, Mississippi State, <sup>2</sup>AviTech, LLC, Salisbury, MD, <sup>3</sup>Clemson University, Clemson, SC.

Effects of automated in ovo injection of various volumes of physiological salts, of various types of metabolic compounds, and of various stimulants on the livability and growth of broiler embryos were investigated in separate trials. Solutions were injected into the amnion of embryos at d 16 of incubation. Embryo mortality; relative embryo weight and moisture content; relative dry embryo weight; and relative yolk sac weight and yolk moisture content were evaluated on d 18 of incubation in each trial. Potassium chloride (5.5 mM; KCl) and physiological saline (117 mM; NaCl) were tested at 200, 400, 800, and 1200  $\mu$ L volumes. The efficacies of metabolic compounds, carried in 5.5 mM KCl, including a carbohydrate/electrolyte solution (CEN), tripotassium citrate (TPC), or sodium monophosphate (NaPO<sub>4</sub>) were investigated in a single trial. The efficacies of 1 mM caffeine, theophylline, creatine monohydrate, or L-arginine, carried in 5.5 mM KCl, were investigated in a separate trial. None of the injected solutions had a significant effect on embryo mortality. The 800 and 1200  $\mu$ L volumes of NaCl and KCl decreased d 0-18 percent egg weight loss. However, d 0-18 percent egg weight loss was not affected by the injection of 200 and 400  $\mu$ L volumes of NaCl or KCl or, alternately, by the injection of CEN, TPC, or NaPO<sub>4</sub> solutions. Injection of NaCl, NaPO<sub>4</sub>, or the CEN caused a decrease in percent embryo moisture. The loss was negated by the injection of TPC, which returned the embryo moisture levels to those of the non-injected controls. These data suggest that injection of the aforementioned solutions may reestablish an ideal moisture level for injected eggs, and that they have potential for use individually or in combination in the commercial injection of broiler hatching eggs to promote subsequent hatchability and post-hatch growth.

**Key Words:** Automated injection, In ovo nutrition, Stimulant, Metabolic compound, Volume

**M35 Effect of the inclusion of phytase in low available phosphorus broiler breeder diets on fecal moisture.** M. Arguelles-Ramos<sup>\*1</sup>, A. B. Leytem<sup>2</sup>, and J. T. Brake<sup>1</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>USDA-ARS, NWISRL, Kimberly, ID.

An experiment was performed to evaluate the effect of inclusion of phytase in diets deficient in available phosphorus (AvP) on fecal moisture and performance of broiler breeders. Forty-eight 30-wk-old Ross 308 broiler breeders were placed in individual cages equipped with aluminum trays and cups for feces and urine collection. The design of the trays and cups was such that a crude separation of feces and urine could easily be made. Mixed feces and urine samples were collected prior to application of dietary treatments to determine the fecal moisture content of each bird with a regular broiler breeder feed. Two replicate groups of six birds each were then fed one of four isocaloric and isonitrogenous diets that contained 3.0% calcium for 3 wk. The positive control (PosCon) diet contained 0.5% AvP and the negative control (NegCon) diet contained 0.25% AvP. Phytase enzyme at 275 FTU/kg of feed (1XPase) and 550 FTU/kg of feed (2XPase) was added to the NegCon diet to create the third and fourth diets. The birds received 154 g of feed in individual feeders daily. There was a surprisingly large variation in the amount of urine produced daily among the hens. However, based upon moisture content of feces relative to pretreatment values on an individual bird basis, the general trend was that the NegCon produced feces with greater moisture content than did the PosCon and the stepwise addition of phytase to the NegCon diet resulted in a stepwise reduction in the fecal moisture content. This would be consistent with an explanation that urinary phosphate is necessary to buffer and provide a mechanism for the loss of hydrogen ions without the necessity of excessive water excretion as a vehicle for hydrogen ion loss.

**Key Words:** Phytase, Broiler breeders, Fecal moisture, Urine, Phosphorus

**M36 Correlation comparison between Coccidiosis lesion scores and fecal oocyst counts.** J. Bray\*<sup>1,2</sup>, T. Cherry<sup>1</sup>, J. Carey<sup>2</sup>, and C. Taylor<sup>1,2</sup>, <sup>1</sup>Stephen F. Austin State University, Nacogdoches, TX, <sup>2</sup>Texas A&M University, College Station.

In the United States, Coccidiosis lesion scoring by the Johnson and Reid Method is the poultry industry's preferred method of evaluating a Coccidiosis control program. In Mexico, fecal oocyst counts are the preferred method of evaluation. With the use of both methods there remains the question, are the two correlated? A study was conducted to determine if there is a correlation between Coccidiosis lesion scores and fecal oocyst counts. In Guadalajara, Mexico broiler chickens were lesion scored using the Johnson and Reid method. Birds were checked for *E. acervulina*, *E. maxima*, and *E. tenella*. Bird necropsies were performed on flocks at approximately 2, 3, 4, 5, 6 and 7 weeks of age. Ten birds per house were randomly selected from each farm for every age group. At the same time, fecal samples were taken from each house at each farm for all age groups. Fecal floatations were conducted for each sample and the oocyst counts were recorded for *E. acervulina*, *E. maxima*, and *E. tenella*. All birds sampled were on their second grow-out using a Coccidiosis vaccine program. After graphing the data, it was determined there is a correlation between the Coccidiosis lesion score method and the fecal oocyst count method for each of the three species. Lesion scores and fecal oocyst counts progressed in a manner normal for a Coccidiosis vaccine program. *E. acervulina* lesion scores and fecal oocyst counts were greatest at 2 weeks of age and then subsided throughout the remaining weeks. *E. maxima* lesion scores and fecal oocyst counts peaked between 3 and 4 weeks, while *E. tenella* lesion scores and fecal oocyst counts were minimal throughout the study. Oocyst production peaks were seen at 2, 4, and 6 weeks of age, demonstrating the cycling of oocyst through the bird, while lesion scores diminished through the weeks.

**Key Words:** Coccidiosis, Vaccine, Broilers, Oocyst, Eimeria

**M37 Effects of air ozonation on commercial broiler houses.** J. H. Small\*, E. O. Oviedo-Rondón, L. Wang, Z. Liu, B. Sheldon, G. Havenstein, and M. Williams, North Carolina State University, Raleigh.

During the grow-out phase of broiler production, ammonia (NH<sub>3</sub>) is generated and released into the environment. It has been proposed that addition of ozone (O<sub>3</sub>) can oxidize NH<sub>3</sub> thereby reducing concentration. This project evaluated the effects of air ozonation on live performance, NH<sub>3</sub> and O<sub>3</sub> concentrations ([NH<sub>3</sub>] and [O<sub>3</sub>]), and bacterial populations in commercial broiler houses. On a single broiler farm, 2 paired houses were selected and O<sub>3</sub> was constantly added to the air, while the other 2 houses served as controls. Trial 1 was run on litter that held 8 previous flocks. New wood shavings were placed and trials 2 and 3 were run. Portable Multi Gas Units using Draeger dataloggers were used to measure [NH<sub>3</sub>] and [CO<sub>2</sub>] over a 48 hour sampling period weekly. [O<sub>3</sub>] outside the houses were obtained bi-weekly using 3 O<sub>3</sub> meters. Trial 1 showed (P<0.05) heavier male and female birds in the control houses at 42d. 56d BW showed no significant differences in any of the three trials. The control birds weighed 50g more at processing, with a feed conversion ratio (FCR) 0.01 g:g better, but mortality was increased by 0.34%. 0-10ppm [NH<sub>3</sub>] reductions were observed in the ozonated houses with no statistical difference between treatments. The external [O<sub>3</sub>] remained 0.01-0.1 ppm over the course of the 3 trials. In Trial 2, male birds were heavier (P<0.05) in the ozonated houses at 42d. At processing the birds from the ozonated houses were 86g heavier, but mortality was 1.79% higher, and the FCR was 0.01 worse. 0-8 ppm [NH<sub>3</sub>] reductions were observed in the ozonated houses with no statistical difference between treatments. Trial 3 male and female control house birds were heavier (P<0.05) at 42d. At processing the control houses weighed 82g more, mortality was 0.8% higher, and the FCR was 0.08 better. No consistent trends in airborne or litter bacterial populations (total aerobes, *Enterobacteriaceae*, and *Salmonella*) were observed between the control and ozone-treated houses. While in some instances, small improvements in broiler performance, due to ozonation, were noted, these improvements were inconsistent.

**Key Words:** Ozonation, Broilers, Ammonia, Performance, Bacteria

**M38 Contaminated larval and adult darkling beetles can serve as vectors in transmission of *Salmonella* Typhimurium in a broiler flock.** A. J. Roche\*<sup>1</sup>, R. J. Buhr<sup>2</sup>, L. J. Richardson<sup>2</sup>, N. A. Cox<sup>2</sup>, B. D. Fairchild<sup>3</sup>, G. R. Siragusa<sup>2</sup>, and N. C. Hinkle<sup>1</sup>, <sup>1</sup>University of Georgia, Athens, <sup>2</sup>Poultry Microbiological Safety Research Unit, Russell Research Center, Athens, GA, <sup>3</sup>University of Georgia, Athens.

Understanding the role darkling beetles serve in *Salmonella* transmission is critical in order to develop better foodborne pathogen intervention strategies on the broiler farm. Prior studies have shown that *Salmonella* can persist in darkling beetles (*Alphitobius diaperinus*) up to 63 d, more than long enough to contaminate subsequent broiler flocks. The objective of this study was to assess the spread of *S. Typhimurium* in a broiler flock via seeder chicks gavaged with colonized adult or larval beetles. Day-of-hatch chicks were challenged with a naladixic acid resistant strain of *S. Typhimurium* at 10<sup>4</sup> CFU/ bird by either a peptone suspension or gavage with 4 adult or 4 larval beetles. Either 1 or 2 seeder chicks for each challenge type were then placed into pens containing non-inoculated chicks. Each pen contained a total of 40 chicks at a density of 0.7 ft<sup>2</sup>/bird. Cecal samples were taken at 3 and 6 wk of age. For the peptone challenge pens, 29% of the seeder broilers and 10% of the sampled pen mates were positive at 3 wk of age and 2% at 6 wk. For the adult beetle challenge pens, 0% of the seeder broilers and 15% of sampled pen mates were positive at 3 wk and 7% at 6 wk. For the larval beetle challenge pens, 33% of the seeder broilers and 45% of sampled pen mates were positive at 3 wk and 11% at 6 wk. In this study, seeder chicks became colonized with *Salmonella* by oral gavage of either adult or larval beetles and spread *Salmonella* to pen mates. These results demonstrate that beetles colonized with *Salmonella* could be a significant vector for the transmission of *Salmonella* to chicks when ingested and readily spread *Salmonella* throughout a broiler flock.

**Key Words:** *Alphitobius diaperinus*, *Salmonella* Typhimurium, Darkling beetles, Lesser mealworm, Broilers

**M39 Effects of crude protein dietary levels on nitrogen mass balance of commercial broilers.** C. Taylor\*<sup>1,2</sup>, J. Bray<sup>1,2</sup>, J. Carey<sup>1</sup>, T. Cherry<sup>2</sup>, and D. Hoehler<sup>3</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Stephen F. Austin State University, Nacogdoches, TX, <sup>3</sup>Degussa Corporation, Kennesaw, GA.

A major concern facing the poultry industry is the amount of nitrogen that is produced within a commercial broiler facility. Ammonia emissions are positively correlated to nitrogen production. Ammonia is considered an air pollutant and nuisance to commercial facility neighbors, high ammonia concentrations also lead to reduced animal performance. In this study, dietary crude protein levels were adjusted utilizing methionine, threonine, and lysine. The study was conducted under simulated commercial conditions to more accurately determine the amount of litter moisture, litter nitrogen, caked litter nitrogen, bird performance, and nitrogen loss. Broilers were housed in twenty-four 10â€™ X 10â€™ pens with 134 broilers placed per pen, such that at 49 days of age 0.75 square foot per bird was allowed. The four dietary treatments were an average industry diet (A) and 3 diets where crude protein was reduced by 0.5% (B), 1.0% (C), and 1.5% (D) for starter, grower, and finisher periods. Samples of incoming and outgoing sources of nitrogen and broiler weights were taken at Day 0 and 49 of age. Mass balance was calculated on a dry matter basis. For Day 49 litter nitrogen, no significant difference was detected at alpha = 0.05 level (A = 3.5598%, B = 3.3641%, C = 3.4942%, D = 3.5684%). A significant difference (p < 0.05) was detected between trt B (4.1543%) and trt C (4.9108%) for caked litter nitrogen. No significant difference was present across the treatments for ending litter percent moisture (A = 29.4722%, B = 24.3844%, C = 27.3443%, D = 25.7142%). For caked litter percent moisture, there was no significant difference (A = 50.9685%, B = 44.4125%, C = 46.1813%, D = 49.8887%). There was a significant difference for trt A (2.9988 kg) and trt D (3.1170 kg) for Day 49 bird weights. For nitrogen loss (g/kg of bird marketed), there was no significant difference detected (A = 4.0691, B = 4.5792, C = 3.2383, D = 4.7177). This experiment aids in determining the impact of crude protein levels on litter characteristics and nitrogen loss in a commercial broiler facility.

**Key Words:** Broiler, Nitrogen mass balance, Moisture, Litter, Crude protein

**M40 Disinfection of eggshells using ultraviolet light and hydrogen peroxide independently and in combination.** J. Wells\*, C. Coufal, H. Parker, and C. McDaniel, *Mississippi State University, Mississippi State.*

Eggshell bacteria are decreased by ultraviolet light (UV) or hydrogen peroxide (HP) alone, however, the antimicrobial effects of these two treatments combined as well as optimum length for UV exposure are not known. Therefore, the objectives were to obtain the optimum length of UV exposure for maximum bacteria reduction and to determine if a greater bacterial reduction would occur when using a combination of UV and HP as opposed to either treatment alone. The first experiment was conducted to find the optimum length of UV exposure by exposing eggs to 4, 8, 16 and 32 min of UV. Three experiments were conducted to determine what concentration of HP in combination with UV exposure would yield maximum bacterial reduction. For experiment 2, treatments consisted of a control and UV alone, as well as 0, 1, 2 and 3% HP alone and in combination with UV. For experiment 3, treatments consisted of a control, UV alone, 3% HP alone, as well as 0, 0.5, 1, 1.5, 2, 2.5 and 3% HP in combination with UV. Experiment 4 contained 10 treatments including control, 1.5, 2 and 2.5% HP at UV exposure times of 2, 4 and 8 min for each HP concentration. After each treatment, eggs were placed in a sterile bag, and 50 ml of sterile phosphate buffered saline (pH 7.2) was added. Rinsate (0.5 mL) from diluted samples was spread plated on tryptic soy agar in duplicate and incubated for 48 h prior to bacterial enumeration. Every control eggshell contained bacteria with an average bacterial count of 4 log. Exposure to only UV for 8 min yielded optimum bacterial reduction. When administered independently, HP and UV each reduced the bacterial count by 2 log, yielding no bacteria on 16% and 30% of the plates for HP and UV, respectively. The combination of HP and UV reduced bacterial counts by a maximum of 3 log and the percentage of eggs positive for bacteria by 65%. Because bacterial contamination was further reduced by using a combination of UV and HP, hatchability and chick quality of broiler breeder eggs may be improved by these treatments.

**Key Words:** Eggshell sanitation, Bacteria, Hydrogen peroxide, Ultraviolet light

**M41 Shaking eggs during incubation: An alternative to turning.** H. R. Cutchin\*, M. J. Wineland, and K. M. Mann, *North Carolina State University, Raleigh.*

The process of turning eggs during incubation causes reduced air flow across eggs potentially leading to hot spots in the machine (Buhr, 1989). However, not turning eggs correlates strongly with decreased hatchability. This project was designed to study the effects of shaking eggs during various periods of incubation. Two customized Chickmaster setters were used, one that turns eggs (turns) and one that oscillates (osc) (shakes) through 4.5cm. Three trials are reported. In trial 1, the shaker ran at 1osc/sec for 20sec every 30min. In trial 2, the duration and frequency increased to 1osc/sec for 30sec every 10min. In trial 3, the speed was increased to 1.25osc/sec for 20sec every 20min. Each of the trials contained 6 treatments: turn control (TC), 3 (T3), and 7 (T7) as well as shake control (SC), 3 (S3) and 7 (S7). The controls remained in the setter for 18 days

**M43 Nutritional value of biochemically treated cocoa bean shell in laying hen diets.** R. A. Hamzat\*, M. D. Olumide<sup>2</sup>, E. O. Uwagboe<sup>1</sup>, and A. O. Akinsoyinu<sup>2</sup>, <sup>1</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria*, <sup>2</sup>*University of Ibadan, Oyo, Nigeria*, <sup>3</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria*, <sup>4</sup>*University of Ibadan, Oyo, Nigeria*.

Many by-products that are considered as wastes in Nigeria have great potentials as poultry feed ingredients if properly handled, processed and incorporated into rations. One of such neglected by-products is Cocoa bean shell (CBS). Nigeria is the fourth largest producer of cocoa in the world and cocoa bean shell is abundantly wasting on all cocoa processing factories in Nigeria. This trial focused on detheobrominising cocoa bean shell through application of enzyme and fermentation in order to enhance its nutritional value for layers.

Two hundred and ten (210) six-week-in-lay hens were used for this trial with thirty birds, randomly allotted to seven experimental diets containing ten birds per

of incubation. The T3 and S3 groups started in their respective setter then were switched to the other setter at d3 of incubation and the T7 and S7 groups at d7. This was performed to determine if there is a critical time period during which eggs should be turned vs. shaken. In all 3 trials, the hatch of fertile was significantly lower in the SC group than the TC group due to significantly high early (d1-3) and late (d17-20) embryonic mortality. There were significantly higher numbers of pipped chicks in SC in trial 2 and trial 3 than the other treatments. Egg temp was monitored in trial 3 using temp probes. In the shake machine the average difference in egg temp between the top and bottom of the machine was 0.2°F, which was significantly different from 0.5°F in the turn machine. In conclusion, shaking 1osc/sec for 30sec every 10min can produce an adequate hatch of fertile, though still significantly lower than turning. Shaking faster is very detrimental and shaking less frequently is not as beneficial to hatch of fertile. Turning eggs for 7 days then moving to the shaker actually improved hatch of fertile in trials 2 and 3.

**Key Words:** Shaking, Incubation, Egg temperature, Turning, Critical period

**M42 Farmers' participatory evaluation of local by-products in broiler feeds.** E. O. Uwagboe\*, F. A. Iyoha<sup>2</sup>, E. O. Aigbekaen<sup>1</sup>, S. O. Adeogun<sup>1</sup>, R. A. Hamzat<sup>1</sup>, R. A. Sanusi<sup>1</sup>, B. O. Iyamu<sup>3</sup>, C. O. Imarhiagbe<sup>3</sup>, and L. A. Akinbile<sup>4</sup>, <sup>1</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria*, <sup>2</sup>*College of Education, Ekiadolor, Benin City, Nigeria*, <sup>3</sup>*Ministry of Agriculture and Natural Resources, Benin City, Nigeria*, <sup>4</sup>*University of Ibadan, Ibadan, Oyo State, Nigeria*.

The demand for animal protein is on the increase due to growth in population in Nigeria. For poultry industry to meet this demand research result need to be utilized for the improvement in poultry production. This study assessed farmers interest in the use of two experimental diets; kola pod husk and cassava peels. Specifically, the study was to investigate the socio economic characteristics of commercial poultry farmers, examine interest of farmers on the research result and examine the constraints militating against the use of by-products. The study was carried out in the Agricultural Development Programme poultry farm in Benin City. Thirty commercial farmers were randomly selected from the list of 300 members of Poultry Association of Nigeria Edo State to participate in the experiment and information was elicited with the use of questionnaire. The data were presented with frequency counts, percentages and charts while analysis was carried out using Chi-Square. The result revealed that the commercial farmers had mean age of 41 years with 85% having post secondary education and 60% have more than 5 years in poultry business. The Chi-Square result revealed that there is a significant relationship between level of education and interest in research results ( $X^2=14.56$ ,  $P\leq 0.05$ ). Based on responses to the constructed attitudinal statements on preferences and constraints, most (60%) of the respondents preferred kola pod husk while (40%) preferred cassava peels. In conclusion, farmers preferred the use of locally acquired by-products as a means of increasing income and reducing the heavy reliance on maize as source of energy for broiler birds.

**Key Words:** Farmers, Participatory, Evaluation, By-products, Broilers

## Nutrition II

replicate in a 3 × 3 factorial design. These diets were: A (0% CBS – control); B (5% raw CBS); C (10% raw CBS); D (5% CBS with enzyme); E (10% CBS with enzyme); F (5% fermented CBS); and G (10% fermented CBS). The layers on each diet were offered feed and water ad libitum throughout the experimental period. The results obtained indicated that there were significant differences ( $P < 0.05$ ) in feed intake, hen – day production and egg weight. Significant ( $P < 0.05$ ) differences were also recorded in internal quality characteristics (yolk weight, yolk height, yolk width, albumin weight, albumin height, yolk colour, haugh unit) and the external quality characteristics (egg length, egg width, shell width, shell thickness and shell percentage) of the eggs from the experimental layers. The enzyme treatment and fermentation technique improved the nutritive quality of cocoa bean shell in layers.

**Key Words:** Biochemical treatments, Cocoa bean shell, Laying hens, Egg quality