

digestibility in respective test diets to that in the basal ration. Complete amino acid (AA) profiles were developed for samples from the grower period (d28) to estimate AID. Extrusion and inclusion level were significant model components for all nutrients ($P < 0.05$). At 15% inclusion, extrusion improved AID of GE, Lys and Met in wheat DDGS by 27% (0.70 vs. 0.55), 34% (0.78 vs. 0.58) and 8% (0.90 vs. 0.85), respectively. Similarly, extrusion improved AID of GE, Lys and Met in corn DDGS (15% inclusion) by 45% (0.86 vs. 0.59), 28% (0.91 vs. 0.71) and 13% (0.96 vs. 0.85), respectively. Similar improvements in digestibility were observed for both DDGS types at 30% inclusion in the diet. Our results suggest extrusion is an effective strategy for improving AID of GE and AA, in particular Lys, in corn and wheat DDGS for broilers.

Key Words: DDGS, extrusion, broiler, digestibility

147 Economic modeling for optimizing broiler profitability on nutrient density. N. Sriperum*, G. M. Pesti, and M. E. Wetzstein, *University of Georgia, Athens.*

It has been stated that the goal of feed formulation should be to maximize profits. Associated cost minimization is a necessary condition for maximizing profits but by itself may not maximize profits. It has also been noted by several researchers, formulating diets to maximize profitability, rather than to maximize body weight gain or breast meat yield can increase the profitability of a broiler production system.

Thus, formulating diets to minimize feed costs might not be the most cost effective means of maximizing profitability. Early approaches of applying economics to feed formulation focused on reducing feed cost per bird, per unit of meat or per unit of breast (Pesti et. al, 1986). The concept behind maximizing profitability through nutrition is to formulate to the profit maximizing nutrient level and this study illustrates the methods used to apply this concept. Using data from a previously published lysine requirement paper, the broken-line quadratic (BLQ) model or the Saturation Kinetic (SK) model provided the best fit, based upon minimizing residual values. While it was noted the BLQ model best describes the concept of a nutritional requirement, it can be difficult to fit. Conversely, the SK model fits economic and diminishing marginal productivity data quite well while offering the concept of a 'most economical feeding level' versus the concept of 'requirement' *per se*. According to the reference paper, two diets were formulated based on digestible lysine (dLys) levels of 0.72 or 1.19%, which gave calculated CP levels of 15.02 and 22.53% respectively, although no crude protein minimum was specified. Feed ingredient prices from February 2008 and 2009 were used, which represents an elasticity of feed prices between high and low. The pricing scenario for 2009 predicted a higher dLys to maximize profits versus the situation from 2008. In general, when feed costs decline, it is more economical to feed a higher nutrient dense diet versus what was previously considered best. This emphasizes the point that formulation constraints should ideally be based upon economics and not just strict technical measurements.

Key Words: broiler, modeling, profitability, nutrient density

Environment and Management III

148 Effect of rate of preincubation temperature increase on hatchability of broiler hatching eggs. O. Elibol*¹, M. Gucbilmez¹, and J. Brake², ¹Ankara University, Faculty of Agriculture, Department of Animal Science, Ankara, Turkey, ²North Carolina State University, Department of Poultry Science, Raleigh.

This study investigated the effect of rate of preincubation temperature increase and broiler breeder flock age on fertile hatchability. In the trial 1 hatching eggs were obtained from Ross 344 male x Ross 308 female broiler breeders at 37 and 52 wk of age. Eggs were collected from the same flocks 4 wk later for trial 2 when the flocks were 41 and 56 wk of age. Eggs were collected from two different flocks at 34 and 47 wk of age in trial 3. Thus, there were younger (34-41 wk) and older (47-56 wk) flocks studied in each trial. All eggs were stored for 6 d at 18 C and 75% RH. Two preincubation treatments were applied with the eggs placed in two Petersime incubators that achieved the preincubation temperature of 26 C in either 1 h or 4 h. The total preincubation period from leaving the cooler to setting was 9 h. The eggs were then set in a single incubator that reached the incubation temperature of 37.8C in 8 h. In all trials each tray of 150 eggs constituted a replicate and 16 replicate trays (2400 eggs) were set per preincubation treatment at each flock age in each trial. Infertile and early deads (0-6 d) were identified by candling and removed at 14 d. At the time of removing the chicks from the hatchers, all unhatched eggs were opened and examined macroscopically to determine remaining embryonic mortality (middle (7-17 d) and late (18-21 d plus pipped)), and percentage fertile hatchability. Fertile hatchability was significantly better for the younger flocks. There were significant interactions of flock age X preincubation treatment for fertile hatchability and percentage early dead embryos because it was only the younger flocks that responded in a significantly positive manner to the more rapid rate of preincubation temperature increase.

These data show that reaching the preincubation temperature faster reduced early embryonic mortality and increased fertile hatchability in younger flocks.

Key Words: broiler hatching eggs, hatchability, preincubation

149 Strain and incubation temperature effects on embryonic and post-hatch growth of broilers. K. Kroesen*, J. Anderson, and M. S. Lilburn, *The Ohio State University, Wooster.*

In a series of experiments, eggs from two broiler strains, a commercial strain (C) and a slow-growing heritage strain (BR) were used. In Experiment 1, egg weight at set was greater in the C (59.3 g) vs BR (55.6 g) lines. Embryo dry weight increased progressively in both strains from 1.44 g (BR) and 1.84g (C) at day 14 to 6.20 g (BR) and 6.39 g (C) at day 19, respectively. In Experiment 2, the eggs were incubated at 38.0 C and 38.5 C from 0 to 10 days and then half the eggs in each initial treatment were switched to the other temperature through 19 days. There were no significant strain differences in embryo dry weight on day 17 but in both strains, embryo dry weight was increased by initial exposure to 38.5 C. Whole embryo staining at 17 days allowed for the determination of strain and temperature effects on the length of the entire torso, tibia, and shank. The length of each of these skeletal components was significantly greater in C versus BR embryos. Exposure to the 38.5 C temperature from 0 to 10 days also resulted in a significant increase in tibia length in both strains but no consistent effects on overall torso or shank length.

Key Words: embryo, broiler, incubation, temperature

150 Effects of two incubation profiles upon embryo and chick characteristics of 3 breed crosses. M. J. Wineland*, H. R. C. Evans, E. O. Oviedo, C. M. Ashwell, and P. R. Ferket, *North Carolina State University, Raleigh.*

Less than optimal incubation temperatures have been demonstrated to have an effect upon the physiology of the embryo which can impact future performance of the broiler chick. The experiment used two incubation profiles, the first (SS) eggshell temperature (EST) was maintained at 37.5C. The second profile (LH) was similar to what one observes when eggs are in a multi-stage incubation system, the first 7 days EST was maintained at 36.5C, during the second 7 days at 37.5C and the remaining days at 39C. 3 breed crosses (B) from the same breeder were used. All eggs were individually numbered and weighed at the start of incubation and again at embryo sampling to determine conductance. Relative embryo weights without yolk (REW) were determined at day 13, 15, 17, 18, 19, 20 and at hatch (H). Relative liver weights (RLW) were determined at 15d, 18d and at hatch and glycogen (GLY) determination made at 15, 18d and hatch. Relative heart weight (RHW), GLY and right ventricle: left ventricle ratio (RV: LV) was determined at hatch. RBW for B was significantly different only at 15 and 19d, while RLW was different only at 18d. LH incubation profile demonstrated significantly lower REW at all days; significantly lower RLW at 15d (1.81 v 1.98%) and at H (2.55% v 2.80%). RHW was significantly less for LH (0.74% v 0.97%). The RV:LV ratio was significantly greater for LH than SS at 37.4 and 30.6% respectively, indicating potential pulmonary hypertension. This experiment demonstrates that the LH profile had serious effects upon the growth of the embryo and specific organ systems critical to the energy needs and viability of the embryo. The experiment demonstrates that incubation conditions can alter heart physiology and potentially impact the health of the hatchling during grow out.

Key Words: incubation, embryo, pulmonary hypertension

151 Incubation temperature and vaccination effects on early post-hatch immune organ weight and yolk sac utilization in commercial broilers. J. Sottosanti*¹, A. Barri¹, M. Wineland², R. Dalloul¹, and A. P. McElroy¹, ¹*Virginia Polytechnic Institute and State University, Blacksburg,* ²*North Carolina State University, Raleigh.*

Temperature stress during embryonic incubation can influence post-hatch performance, response to post-hatch stress, and development of immunocompetence. Vaccination in ovo or at hatch can induce physiological stress by necessitating an immune response in chicks, and response to vaccination may be impacted by other stressors. This study evaluated effects of incubation temperature and vaccination on post-hatch immune organ weight, yolk sac absorption, and yolk-free body weight (YFBW) in commercial broilers. Cobb 500 eggs were incubated with the following shell temperatures during early and late incubation: low (L:36.7°C), standard (S:37.5°C), and high (H:39°C). Eggs were incubated at S from E8-14, and combinations of L or S during early (E0-7) incubation and S or H during late (E15-21) incubation, yielding four incubation treatments: LH, LS, SH, and SS. Marek's (MDV) and Newcastle (NDV) vaccines were administered in ovo at E18 or by subcutaneous injection at hatch, respectively. Birds were selected from each of the four incubation groups and were administered no vaccine, MDV or NDV, or both vaccines (MDV+NDV) producing 16 treatments. Birds were weighed and yolk sac, bursa, thymus, and spleen were collected at d0, 2, 4, 10, and 14 post-hatch. There were no significant incubation effects on YFBW at d0. However, by d2 SH and SS groups had higher ($P<0.0001$) YFBW compared to LH, which was higher than LS. At d4, LS birds had the lowest ($P<0.0001$) YFBW relative to other groups. Cor-

respondingly, yolk sac weights were highest ($P<0.0001$) in LH and LS and lowest in SS from d0 to d4. At d2, MDV birds had higher ($P=0.04$) YFBW than those vaccinated for NDV. Spleen weights at d10 were higher ($P=0.0036$) in MDV or MDV+NDV birds compared to control. At d14, MDV and MDV+NDV groups had higher ($P=0.009$) spleen weights compared to NDV. While there was no interaction between incubation temperature and vaccination on the parameters measured, results suggest that early and late incubation temperature stress may negatively impact early BW and yolk sac absorption.

Key Words: incubation, vaccination, broiler

152 Effects of maternal energetic efficiency on myofiber number of biceps femoris muscle of one-day-old broiler chicks. L. F. Romero*¹, M. J. Zuidhof², F. E. Robinson², A. Naeima², and R. A. Renema², ¹*Danisco Animal Nutrition, Marlborough, United Kingdom,* ²*University of Alberta, Edmonton, AB, Canada.*

This study evaluated the effect of maternal broiler breeder (BB) energetic efficiency on egg and chick weights, and weight and total fibre numbers (TFN) of biceps femoris muscles of 1 d old chicks. The experimental design was a 2 x 2 factorial with 2 levels of maternal residual feed intake (RFI_{mat}: Low and High) and 2 levels of maternal residual ME_m (RME_{mmat}: Low and High). RFI was the difference between observed and predicted ME intake, and RME_m was the difference between observed and predicted maintenance requirements relative to ME intake. Egg and chick weight were investigated in 214 chicks hatched from 32 59-wk old hens selected from a larger study. Biceps femoris muscle weights were assessed in 1 chick per hen, and myofibre number assessed in 1 biceps femoris muscle from 16 of these chicks representing hens with the greatest or least RFI and RME_m values. The least efficient hens (High RFI_{mat} x High RME_{mmat}) produced smaller eggs (61.9 g; $P=0.08$) and smaller chicks (39.4 g; $P=0.005$) than the other sub-groups (66.0 to 67.4 g and 42.8 to 45.7 g, respectively). Similarly, chick yield from the least efficient hens was lower (63.8% of egg weight) compared to the other efficiency treatments (65.0 to 67.4%). Chicks from inefficient hens not only had fewer nutrients from the eggs to start off, but also a proportionally lower weight at hatch. Neither total nor relative muscle weights differed among RFI_{mat} or RME_{mmat} categories. No differences were evident for biceps femoris muscle section areas and myofibre density among RFI_{mat} or RME_{mmat} categories. The biceps femoris muscle of High RME_{mmat} chicks contained a total of 68,123 myofibres compared to 60,359 myofibres for Low RME_{mmat} chicks ($P=0.10$). Although no significant effects in myofibre number or density were detected, myofibre characteristics warrant further study as a possible factor affecting the trade-off between BB energetic efficiency and broiler growth and yield.

Key Words: broiler breeder, broiler, muscle, myofiber number, energy efficiency

153 The effect of incubation environment on intestinal development in White Pekin ducklings. T. Schellhardt¹, H. Kohl², and M. S. Lilburn*¹, ¹*The Ohio State University, Wooster,* ²*Maple Leaf Farms, Syracuse, IN.*

Fertile Pekin duck eggs (Maple Leaf Farms, Syracuse, IN) were placed in each of two incubators set at 38.0 or 38.5 C from 0 to 10 days and at 38.0 C thereafter. Previous experiments had shown us that the higher temperature would accelerate embryonic growth so ducklings were

removed on both day 27 (largely 38.5) and day 28 (largely 38.0) of incubation. Body weight and cloacal temperature were recorded on the day of hatch. The weight and length of the duodenum and lower small intestine were also recorded.

A sample of the lower small intestine from each day and treatment were processed for villus height and crypt depth determination. Ducklings that hatched on Day 1 weighed significantly more than those on Day 2 and the 38.5 C treatment also resulted in lower body weight on both days. Ducklings that hatched on Day 2 had lower cloacal temperatures than those on Day 1. The weight of the duodenum was heavier in Day 2 ducklings (no temperature effect) and both Day 2 and 38.5 C ducklings had a significantly longer duodenum. The only effects on the lower small intestine was the length which was greater in day 2 ducklings.

Similar to the weight and length data, villus height and crypt depth were greater on Day 2 versus Day 1 and 38.5 C ducklings had increased villus and crypt measurements on Day 1 only. When comparing incubation temperature effects on hatchling status, it is important to consider the day of hatch in the statistical model.

Key Words: ducklings, incubation, temperature, intestine

154 In ovo technology—Commercial trial to evaluate the site of vaccine delivery in day 18 embryonated chicken eggs. B. Hopkins*¹ and C. Williams², ¹Hopkins Consulting, Overland Park, KS, ²Pfizer Animal Health, Research Triangle Park, NC.

Site of vaccine delivery in ovo is critical to Marek's disease (MD) vaccine efficacy. 1 Application of MD vaccine on the air cell membrane (0% efficacy) or into the allantoic fluid (28% efficacy) has been shown to greatly reduce the protective index against MD challenge. The objective of the trial was to evaluate the quality of vaccine delivery under commercial conditions as measured by site of vaccine delivery in ovo. 2 A standard protein staining dye was included in the vaccine diluent to elucidate the exact location of vaccine delivery within embryonated broiler chicken eggs at day 18 plus 10 hours of incubation. Comparisons were made between the two U.S. manufactured in ovo systems (Embrex[®] Inovoject[®] System, Pfizer Animal Health, Research Triangle Park, NC and the ManualJect[®] System, Avitech, Salisbury, MD). All eggs were incubated in Super J incubators (Jamesway[™] Incubator Company Cambridge, Ontario) at two separate commercial hatcheries. Injections were completed at the same chronological embryonic age (18 days and 10 hours of incubation): however injections with each system were done on separate days. Eggs were evaluated immediately after injection to determine normal embryonic development and the exact location of vaccine delivery. Analyzed categories and results for site of injection included three classifications: correct site (amnion, embryo); incorrect site (air cell, allantois); and non-vaccinated. The correct in ovo site of vaccine delivery was significantly greater using the Inovoject System (95.3%) as compared to the ManualJect System (52.3%). Regardless of breeder flock source, the ManualJect System had significantly increased results in delivery to the incorrect in ovo injection sites (air cell, allantois, and air cell/allantois combination) than the Inovoject System ($p \leq 0.0001$).

1. Wakenell et al. Effect of In Ovo Vaccine Delivery Route on Herpesvirus of Turkeys/SB-1 Efficacy and Viremia. *Avian Diseases* 2002; 46 (2) 274-280.

2. Data on file, Study Report No. 15-08-1100, Pfizer Inc.

Key Words: in ovo, site of injection, amnion, embryo, allantois

155 The use of distillers dried grains plus solubles as a feed ingredient on nutrient excretion and air emissions from laying hens. W. Wu-Haan*¹, W. J. Powers¹, C. R. Angel², and T. J. Applegate³, ¹Michigan State University, East Lansing, ²University of Maryland, College Park, ³Purdue University, West Lafayette, IN.

The objectives of the current study were to evaluate the effect of commercial diets containing 0, 10, or 20% distillers dried grains plus solubles (DDGS) laying hens from 21 to 26 wk of age on emissions of NH₃, H₂S, NO, CO₂, CH₄, SO₂ and non-methane total hydrocarbon (NMTHC), hen performance, as well as manure DM, N and P excretion. Hens (n= 640) were allocated, randomly to eight environmental chambers for a five-wk period (2 replicates of 0%; 3 replicates each of 10 and 20%). Average egg weight (50.6 g), egg production (85%), and feed intake (87.9 g/hen/d) were unaffected by diets ($P > 0.05$). A linear decrease in daily mass of NH₃ and H₂S emitted adjusted per kg N or S intake were observed ($P < 0.01$) as DDGS in the diet increased from 0 to 20%. Daily NH₃ emissions from hens fed diets containing 0, 10, and 20% DDGS were 19.0, 16.2, and 14.7 g/kg N intake respectively. Daily H₂S emissions from hens fed commercial diets containing 0, 10, and 20% DDGS were 2.9, 2.4, and 2.0 g/kg S intake, respectively. Daily emissions of CO₂ were decreased linearly ($P < 0.01$) as inclusion of DDGS increased. No diet effects on emissions of NO, NO₂, CH₄, SO₂, and NMTHC were observed ($P > 0.05$). There were no significant differences in manure DM excretion (60.7, 76.4, and 71.5 g/hen per day, respectively), N excretion (2.6, 2.5, and 2.7 g/hen per day, respectively), or P excretion (1.5, 1.8, and 1.9 g/hen per day, respectively) from hens fed commercial diets containing 0, 10 or 20% DDGS ($P > 0.05$). The results of this study demonstrate that 10 to 20% DDGS derived from ethanol production can be fed to laying hens with no effects on nutrient excretion and can potentially lower emissions of NH₃ and H₂S.

Key Words: ammonia, distillers dried grains with solubles, hydrogen sulfide, laying hens

156 Evaluation of char and active carbon for the reduction of ammonia volatilization from poultry manure. C. Ritz*, A. Tasistro, B. Fairchild, and B. Bibens, *University of Georgia, Athens.*

Locally available biomass materials, such as peanut hulls or tree clippings, have the potential for use as raw materials for producing chars and active carbons. Chars have long been known to possess properties that make them valuable environmental tools. One such application is the adsorption of NH₃. By properly activating the char, ammonia can be captured on its surface. Active carbon can be found in numerous products designed to absorb moisture and odors, such as carbon filters for use in drinking water filtration and air purification. Chemical adsorption of ammonia is mostly due to its interaction with oxygen functional groups via hydrogen bonding. It is expected that chars used with poultry litter application will perform mostly based on their chemisorption capacity. The purpose of this study was to evaluate the effectiveness of char and active carbon on reducing ammonia volatilization from poultry manure when used as a surfaced-applied litter treatment. Char from peanut hull waste was produced by pyrolysis, wherein the material was heated to 400°C in the absence of oxygen for 30 minutes. The unamended peanut hull char (pH 9.20) and an acidified poultry litter char (53% sulfuric acid) were applied to replicate pens at rates of 50, 75 and 150 lbs per 1000 square feet. Broilers were raised in the pens at 0.75 square feet per bird to generate the manure ammonia. The unamended chars actually increased the release of ammonia an average of 14% over the control. The acidified char applied at the 50, 75 and 150 lb rates reduced overall ammonia release by 11, 25, and 35%, respectively over the control. The

reduction in ammonia from the acidified char treatment is most likely due to litter pH reduction from the acid application and not from chemisorption by the carbon. Further investigation into the use of activated carbon products for ammonia control in poultry houses is warranted.

Key Words: broiler, ammonia, char, active carbon, pyrolysis

157 Litter nutrient estimates for broiler chickens. J. P. Blake*, J. B. Hess, and K. S. Macklin, *Auburn University, Department of Poultry Science, Auburn, AL.*

Data was obtained from a series of seven consecutive experiments conducted over a 16-month period using the same broiler strain (Ross x Cobb) and corn-soybean meal starter (0.68 kg/bird; 22% CP, 3087 kcal/kg ME), grower (1.36 kg/bird; 20% CP, 3131 kcal/kg ME), finisher (1.81 kg/bird; 17.5% CP, 3197 kcal/kg ME) and withdrawal (c.a. 1.36 kg/bird; 16.5% CP, 3219 kcal/kg ME) diets. Four replicate pens (2.44 x 2.44 m) with 70 birds each represent data obtained from each experiment. New pine shavings (54.42 kg) were placed in each pen. Feed and water were provided ad libitum with 24 hr light. For each experiment birds and feed were weighed on day 21, 42 and 49 and amount of litter production was determined upon termination. Litter nutrient outputs were calculated on a dry matter basis for a single production cycle.

Seasonal differences ($P < 0.05$) in growth performance occurred with ranges in live weight (2.75-3.38 kg), feed consumption (4.85-6.49 kg) and feed efficiency (1.74-1.93) for the seven experiments. Variations in seasonal and weekly differences occurred with overall averages presented. Nutrient output in kg/tonne (dry matter) was estimated at 35.6 N, 18.2 P, 22.9 K, 26.8 Ca, and 4.7 Mg. Trace mineral output in g/tonne was estimated at 38 Cu, 926 Fe, 290 Mn, 281 Zn, and 5.42 kg Na. The amount of nutrients produced in kg/tonne of live weight on a dry matter basis was calculated as 12.9 N, 6.3 P, 8.2 K, 9.4 Ca, and 1.7 Mg. Trace mineral production was estimated in g/tonne of live weight as 13.9 Cu, 329 Fe, 104 Mn, 100 Zn, and 1.95 kg Na. Approximately 0.36 kg of litter dry matter was produced per kg of live weight. Litter moisture increased from an initial value of 10.5% for clean dry pine shavings to an overall value of 26.2% for the seven experiments. However, weekly and seasonal variations in litter moisture ranged from 17.5 to 31.0%.

Key Words: litter, nutrients, broiler

158 A molecular approach to understanding the interrelation between the microbiomes in the litter and intestines of commercial broilers. M. D. Cressman*, S. Wei, M. S. Lilburn, S. J. Moeller, H. N. Zerby, and Z. Yu, *The Ohio State University, Columbus.*

Pine shavings are a commonly used bedding material in the U.S. broiler industry, and producers typically reuse litter across many growth cycles. The microbiome of reused litter can affect the colonization and development of the simple, dynamic intestinal microbiome of the young chick. The objective of the study was to examine the effect of clean and reused litter on the ontogeny of intestinal tract microbiome in broilers over a 6-week growth cycle. Composite (10 random birds/sample) mucosal and cecal samples from birds reared on both clean and 2-year old reused pine litter were collected at days 7, 14, 21, and 42. Litter samples were collected and pooled from multiple locations within the barn at the same times. Microbiome DNA was extracted from all samples using the RBB+C method. Community profiles were compared within sample type using PCR-DGGE. Diversity and community structure were further examined using clone libraries of the 16S rRNA gene for all sample

types at day 7. Abundance of total *Clostridium perfringens* and *C. perfringens* type A (α toxin-producing) was quantified using specific real-time PCR. Results of DDGE indicated significant differences between the microbiomes of both litter types and of the ileum of birds raised on each litter type. As demonstrated in the 16S clone libraries, different samples (both mucosa and litter) have distinct microbiomes at day 7. Generic and α toxin-producing *C. perfringens* were detected in both the clean and reused litter at all the time points. No generic or α toxin-producing *C. perfringens* was found in the cecum of birds raised on the reused litter until day 42; however, both were detected in the cecum of birds raised on the clean litter by day 14. The results suggest that reused litter can delay the colonization of generic and α toxin-producing *C. perfringens* within the cecum. More studies are needed to examine the relationship between chemical conditions and the microbiome of litter and between the litter, intestinal microbiomes, and pathogens. The results may help broiler producers develop more cost-effective litter management strategies.

Key Words: broilers, ileum, cecum, *Clostridium perfringens*, litter

159 Litter depth and its effect on foot pad dermatitis. E. M. Shepherd*, B. D. Fairchild, and C. W. Ritz, *University of Georgia, Department of Poultry Science, Athens.*

High grade chicken paws have become one of the most profitable portions of the broiler carcass. The biggest cause of downgrades and condemnations of processed paws are from Footpad Dermatitis (FPD). This condition is characterized by inflammation and necrotic lesions on the plantar surface of the footpad. Litter depth in commercial broiler facilities can be variable depending on the frequency of cleanout and availability of materials to re-bed houses. Field observations suggest that as litter depth is decreased, paw quality is reduced. The objective of this study was to evaluate differing depths of litter on the incidence and severity of FPD. The experimental design consisted of 12 pens containing 31 birds each for a total of 372 birds. The four treatments consisted of 1, 3, and 5 inches of fresh litter and one with 2 inches of used litter. Litter moisture analysis, paw scores, bird weights, and feed consumption were taken weekly through six weeks of age.

Results from the study showed that paw quality at weeks 2 and 3 was better when litter was 3 inches or deeper as compared to the control and reused litter. Litter moisture decreased as litter depth increased. No significant differences were observed in body weight, feed conversion, or mortality when compared to litter depth. These results imply that there is a connection between increasing litter depth, decreasing litter moisture, and an improvement in paw quality. Field observations have indicated that paw quality is better on built up litter, but these results suggest that it may be more closely associated with litter depth. Houses that utilize built up litter programs tend to have deeper litter than houses that are cleaned out after each flock. By increasing litter depth, moisture holding capacity is increased which could result in better paw yields at the processing plant.

Key Words: footpad dermatitis, litter depth, broiler, moisture, paw scores

160 Trace element accumulation during litter treatment usage for broiler chickens. J. P. Blake*, J. B. Hess, and K. S. Macklin, *Auburn University, Department of Poultry Science, Auburn, AL.*

For three consecutive experiments, 1500 mixed-sex broiler chicks (Cobb X Ross) were assigned among 30 floor pens (1.8 x 2.1 m) containing

once-used litter with 50 birds each. Experiment 1 was conducted February-March; Experiment 2, April-May; and Experiment 3, June-July. Birds received a corn-soybean meal starter (0.68 kg/bird; 22% CP, 3087 kcal/kg ME), grower (1.36 kg/bird; 20% CP, 3131 kcal/kg ME), and finisher (c.a. 2.27 kg/bird; 17.5% CP, 3197 kcal/kg ME) to 42 days of age. Treatments were control (CON); Poultry Litter Treatment (PLT), Poultry Guard (PG) or 50:50 All-Clear:PLT (ACPLT) at 100 lbs/1,000 ft² and liquid alum (A-7) at 30 gals/1000 ft² with six pens per treatment. Treatments were top-applied 24-hrs prior to placement with a 14-day downtime between experiments. Feed and water were provided ad libitum with 23 hr light. Litter samples were obtained initially, at experiment termination, and during litter reconditioning between experiments. Trace element levels are presented on a dry matter basis.

Specific treatment regimens resulted in increased concentrations of litter trace elements. As compared to CON, PLT contributed an increase in Na accumulation (10,546 vs. 6576 ppm); PG increased Al (1018 vs. 623 ppm) and Fe (1433 vs. 1176 ppm); ACPLT increased both Na (8959 vs. 6576 ppm) and Al (1251 vs. 632 ppm); and A-7 increased Al to 2865 ppm as compared to CON (623 ppm). Initial levels of minerals such as P, Ca, and K; Cu, Fe, Zn, and Mn were 1.06, 1.99, and 1.56%; 22.4, 649, 217, and 219 ppm, respectively. At the end of the third experiment, levels were 2.16, 3.83, and 2.89%; 35.7, 1212, 409, and 397 ppm, respectively. Nitrogen composition following each experiment increased from 3.32 to 3.52 to 3.73%, respectively. Reconditioning of litter between experiments yielded an average reduction in nitrogen of 26.2 and 17.9% prior to the start of Experiment 2 and 3, respectively. Trace element loading of soils from prolonged application of poultry litter requires additional investigation to determine its detrimental effects on soil and water quality.

Key Words: trace element, litter treatment, broiler

161 Using mortality compost in vegetable production. C. Dunkley*¹, D. Cunningham², C. Ritz², and S. Rahjeev¹, ¹University of Georgia, Tifton, ²University of Georgia, Athens.

A study was conducted to determine the effectiveness of composting to breakdown the carcasses of poultry mortality and destroy pathogenic microbes that may be present. The study was divided into two phases, the first involving the composting of daily mortality while the second used the composted material to amend vegetable plots planted with cabbage seedlings. Phase 1 was first conducted during the summer and then repeated during the winter to determine whether time of year had an effect on the temperature profile achieved or the length of time needed for the process to be completed. Daily mortalities from a broiler flock that was approximately 24 to 30 days old were collected from a producer and layered in a compost bin each day for four days. Samples were collected from the litter before it was placed in the bin and every other day for a week after the bin was compiled. Samples thereafter collected once per week until the process was completed. Samples were evaluated for microbial content. Temperature was taken and recorded from random points in the bins on a daily basis. For Phase 2 the finished composted material was used as a soil amendment in two vegetable plots. A third plot without compost material was used as the control. Soil samples were collected from each of the plots prior to application of the compost material after which cabbage seedlings were planted in each of the plots. Vegetative and soil samples were collected and evaluated for microbial profile prior to planting and again at 1 wk, 3 wk, 7 wk, and at harvest. The summer compost had the highest temperature of 156°F on d9 during the primary phase while the winter compost had the highest temperature of 156°F on d42 during the secondary phase of the compost. The summer compost samples were salmonella negative from d2 of the trial but mixed bacterial colonies remained for the duration of the study. The vegetative samples showed coliform levels up to 2.6 log10/gm at wk3. The results show that while winter composting can effectively breakdown poultry carcasses summer compost is more efficient.

Key Words: compost, mortality, broiler, microbes, vegetable

Genetics

162 Ascites-resistant and susceptible broiler lines express different genes in their right ventricles. R. L. Taylor, Jr.*¹, M. E. Chapman², R. F. Wideman, Jr.², N. B. Anthony², and C. M. Ashwell³, ¹University of New Hampshire, Durham, ²University of Arkansas, Fayetteville, ³North Carolina State University, Raleigh.

Inadequate pulmonary vascular capacity in fast-growing broilers promotes susceptibility to pulmonary arterial hypertension (PAH) and subsequent pulmonary hypertension syndrome (PHS, ascites). Lower pulmonary vascular capacity requires the right ventricle (RV) to boost pulmonary arterial pressure (PAP) to maintain sufficient circulation to the lungs. Elements that raise cardiac output, lower pulmonary vascular capacity, or elicit pulmonary vasoconstriction comprise possible contributors to PAH. Yet, factors that initiate PAH remain unknown. To profile RV gene expression, we used ascites-resistant (RES) and -susceptible (SUS) broiler lines selected using hyperbaric hypoxia, which have >10x differential ascites incidence. Tenth generation RES and SUS line male progeny were housed in environmental chambers with ad libitum access to feed and water. Beginning at d 45, ten birds of each line were injected i.v. with cellulose microparticles to challenge the RV by

increasing the pulmonary vascular resistance. PAP values were recorded for 60 min post-injection followed by sampling of the RV tissue from each bird. Extracted RNA was reverse transcribed to cDNA, indirectly labeled with either Cy3 or Cy5 and hybridized (including dye swap) to a focused 70-mer oligonucleotide microarray containing 320 genes. Each gene was spotted twelve times increasing sensitivity to detect sample group differences. Thirty-eight genes with differential expression were divided equally between the two lines. Interferon regulatory factor 2 (Irf2), phospholamban, glyceraldehyde-3-phosphate dehydrogenase, and heart and neural crest derivatives expressed protein 2 were among higher expressed genes in the RES Line. Genes in the SUS Line having higher expression included insulin-like growth factor binding protein 1, CD36 molecule (thrombospondin receptor), homeobox A13, and CD3d molecule. Heart development and ventricular cardiac muscle morphogenesis were biological processes related to the genes identified. Network analysis found that genes identified included biomarkers associated with signaling in cardiac hypertrophy.

Key Words: ascites, gene expression, microarray, cardiac hypertrophy