

## ABSTRACTS

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### SYMPOSIA AND ORAL SESSIONS

\*Author Presenting Paper

#### Environment and Management: Broilers II

**114 Fire fighting foam as an alternative method of mass euthanasia for meat-type poultry flocks.** E. Benson<sup>1</sup>, R. Alphin<sup>1</sup>, G. Malone<sup>\*1</sup>, M. Dawson<sup>1</sup>, G. Van Wicklen<sup>1</sup>, and I. Estevez<sup>2</sup>, <sup>1</sup>University of Delaware, Newark, <sup>2</sup>University of Maryland, College Park.

Current methods of control for quick spreading, highly contagious poultry diseases such as Avian Influenza (AI) or Exotic Newcastle, require large numbers of poultry to be rapidly and humanly killed to prevent further spread. On-farm euthanasia, rather than conventional slaughter at the processing plant, is often required to avoid the spread of the infectious agents. Therefore, it is essential to have options for rapid, on-site mass euthanasia. The techniques for mass euthanasia must be humane, minimize human and animal health risks, and be compatible with the carcass disposal method. The options for mass euthanasia are limited, as reported by the 2000 Report of the AVMA Panel on Euthanasia (AVMA, 2001). A pilot study was initiated to test a new emergency euthanasia concept. An experimental method for emergency mass euthanasia of infected poultry is being developed using fire fighting foam. This method covers birds in a protective blanket of high expansion foam enriched with carbon dioxide. In three experimental trials, the method has been shown to provide effective euthanasia. The foam with varying concentrations of carbon dioxide was directly compared to a currently used industry technique of overlapping layers of polyethylene to cover birds and gassing with carbon dioxide. The foam and polyethylene methods resulted in euthanasia in less than three minutes (CO<sub>2</sub> polyethylene 2:08 minutes, foam with CO<sub>2</sub> 2:09 minutes, foam without CO<sub>2</sub> 2:54 minute). On-going research is designed to evaluate the humane aspects of this procedure and develop the equipment for commercial application. Additional technical details of this patent-pending process will be reported in subsequent presentations.

**Key Words:** Poultry, Mass euthanasia, Avian epidemic

**115 Litter bacterial levels associated with broilers fed mannan oligosaccharides.** K. S. Macklin<sup>\*1</sup>, J. P. Blake<sup>1</sup>, B. A. McCrea<sup>1</sup>, R. A. Norton<sup>1</sup>, J. B. Hess<sup>1</sup>, S. F. Bilgili<sup>1</sup>, T. Sefton<sup>2</sup>, and A. Kocher<sup>2</sup>, <sup>1</sup>Auburn University, Auburn, <sup>2</sup>Alltech, Nicholasville, Kentucky.

Two successive trials were performed in which litter bacterial levels were measured in birds fed one of three corn-wheat based diets: one supplemented with Bacitracin Methyline Disalcylate (BMD), one containing mannan oligosaccharide (MO) (Bio-mos, Alltech, Nicholasville, KY) and a control diet that had no additional supplementation (CON). Each diet was replicated in 10 pens containing 50 birds/pen. Birds for both trials were raised on used litter to 6 weeks of age under standard management conditions. Litter samples were collected before chick placement and immediately after bird removal from three locations within each pen and mixed in a sterile bag. Samples were then serially diluted and plated on the following media: plate count agar (PCA) for determining total aerobic bacteria, reduced tryptic soy agar with 5% sheep red blood cells (RBA) to determine anaerobic bacterial numbers, and MacConkey agar (MA) for total enteric bacterial numbers. Media was then incubated at 37C under appropriate conditions for 24 hours then counted. CFU/g counts were transformed using log<sub>10</sub> and analyzed using General Linear Model with P<0.10.

Trial 1 showed no statistically significant differences (P>0.10) for the bacterial counts between the three diets. Counts at the end of Trial 2 showed significantly lower bacterial counts with MO on PCA (11.25) and RBA (9.93) than the CON (11.72 and 10.22) group, with BMD (11.41 and 10.15) producing intermediate results. MA produced no statistically significant differences between the three groups. In these two successive trials it was observed that MO reduced the total aerobic and anaerobic litter bacterial counts, especially on built up litter.

**Key Words:** Mannan oligosaccharides, Litter, Bacteria

**116 Impact of daylength and light intensity on live performance and an indicator of long-term stress in broilers.** J. C. Townsend<sup>\*</sup>, R. J. Lien, J. B. Hess, S. R. McKee, and S. F. Bilgili, Auburn University, Auburn.

Broilers were reared to 49 d on either primarily long or short daylengths and bright or dim light intensities in a 2X2 factorial design to assess effects on growth and stress level as measured by heterophil/lymphocyte (H/L) ratios. Fifty male and 50 female broilers (Ross 708) were co-mingled in each of 12 light-tight environmentally controlled rooms. Six rooms were subjected to either long

(23L:1D, 1-49 d) or short (23L:1D, 1-8 d; 18L:6D, 8-42 d; 23L:1D, 42-49 d) daylengths. Intensities in 6 rooms were bright (3.0 foot candles [fc], 1-8 d; 1.0 fc, 8-49 d) and in 6 rooms were dim (3.0 fc, 1-8 d; 0.1 fc, 8-49 d). At 40 d, blood samples were drawn from 3 birds per room. Two smears from each sample were prepared, stained, counted, and H/L ratios determined. Data were analyzed for main effects of daylength and intensity, and their interaction with rooms as experimental units.

Decreasing daylength or intensity caused a decrease in BW through 43 d, which was minimized in the short-dim treatment. At 49 d, BW of long-bright and short-dim treatments were equal, while short-bright and long-dim treatments were decreased. Consumption was decreased by short and dim treatments through 29 and 22 d, respectively. At 49 d, daylength and intensity weakly affected consumption; however, consumption was 0.16 lb/bird less in the short-dim treatment than the long-bright treatment. FC did not differ between treatments. Decreasing from 3.0 to 0.1 fc at 8 d in the dim treatment caused a decrease in uniformity at 15 d. Uniformity at 49 d was slightly reduced in the bright treatment. Mortality did not differ between treatments. H/L ratios averaged 0.45 and were not affected by treatments. Decreasing both daylength and intensity may improve overall live performance when long daylengths are resumed during the final wk of grow-out. Daylength and intensity differences tested did not affect stress levels.

**Key Words:** Broilers, Lighting programs, Live performance

**117 Effects of season on nitrogen mass balance of broilers.** C. Coufal\*, P. Niemeyer, and J. Carey, *Texas A&M University, College Station.*

Emission of nitrogen (ammonia) from commercial broiler facilities has become a topic of increased concern, debate and research efforts worldwide. Most studies to date have been performed in commercial facilities by measuring ammonia concentrations and ventilation rates, resulting in large variation and uncertainty in reported results. Recent studies by our laboratory have employed the mass balance technique to quantify nitrogen loss from pens of commercial broilers raised under simulated commercial conditions on recycled litter. Eighteen consecutive flocks were reared to 42 days of age with an average ending body weight of 2.2 kg. All birds and feeds were obtained from a commercial broiler integrator. Feed and day-old chicks were calculated to be 99 and 1% of nitrogen inputs, respectively. Average nitrogen loss for all eighteen flocks was 11.05 g N/kg of marketed live broiler or 0.603 g N/d/bd or 21% of N inputs. Season (summer vs. winter) significantly influenced nitrogen loss from the facility as well as the nitrogen content of broiler carcasses. N loss as a percent of inputs ranged from 7.9% in cool weather (Flock 10) to 36.6% in hot weather (Flock 7). Broiler carcass nitrogen (percent of dry matter) ranged from 7.8 to 8.8%. Broiler carcasses in winter contained significantly more N than carcasses from broilers reared in the summer (8.5 vs. 8.1%). Regression analysis revealed that broiler body weight and N content were not related ( $r^2=0.10$ ). The combination of litter age and season also affected nitrogen loss from the facility. Flock 1 occurred during summer months and had an 18.2% loss of N inputs. Nitrogen loss from 3 of 4 subsequent summer flocks was significantly greater than Flock 1, as might be expected with older litter. However, this trend was not observed in winter flocks. Flocks 4, 11 and 18 (winter flocks) had N losses of 17.7, 13.8 and 9.1%, respectively. These results suggest that older litter may not result in greater ammonia loss during cooler weather. In summary, this study demonstrated that season is an important factor affecting nitrogen volatilization from broiler facilities.

**Key Words:** Nitrogen, Broilers, Mass Balance

**118 Effects of recycling on nutrient composition of loose and caked broiler litter.** C. Coufal\*, P. Niemeyer, and J. Carey, *Texas A&M University, College Station.*

Large amounts of broiler litter must be disposed of from broiler facilities each year. The nutrient content of that material is of concern due to potential negative environmental impacts. Large variation exists between published data regarding the nutrient content of litter from many areas of the United States. Additionally, little data has been published to differentiate the moisture and nutrient content of caked litter. Therefore, a study was conducted under simu-

lated commercial broiler rearing conditions to more accurately characterize the production and nutrient content of loose and caked litter. Broiler chicks and feed were obtained from a commercial integrator, and 8 consecutive flocks were raised on recycled rice hull litter. Broilers were reared in 4 large experimental pens utilizing a total of 562 birds per flock. Grow-out period was 42 days with an ending bird weight averaging 2.2 kg. Caked litter was removed from each pen after the removal of each flock. Management practices were followed to closely simulate commercial conditions. Samples of loose and caked litter were collected and analyzed for moisture, total nitrogen (N), phosphorus (P) and potassium (K) and organic carbon (OC). Beginning moisture content for new litter in Flock 1 was 9.44%. Loose and caked litter moisture content ranged from 23.4 to 27.4% and 38.4 to 55.6%, respectively. Loose litter N, P and K content significantly increased between each consecutive flock between Flocks 1 and 4. Flock 8 ending litter N, P and K values were 3.6, 2.3 and 3.9% of dry matter, respectively. In comparison, caked litter N increased significantly between Flocks 1 and 2, but then leveled off. Caked litter P significantly increased in Flocks 3 and 4 and again in Flocks 7 and 8. No significant differences were observed between consecutive flocks for caked litter K. Flock 8 ending caked litter N, P and K values were 5.2, 2.6 and 4.6% of dry matter, respectively. Litter OC varied little and ranged from 30.7 to 32.3%. The C to N ratio (C:N) was 68:1 in new litter, but dropped to 15:1 after Flock 1. C:N significantly decreased until Flock 4 and then leveled off at approximately 8.5:1.

**Key Words:** Litter, Nutrients, Broilers

**119 Modeling the growth and death of *Salmonella* in poultry litter.** J. B. Payne\* and B. W. Sheldon, *North Carolina State University, Raleigh, NC.*

Contaminated poultry litter, serving as a reservoir for *Salmonella*, can be linked to both food safety concerns when contaminated birds enter processing plants and environmental concerns when used as a fertilizer. Predictive modeling allows for the estimation of microbial growth or inactivation while controlling environmental growth factors. A study was conducted to observe the combined effects of pH and water activity ( $A_w$ ) at a constant temperature on *Salmonella* populations in turkey litter for the purpose of predicting microbial behavior over time. Litter, pH adjusted and then inoculated with a 3-strain *Salmonella* serovar cocktail to an initial concentration of  $\sim 10^6$  CFU/g, was placed into individual sealed plastic containers with saturated salt solutions for controlling  $A_w$ . A balanced design including 3  $A_w$  values (0.85, 0.91, 0.97), 3 pH values (4, 7, 9) and a constant temperature of 30°C was employed with litter samples periodically removed and analyzed for *Salmonella* populations, pH and  $A_w$ . At each combination of environmental factors, the Churchill model was employed to describe the growth and death of *Salmonella* as a function of the experimental model. *Salmonella* populations exhibited growth ( $\sim 2$  log) with little decline up to 42 days in litter environments of pH 7 and 9 and a  $A_w$  value of 0.97. As litter  $A_w$  levels were reduced, populations further declined with the largest reductions ( $\sim 6$  log) occurring in low pH (4) and low  $A_w$  (0.85) environments. These findings suggest that best management practices and litter treatments that lower litter  $A_w$  and pH are effective at reducing *Salmonella* populations. The use of a single equation to predict the growth and decline of *Salmonella* populations as a function of pH,  $A_w$  and temperature has potential application for the development of effective pathogen control strategies at the farm level.

**Key Words:** *Salmonella*, Litter, Predictive modeling

**120 Broiler barn surface type and presence of organic material influences the ability of disinfectants to reduce bacterial populations.** P. Ward\*, M. LaForge, S. Gibson, L. McMullen, and G. Fassenko, *University of Alberta, Edmonton, AB, Canada.*

The objectives of this research were to determine the efficacy of 2 commercial disinfectants on the viability of bacteria: 1) on 3 surfaces commonly found in commercial poultry barns (Exp 1); and 2) in the presence of organic material (Exp 2). In Exp 1, cement, galvanized steel & wood were inoculated with *Salmonella enterica* serovar Typhimurium & broiler manure. After inoculation, disinfectants [1% Virkon®(V), 470 ppm ProQuat®(P)] were applied to the surfaces, air dried, & counts enumerated on PCA & VRBG agar. The data were analysed using the GLM procedure of SAS® & probability assessed at  $P=0.05$ . *Salmonella* were inoculated at 105 to 106 CFU/cm<sup>2</sup>. In Exp 2 eight broiler floor

pens were swabbed for bacterial cultures prior to bird shipment. Four pens were washed with cold water, swabbed, then disinfected with either P or V, & swabbed again. The remaining 4 pens were sampled in the same manner except the washing step was eliminated. In Exp 1, on wood & steel surfaces, both disinfectants reduced the Salmonella population by approximately 2 or 3 logs, respectively, but there was no difference in the log reductions between P & V. Cement had an immediate inhibitory effect on Salmonella & no differences between P & V were detected. Manure resulted in an inoculum level of 106 CFU/cm<sup>2</sup>. Both P & V reduced microbial populations inoculated from manure, but the reduction was dependent on the surface type. On cement, V was more effective than P in reducing microbial load, but P was more effective on wood. In Exp 2 washing the pens resulted in a 2-log reduction in microbial populations. Disinfection with V or P resulted in an additional 1-log decrease in microbial load. Disinfection of unwashed pens resulted in a 2-log decrease in microbial load regardless of disinfectant type. This research demonstrates that both V and P are effective when used at recommended concentrations, however the surface type to be disinfected should be considered in the choice of disinfectant. The presence of organic material reduced the efficacy of both disinfectants.

**Key Words:** Bacterial load, Broiler barn, Disinfectant

**121 Effects of slaughter plant and time on gross composition of poultry processing wastewater particulate matter.** B. Kiepper\*, W. Merka, and D. Fletcher, *University of Georgia, Athens.*

An experiment was conducted to compare the effects of slaughter plant and time on the gross composition of particulate matter recovered from poultry processing wastewater. Independent 24-hour composite samples of post-secondary screened wastewater from three poultry slaughter plants were collected over eight consecutive weeks. Composite samples were collected using an automatic sampler programmed to collect 1 L of wastewater every 20 minutes. A total of 72 liters of wastewater was collected from each plant each week. The 72 L sample was thoroughly mixed and 60 liters was passed through a series of laboratory screens of 1000 um, 500 um and 53 um. The solids recovered on the 53 um screen, representing particulate matter between 53 um and 500 um, were subjected to proximate analysis to determine moisture, protein, fat, crude fiber, and ash. Protein, fat, fiber, and ash were converted to a dry weight basis for treatment comparisons. The average results for dry protein, fat, fiber, and ash were 26.3, 54.0, 4.0, and 6.6 %, respectively. There was a significant difference in protein and ash between the three plants. When analyzed by week, only ash was affected over time. The gross composition of poultry processing wastewater solids, between 50 and 500 um, was more influenced by plant source than the 8 week sampling time. These results indicate that poultry plant wastewater solids vary more between plants than within a plant over time.

**Key Words:** Poultry processing, Wastewater solids, Wastewater screening

**122 Performance of broiler males through 8 weeks production in response to supplemental corn-soybean enzymes after exposure to *Campylobacter jejuni*.** E. Moran\* and O. Oyarzabal, *Auburn University, Auburn University, Alabama.*

Avizyme 1502® (A) is a commercial enzyme designed for corn-soybean feeds that has been shown to enhance ceca fermentation and improve ME recovery. Present experimentation examined A's effect on broiler live performance and the extent of cecal *Campylobacter* colonization after water exposure at 7 days of age. Broilers were fed corn-soybean meal feeds from 0-3 wk (22.0 %CP-3.07 kcal ME/g), 3-6 wk (19.3%CP-3.14 kcal ME), and 6-8 wk (17.4%CP-3.20 kcal ME) in fresh pine shaving litter floor pens. No antimicrobials had been included other than salinomycin used as a coccidiostat from 0 to 6 wk. At the end of the first week, all birds received five *Campylobacter jejuni* strains each at 107 CFU/ml in water for 8 h *ad libitum* access. No adverse effects on broilers in their activity, mortality, and live performance from consumption of these bacteria were obvious throughout experimentation. Although body weight and mortality were similar between males receiving either treatment at 3, 6, and 8 weeks of age, feed conversion was significantly improved with broilers receiving A compared to the control. Ceca weight and its proportion of the body was reduced at 3, 6 and 8 weeks of age with birds receiving A; however, *Campylobacter* colonization of ceca and litter contamination was high at high

levels throughout the experiment. Ceca from broilers cooped for 16 hours to simulate pre-slaughter conditions were lighter than those full-fed but *Campylobacter* incidence was not affected by feed withdrawal. Chilled carcasses from broilers receiving A had additional abdominal fat to further support an increased recovery dietary ME.

**Key Words:** *Campylobacter*, Enzyme supplementation, Ceca

**123 Effect of midnight feeding on egg production and quality of white- and brown- egg-laying hens.** C. M. Riczu\*, K. L. Nadeau, and D. R. Korver, *University of Alberta, Edmonton, AB, Canada.*

The effects of midnight feeding (MF) on BW, feed intake, egg production and quality traits were determined using Lohmann White and Lohmann Brown (n=64/strain) laying hens. At 18 wk of age, hens were individually caged in 1 of 4 light-tight rooms (n=16/strain per room). In 2 of the rooms, 1 h of additional light from 0000 h to 0100 h was provided to allow the hens to consume a meal during the night (MF). The hens in the remaining 2 rooms had access to feed, but not light during the night (control, C). All birds were photostimulated at 20 wk according to the Lohmann management guide; by 25 wk the C hens received 15L:9D. Daily egg production and weekly feed intake were recorded. At 2-week intervals from 18 to 34 wk, and at 4-week intervals to 54 wk of age, individual BW, daytime feed intake (0500 h to 2000 h), night-time feed intake (2000 h to 0500 h), and egg traits were measured.

The brown hens were heavier at all ages, and had higher daytime, night-time, and total daily feed intake to 42 wk. Strain differences in feed intake disappeared from 45 to 52 wk, however, the brown hens consumed more feed from 53 to 54 wk. At several time points, the C hens had greater weekly feed intake than the MF hens; this occurred only sporadically through the trial. Total daily feed intake was not affected by feeding program; C hens consumed more feed during the daytime, whereas MF hens had higher night-time intake. MF resulted in an earlier age at first egg, however neither total nor saleable egg production to 54 wk was affected by any treatment. The C birds had a longer average sequence length, but a longer average pause between sequences than the MF hens. The brown hens had larger eggs throughout the trial, with thinner shells but greater overall shell weights to 34 wk; eggs from the white hens had higher egg specific gravity. After 34 wk, differences in shell quality measures were minimal, although the brown eggs had thicker shells than the white eggs from 50 to 54 wk. MF did not improve egg production or egg traits to 54 wk under the conditions of the current experiment.

**Key Words:** Midnight feeding, Laying hens, Feed intake

**124 Stocking density effects on male broilers destined for fast-food markets.** W. A. Dozier, III\*<sup>1</sup>, J. P. Thaxton<sup>2</sup>, S. L. Branton<sup>1</sup>, and W. B. Roush<sup>1</sup>, <sup>1</sup>USDA-ARS Poultry Research Unit, Mississippi State, <sup>2</sup>Mississippi State University, Mississippi State.

Animal welfare concerns are influencing sales of poultry products to the food service industry. In growout, stocking density is viewed as a welfare concern when broilers approach market weight. This study examined the effects of stocking density on live performance and processing yields of male broilers grown to 1.8 kg. A total of 3,120 Ross x Ross 708 male chicks was placed into 32 floor pens of a solid-side wall facility at 1 d of age. Each pen (5.57 m<sup>2</sup>/pen) was equipped with fresh pine shavings, one nipple waterer line having 15 nipples, and two tube feeders. The lighting schedule consisted of continuous lighting with an intensity of 20 lux from placement to 7 d, 19L:5D and an intensity of 20 lux from 8 to 14 d, 20L:4D with an intensity of 5 lux from 15 to 22 d, and continuous lighting with an intensity of 3 lux from 23 to 35 d. Stocking density treatments were 25, (75 birds/pen), 30 (90 birds/pen), 35 (105 birds/pen), and 40 (120 birds/pen) kg BW/m<sup>2</sup>. The four stocking density treatments were represented by eight replicate pens.

From 1 to 35 d, BW gain, feed consumption, and feed conversion were adversely (P<0.0001) affected with increasing stocking densities. The incidence of mortality was unaffected. Litter moisture increased (P<0.0001) as stocking density increased, which led to a higher occurrence (P<0.0001) of foot pad lesions. Carcass weight was oppressed (P<0.0001) by increasing stocking den-

sity, but carcass yield, absolute and relative amounts of abdominal fat, and carcass skin defects were not affected. Increasing the stocking density decreased ( $P \leq 0.006$ ) breast fillet weight and its relative yield and breast tender weight, but not breast tender yield. For each 5 kg BW/m<sup>2</sup> unit increase of stocking density beyond 25 kg BW/m<sup>2</sup>, final BW and breast fillet weight were decreased by 41 and 12 g, respectively. We conclude that increasing stocking density beyond 30 kg BW/m<sup>2</sup> adversely affects growth responses and meat yield of broilers grown to 1.8 kg.

**Key Words:** Broiler, Stocking density

**125 Effects of density on movement and use of space in broilers.** I. Estevez\*, M. S. Freed, and M. C. Christman, *University of Maryland, College Park.*

Increments in stocking density have been argued to restrict movement and use of space in broilers due to social factors (associated with concurrent increments in group size (GS)) and/or a reduction of space availability). The aim of this experiment was first, to quantify the effect of increasing stocking density on movement and use of space in broilers and second, to isolate the contribution of social factors from the impact of the reduction of space available. Artificial chicken-sized models, added to pens with 30 and 60 broilers, simulated the spatial availability of 90 birds while theoretically controlling for social factors associated with increasing GS. Model size was increased bi-weekly to mimic broiler growth. Group size/stocking density treatments (GSD) were as follows: 90/0, 60/0, 60/30, 30/0, 30/60 (# birds/# models). In the absence of social factors, broilers in the 30/60, 60/30, and 90/0 GSD were predicted to show similar use of space patterns. Walking, steps taken, and path linearity (# of changes in direction of movement) were recorded. Core areas were calculated using spatial data obtained from focal birds. Data were analyzed by Mixed Model ANOVA with age as the repeated measure. Walking frequency and duration and number of steps taken were similar across all GSD ( $P > 0.05$ ). GSD groups differed in the level of path linearity ( $P < 0.05$ ), with trajectories being more linear in the 90/0, 60/0, and 30/0 GSD. GSD with equal density (90/0, 60/30, 30/60) had core areas of similar size ( $P > 0.05$ ), all of them surprisingly larger than those of 30/0 and 60/0 GSD. Aggressive interactions were affected by GSD ( $P < 0.05$ ) with lowest levels of aggression observed in the 30/0 and 90/0 GSD. These results suggest that at relative low ranges of density, walking behavior and steps taken are not affected by density. In contrast, the analysis of core areas suggest that birds at higher densities use a wider range of space, possibly as result of the presence of other birds in their path of movement. In this study social factors associated with increments in density do not appear to have a relevant impact on the patterns of movement and use of space.

**Key Words:** Density, Behavior, Use of space

**126 Nutritional value of poultry litter ash fed to broiler chickens.** J. P. Blake\* and J. B. Hess, *Auburn University, Auburn, Alabama.*

Practical alternatives to land application of poultry litter are needed because of concerns about phosphorus runoff into surface waters. Poultry litter ash (PLA) resulting from combustion of broiler litter offers potential as a phosphorus supplement. A total of 1600 commercial broiler chicks (Cobb X Ross) were randomized with 25 birds assigned to each of 64 pens. Birds were fed starter (1.8 lbs/bird; 21.5% CP, 3142 kcal/kg), grower (3.5 lbs/bird; 19.5% CP, 3153 kcal/kg), and finisher (c. a. 6.7 lbs/bird; 16.5% CP, 3175 kcal/kg). For diet formulation, PLA (16.70% Ca, 10.00% P) was substituted for dicalcium phosphate (dical-P) (24.1% Ca, 18.5% P). The eight dietary treatments were 0, 25, 50, 75, or 100% PLA in the starter, grower, and finisher diets or 25, 50, or 75% in the starter diet followed by 100% supplementation with PLA in the grower and finisher diets. Diets and water were available ad libitum. Birds and feed were weighed at 14, 28 and 41 d to determine growth and feed performance. Carcass yield (front and rear halves) was evaluated at 42 days of age for ten broilers from each pen. Results indicate no significant effects ( $P > 0.05$ ) on bodyweight, bodyweight gain, feed consumption, or feed efficiency due to level of dietary PLA. Also, there were no differences ( $P > 0.05$ ) in the processing performance of broilers at 42 days of age that received graded levels of PLA as a substitute for dietary dical-P. Results indicate that the complete substitution of dical-P with PLA ash

failed to compromise growth and processing performance in market age broilers. In the 100% supplemented starter, grower and finisher diet, substitution of dical-P with PLA was 0.864 vs. 1.610 kg, 0.800 kg, and 1.480 kg, and 0.690 vs. 1.280 kg/tonne, respectively. As a result, there is a requirement to use almost twice as much (ca. 46% more) PLA to meet phosphorus requirements of the broiler. The breakeven value for PLA used in this experiment can be estimated at approximately 54% the value of dical-P, based on phosphorus composition.

**Key Words:** Poultry litter ash, Phosphorus, Dicalcium phosphate

**127 Direct substitution of dicalcium phosphate with poultry litter ash in broiler diets.** J. P. Blake\* and J. B. Hess, *Auburn University, Auburn, Alabama.*

Poultry litter ash (PLA) that results from the combustion of broiler litter has potential for use as a dietary phosphorus supplement. The direct substitution of PLA (16.70% Ca, 10.00% P) for dicalcium phosphate (24.1% Ca, 18.5% P) on a weight:weight basis was accomplished at dietary levels of 0, 25, 50, 75, and 100%. A starter was fed from 0-21 d (22.0% CP, 3087 kcal/kg) and grower from 21-41 d (20.0 CP, 3153 kcal/kg). For each of the five dietary treatments, nine replicates of eight birds were used. Birds were weighed at 21 and 41 days of age. On day 41, femur bones were obtained from three birds per pen and pooled for ash analysis. A significant growth decrease ( $P < 0.05$ ) occurred for the 100% substitution rate during the starting period, but effect on growth rate disappeared by day 41. Results indicate that complete substitution of dicalcium phosphate with PLA failed to compromise performance in market age broilers. Bone ash results indicate that integrity of bones should not be compromised by the use of PLA. With increasing level of ash there was a linear increase ( $P < 0.001$ ) in excreta moisture from 72.93 to 81.72% for the 0 and 100% substitution, respectively. A 24-hr balance study was also completed utilizing 45 pens and the grower diet from 22-23 d of age to calculate mineral bioavailability determined as a percentage of the difference between amount consumed versus amount excreted on a dry matter basis. Following a 24-hr period, feed weights were obtained and excreta were quantitatively collected from all 45 pens. Excreta from each pen was freeze-dried, ground and analyzed for nitrogen, calcium, phosphorus, and potassium. The dry matter digestibility of calcium and phosphorus tended to increase ( $P < 0.05$ ) with increasing level of PLA. Such a relationship infers that the calcium and phosphorus component of the diet was more efficiently utilized as the level of PLA increased.

**Key Words:** Poultry litter ash, Phosphorus, Availability

**128 Pennsylvania research/extension programs on vegetative shelter belts for poultry farms.** A. Adrizal\*, P. Patterson, M. Hulet, and R. Bates, *Pennsylvania State University, University Park.*

Emissions from poultry production are being scrutinized by environmental groups, EPA, and the commercial industry. Planting trees around farm sites as windbreaks and shade has been practiced for many years. Recent studies indicate additional benefits for the environment including better air quality, biosecurity, and beautification of the farm. However, further studies are needed to elucidate appropriate plant species, orientation, density and management for airborne poultry emissions. To these ends an NRI Air Quality grant to study vegetative shelter belt (VSB) to mitigate emissions from poultry was submitted by Penn State, University of DE, and IA State. The grant (2003-05) is to quantify the efficacy of VSB for NH<sub>3</sub> mitigation, species hardiness, biochemical and physical tree interaction with NH<sub>3</sub> and particulate matter (PM), management practices and costs. The PSU team has initiated both environmental chamber and pot-in-pot studies to measure the impact of poultry NH<sub>3</sub> and PM emissions on plant parameters. In 2004, 7 rows of fir, hackberry, juniper, lilac, and willow were planted as a pot-in-pot study next to a PSU hen barn with four 61cm fans exhausting into the VSB. The chamber study is monitoring NH<sub>3</sub> tolerance of cedar, poplar, locust, and grass and plant biomass, architecture, tissue nutrients and damage. The PSU team has been also working with NRCS and extension agents on field studies in PA. In the period from 2003-04, more than 2000 spruce, poplar, and willow trees were planted in 2 and 3 row arrangements on 9 poultry farms (3 broilers, 3 layers, 1 pullet, and 1 turkey). The results showed that some species planted 10m in front of the fans were injured or dead, but not those planted in the second or third rows. Winter ambient

temperature around chicken houses were not different between control and areas in front of fans (32.4 vs 32.2F) while control areas around turkey and pullet houses were higher than near the fans (34.49 vs 33.69 and 31.54 to 28.98F) indicating plant dormancy would not be interrupted by exhaust heat. No plants were injured in the pot-in-pot study, and air speed was reduced more than 80% 9m away from the fans. Further outreach including field days and extension publications are planned for 2005 to demonstrate the potential, limitations and management of VSB for poultry farms.

**Key Words:** Vegetative shelter belt, NH<sub>3</sub>, Particulate matter

**129 Effect of feed withdrawal on total antioxidant, antioxidant enzyme activities, H/L ratio, and carcass characteristics in male broiler chicks subjected to acute heat stress.** K. Mahmoud\* and O. Al Marashdeh, *Jordan University of Science & Technology, Irbid, Jordan.*

One hundred forty-four day-old Lohman broiler chicks were randomly assigned into four regimens of feed withdrawal through the first three weeks of age to evaluate their effect on bird's antioxidant status, heterophil/lymphocyte ratio (H/L), and carcass characteristics. One group of chicks was fed ad libitum (FW-0; control) and the other three groups were subjected to feed withdrawal for six hours one (FW-1), two (FW-2), or three (FW-3) times a week. Carcass weight (Cwt), breast weight (Brwt), and abdominal fat weight (Afw) were evaluated by the end of the fourth and sixth weeks of age. At six weeks of age, twelve randomly selected chicks were sampled from each group before and after heat stress challenge (HS; 35 °C; 3 hr) to assess the response of H/L and plasma levels of total antioxidant (TAO), glutathione peroxidase (GPx), superoxide dismutase (SOD). Carcass weight was comparable among all treatments at four weeks of age, however FW-1 and FW-3 chicks registered lower ( $P < 0.05$ ) carcass weight compared to control group at six weeks of age. Breast weight at four and six weeks of age was not affected by feed withdrawal regimens. Compared to control group, Afw was higher in FW-3 at four weeks of age however it was numerically lower at six weeks of age. Heat stress elevated ( $P < 0.001$ ) H/L ratio and TAO with no sign of feed regimen effect. Plasma activities of SOD and GPx of FW-3 chicks were not affected by HS; to the contrary, chicks of all other groups experienced an increase ( $P < 0.05$ ) in plasma SOD activities when challenged with HS. The FW-3 chicks recorded the least increase in H/L ratio

with minimal deviations of plasma activities of both SOD and GPx as they were challenged to HS. These results may insinuate that chicks subjected to three times of feed withdrawal could be more tolerant to heat stress.

**Key Words:** Feed withdrawal, Broiler, Heat stress

**130 Maximizing efficiency: Feeding strategies of broilers.** E. H. Leone\* and I. Estevez, *University of Maryland, College Park.*

The feeding behavior of broilers (*Gallus gallus domesticus*) was investigated in a novel environment to test the immediate feeding strategy of birds when effort is required to obtain a food reward. Broilers were tested at 9 weeks of age in groups of 5, 10 and 20 birds, to examine the mediating effects of group size on feeding behavior. Each group was tested once in an arena with three small feeders that contained equal total amounts of food, but varied in the ratio of food resources to non-edible 'filler' material. The feeders were of high quality (HQ), containing 75% food and 25% filler, medium quality (MQ), with 50% food and 50% filler, and lastly low quality (LQ), with 25% food and 75% filler. Measurements were extracted from a video recording of each trial. All analyses were conducted using a Mixed Model ANOVA in SAS statistical analysis software (v. 8.1, SAS Institute, Cary, NC). All significant results are reported at the  $P < 0.05$  level. Every group size consumed significantly more food from HQ feeders than MQ or LQ feeders. The number of feeding bouts and their average duration, total residence time at the feeder, the number of individuals feeding, and the frequency of aggressive interactions all increased with feeder quality. Regarding group size effects, total residence time at the feeder and the number of individuals feeding increased, while average feeding duration decreased with increasing group size. As group size increased, more individuals accessed the feeders, suggesting that resource monopolization did not occur. Our results demonstrate that despite generations of intense artificial genetic selection for heightened performance, broilers are immediately able to distinguish feeder quality based upon the effort required to obtain a food reward. These results demonstrate that broilers adjust their feeding strategy according not only to the quality of the food resources but also to the number of competitors present. From an applied standpoint, our results suggest that broilers will favor clean feeders and may avoid feeders filled with wood-shavings from the litter.

**Key Words:** Broiler, Feeding strategy, Behavior

## Extension and Instruction: Scientific Session

**131 Effect of two protein regimens and two lighting intensities on performance of Hungarian partridge (*Perdix perdix*).** J. P. Blake\*, J. B. Hess, and W. D. Berry, *Auburn University, Auburn, Alabama.*

Limited information exists concerning dietary protein requirements of the Hungarian or gray partridge (*Perdix perdix*) when reared for sporting purposes and producers could benefit from such information. In this experiment, 560 Hungarian partridge hatchlings were randomized into 16 environmental chambers with 35 birds/rep. Two protein regimens, high (H) or low (L) and two lighting intensities, 20 Lux or 10 Lux were evaluated. The H and L protein regimens were 30-26-22 and 26-22-18% CP diets, respectively, that were fed from 0-4, 4-8, and 8-13 wks, respectively. All diets were corn-soybean meal-rice mill feed based and contained 2,811 kcal/kg ME. Protein and light intensity were assigned to each of four chambers in a 2x2 design. In addition, 2 reps/set were offered a top-dressed feed supplement (Oasis) for three days post-hatch. Brooding temperature was 35 C (95 F) for the first week and reduced 2.8 C (5 F) weekly through 4 wks of age. Birds and feed were weighed at 4, 8, and 13 wks. Results indicate that there were no distinct patterns in bodyweight or bodyweight gain of birds due to protein level. However, during the 4-8 and 8-13 wk periods, feed consumption was greater (c. a. 11.8% and 21.6%, respectively) ( $P < 0.0001$ ) in the H regimen. However during the 4-8 and 8-13 wk periods feed efficiency was lower ( $P < 0.05$ ) for the L as compared to the H regimen where 13 wk feed efficiencies were 5.021 and 5.961 g feed/g BWG, respectively. Light intensity had little if any effect on performance characteristics. Mortality was not influenced by treatment, but averaged 20% overall. Using a feed scattered additive

had no impact on reducing early mortality or improving performance characteristics from 0-4 wk. Qualitative feather scores (5=excellent; 1=poor) obtained at 13-wk of age indicated that the L regimen had a significantly higher ( $P < 0.03$ ) score, 2.275 vs. 1.963 for the H regimen. The 10 Lux intensity had a better feather score ( $P < 0.0001$ ) than the 20 Lux intensity (2.438 vs. 1.800, respectively).

**Key Words:** Partridge, Protein, Light

**132 Overview of management practices of small flock owners in Minnesota.** J. Griggs\*<sup>1</sup>, J. Bender<sup>2</sup>, and J. Jacob<sup>1</sup>, <sup>1</sup>University of Minnesota, St. Paul, <sup>2</sup>University of Minnesota, St. Paul.

A study of Minnesota farms that produce small flocks of broiler chickens was conducted to learn about the different management practices being used to raise these flocks. Information about management practices was obtained either through an on-farm interview or a telephone interview with the owner of each farm. The questionnaire used for the telephone interviews was an abbreviated version of the one used for the on-farm interviews. Participants of the on-farm interviews were individuals identified by state inspectors at small processing facilities as those who raise broilers without antibiotics. Candidates for the phone interviews were broiler growers listed in 'Minnesota Grown', a listing of farms published by the Minnesota Department of Agriculture. There were a wide range of housing systems and broiler management practices being utilized by the farms