the wheat gluten film with nisin was effective in reducing numbers of L. monocytogenes, but was ineffective against S. typhimurium. The combined treatment of nisin-containing film and in-package pasteurization substantially reduced the population of L. monocytogenes and prevented the recovery and outgrowth of cells during the two-month storage period. Growth of S. typhimurium not subjected to a treatment was limited or reduced during refrigerated storage while L. monocytogenes showed significant growth.

**Key Words:** Turkey bologna, Food Safety, In-package pasteurization, antimicrobial packaging, Listeria monocytogenes

### Environment & Management

#### Hatching Eggs & Other

**64** The effects of feeding eight different dietary formulations on growth criteria in Bobwhite quail. G. S. Davis¹ and L. R. Minear², ¹NC State University, Raleigh, NC USA, ²Southern States Cooperative, Providence Forge, VA USA.

Approximately 20,000,000 Bobwhite quail (BQ) are produced each year in the US with the majority of these birds being raised and released on commercial hunting preserves. There is very little available information regarding the dietary requirements of BQ. Therefore, 2 studies were conducted simultaneously to examine production parameters of BQ provided 8 different dietary rations from 1 to 10 wk of age. Each treatment group consisted of 90 BQ with 6 replications per treatment. Experiment 1 consisted of a 2 X 2 factorial arrangement of treatments: Extruded Soybean Meal (E-Soy) with 28% protein; Standard Soybean Meal (SSBM) with 26% Protein; E-Soy with 26% Protein; and SSBM with 26% Protein. Experiment 2 also consisted of a 2 X 2 factorial design: A control diet (E-Soy, 28% protein) with and without Bacitracin (BMD) (200 g/ton) versus a heat ready ration (HRR) (E-Soy, 28% protein) with and without the Direct-Fed Microbial, PrimaLac. Percent protein and E-Soy vs. SSBM only affected BW during the early stages of growth. BW of quail in HRR vs. control were heavier at 4, 6, and 9 wk. The presence of BMD or PrimaLac in the diets did not affect BW. However, BQ provided dietary PrimaLac had significantly (p < 0.05) better feather score at 10 wk. Cumulative feed conversion at 10 wk in BQ fed the SSBM was significantly improved (3.87) vs. the heat ready ration (HRR) (E-Soy, 28% protein) with and without the Direct-Fed Microbial, PrimaLac. Percent protein and E-Soy vs. SSBM only affected BW during the early stages of growth. BW of quail in HRR vs. control were heavier at 4, 6, and 9 wk. The presence of BMD or PrimaLac in the diets did not affect BW. However, BQ provided dietary PrimaLac had significantly (p < 0.05) better feather score at 10 wk. Cumulative feed conversion at 10 wk in BQ fed the SSBM was significantly improved (3.87) vs. the heat ready ration (HRR) (E-Soy, 28% protein) with and without the Direct-Fed Microbial, PrimaLac. Percent protein and E-Soy vs. SSBM only affected BW during the early stages of growth.

**Key Words:** Extruded soybean meal, PrimaLac, Feather quality

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**65** Effect of inoculation and application methods on the performance of chemicals used to disinfect *Salmonella* contaminated hatching eggs. M.T. Musgrove¹,¹, N.A. Cox¹, M.E. Berrang¹, R.J. Buhr¹, J.S. Bailey¹, and J. M. Mauldin², ¹USDA-ARS, ²University of Georgia.

Salmonellae can penetrate the shells and shell membranes of hatching eggs and this can critically affect final product contamination levels (processed broiler carcass). There have been numerous published studies on the efficacy of chemical disinfectants for hatching eggs. The objective of this study was to provide information that allowed the reader to accurately assess the published works on chemical efficiency to reduce salmonellae on hatching eggs. Three methods of inoculating the eggs were used: immersion, fecal smear, and droplet technique. Following incubation, two different methods of applying the treatment were used: immersion and spraying. When an immersion inoculum was used at a high level (10⁵-10⁷), it was extremely difficult to demonstrate any reduction in Salmonella contamination of eggs with any chemical used. When the fecal smear was the method of inoculation, an effective chemical treatment dramatically reduced the number of Salmonella positive eggs with either an immersion or spray application. A relatively ineffective chemical showed no advantage over water. However, if a lower inoculum (10³) was applied by fecal smear then an immersion chemical or water treatment resulted in dramatic reductions in Salmonella positive eggs. With the droplet inoculum method at a moderate level (10⁴), immersion and spray applications produced dramatic reductions with either chemical tested. By this egg inoculation method, slight reductions were noted even when water was used as the disinfection treatment. Studies such as these can be easily biased and the reader should pay close attention to method and levels of inoculation and application before deciding on the efficacy of a chemical treatment.

**Key Words:** *Salmonella*, Disinfection, Hatching eggs

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**66** Identification of critical periods for turning broiler hatching eggs during incubation. O. Elibol¹ and J. Blake³, ¹University of Ankara, Ankara, Turkey, ³North Carolina State University, Raleigh, NC USA.

Broiler hatching eggs were collected four times daily and stored for 1-3 d at 18 C before being set in a commercial hatchery. All eggs were turned 24 times per day during incubation except as required for each specific treatment. In the single trial of Experiment 1, 7,200 eggs were either turned or not turned during the 0-7 d, 8-14 d, and 15-18 d periods in eight regimens that included all possible turning combinations. The absence of turning from 0-7 d of incubation caused the greatest decrease in fertile hatchability and greatest increase in all stages of embryonic mortality and the incidence of Malposition II (head in small end of shell). A significant turning treatment by flock age interaction showed that the 0-7 d effect was more pronounced in the 68-wk-old flock as compared to the 29-wk-old flock used in the experiment. In the two trials of Experiment 2, 9600 eggs from each of 33-wk-old (Trial 1) and 35-wk-old (Trial 2) broiler breeder flocks were either turned or not turned from 0-2 d, 3-4 d, 5-6 d, or 7-8 d in 16 regimes that included all possible turning combinations. Generally, the absence of turning from 3-8 d, or 0-2 d alone or in combination with other time periods reduced fertile hatchability and increased embryonic mortality and percentage Malposition II. The 3-8 d period has been typically associated with the formation of the subembryonic fluid while the 0-2 d period was apparently more associated with dynamics of the shell membranes and albumen. It was concluded that the most critical period for turning commercial broiler hatching eggs during incubation was from 0-7 d with the single most critical 2-d period being 0-2 d.

**Key Words:** Turning, Hatchability, Embryonic mortality, Broiler hatching eggs

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**67** Performance of Bobwhite quail fed different levels of protein and enzyme supplementation. J. P. Blake*, J. B. Hess, B. D. Bowers, and A. Corzo, Auburn University, Auburn, AL.

Native Bobwhite quail populations have declined almost 80% during the previous 40 years. As a result, about 20 million birds are produced commercially to fulfill hunting needs. Limited information exists concerning dietary requirements of Bobwhite quail and producers could benefit from such information. In Experiment 1, 240 one-week-old Bobwhite quail were divided among 4 treatment groups and randomized into 6 replications with 10 birds/rep. A 26% protein mash starter diet (2810 kcal ME/kg) was fed to 3, 4, 5, or 6 weeks of age followed by the introduction of a 20% protein mash grower diet (2810 kcal ME/kg) at the appropriate time and fed through 8 weeks of age. In Experiment 2, 240 one-week-old Bobwhite quail were divided among 4 treatment groups and randomized into 6 replications with 10 birds/rep. A 26% protein mash starter diet was fed from 1-6 weeks of age where dietary treatments were: Control, Allzyme Phytase (2 lb/ton), Bio-Mos Plus XCL (3 lb/ton), and Penicillin (20 g/ton). Birds were fed a 28% mash grower diet containing no additives from 6-8 weeks of age. Birds and feed were weighed weekly in both experiments. Results from Experiment 1 indicate that birds were significantly (P<0.05) smaller at 6 weeks of age when fed the starter diet to three or four weeks of age. However, by eight weeks of age bodyweight averaged 149 g/bird and no differences between treatments occurred suggesting that compensatory growth prevailed. Feed efficiency (feed/gain) averaged 4.37 for the seven-week experimental period while no significance among treatments occurred. Results indicate that Bobwhite quail are responsive to a decrease in protein intake, but respond to compensatory gain. Results from Experiment 2 indicate that the feed additives had no effect on improving bodyweight gain, feed efficiency, or mortality. By eight weeks of age average bodyweight and feed efficiency was 148 g/bird and 4.43, respectively. The feed additives failed to provide
a significant improvement in growth, feed efficiency, or mortality under conditions of this trial.

Key Words: Bobwhite, Quail, Protein


Three studies were conducted to evaluate the efficacy of using the antimicrobial Cecure® as a hatching egg sanitizer. Cecure is 40% cetylpyridinium chloride (a quaternary ammonium compound) and 60% propylene glycol. The first two experiments were designed to determine the concentration of disinfectant to apply to the shell surface. It was important to identify the concentration of Cecure which would provide significant antimicrobial reductions without harming the developing embryo. It was determined that when Cecure was applied at 1% there was a negative impact on hatch. A third experiment evaluated the application of Cecure on nest and floor gathered eggs. Four thousand nest eggs were gathered from a single poultry house and divided evenly into 4 treatment groups. Group one received no treatment and served as the control. Group two was sprayed with a popular egg sanitizer at the rate of 3.5 ounces per thirty eggs. Group three was sprayed with Cecure at the concentration of 0.1% at the rate of 3.5 ounces per 30 eggs. Group four was treated the same as group three except that the concentration of Cecure was 0.38%. None of these eggs were washed prior to disinfection. All eggs were incubated and hatched and a complete hatchery egg residue analysis was performed. A concurrent study applied the same treatments to 1000 washed floor eggs gathered from two houses. It was determined that Cecure applied at the 0.1% level provided antimicrobial protection without any adverse effects on hatch characteristics as compared to control and the other antimicrobial. Washed floor eggs disinfected with 0.1% Cecure improved hatch (92% hatch of fertile) over that of the control (81% hatch of fertile). Chicks generated from these trials were not negatively impacted by any of the disinfectant treatments applied as indicated by mortality and growth data. It appears that Cecure applied at the 0.1% level can serve not only as an excellent egg antimicrobial but also may aid in the recovery of floor eggs typically lost in a production setting.

Key Words: Hatching eggs, Disinfection, Egg washing, Cecure, Cetylpyridinium chloride

69 Influence of hatching egg shell mottling on shell quality and hatchability in commercial broiler breeders. Keith Bramwell*, University of Arkansas, Fayetteville, AR.

Egg shell quality parameters have become increasingly important as commercial broiler breeder producers attempt to maximize hatchability. Shell mottling appears as a thinner, weaker portion of the egg shell and it has been postulated by many commercial hatchery personnel that mottled shells caused reduced hatchability and increased moisture loss. The purpose of this study was to identify if, and to what extent, shell mottling affects hatchability and potentially chick quality. Four flocks of broiler breeders were chosen ranging from 37 to 55 weeks of age, with a different flock selected for each of the four replicate trials. Hatching eggs from the egg storage room from two commercial hatcheries were candled and sorted into two groups; one group contained eggs with extreme cases of shell mottling, and another group contained eggs with no visible shell mottling. All eggs in each trial were laid on the same day and stored and handled as normally mandated by company protocol. Each replicate trial consisted of three trays of 154 eggs per tray for each of the mottled and non-mottled egg shell groups. In each trial, each tray of eggs was weighed prior to placement in the commercial setter and weighed again at transfer at 18 days of incubation to determine percent moisture loss. Following transfer to the egg hatching baskets, each of the three trays of eggs from each group was pulled from the hatchers after 21 days of incubation to determine percent hatchability. Percent moisture loss was 13.16 and 13.71 for the two groups of eggs while percent hatchability was 78.79 for the mottled eggs and 72.73 for the non mottled eggs, respectively. Results from this study indicate that while shell mottling in hatching eggs may distract from their visual appearance, it does not increase moisture loss or negatively affect hatchability.

Key Words: Broiler breeders, Shell quality, Hatchability

70 Early embryo mortality in hatching and cull broiler breeder hatching eggs from young breeder flocks following low and high incubation temperatures. Keith Bramwell*, University of Arkansas, Fayetteville, AR.

Elevated early embryo mortality in young commercial broiler breeder flocks is not unusual. The purpose of this study was to evaluate embryo livability and effect of eggs not considered optimum hatching eggs. Two similar but different trials were conducted to evaluate embryo viability under low and high incubation temperatures. In the first study, eggs from a two house breeder farm (25 wk of age) were separated into hatching eggs and cull eggs each week for four consecutive weeks. Hatching eggs were selected by the grower while the cull egg group consisted of eggs that were misshaped, or hatched but did not meet hatch shell conditions. Both groups of eggs were divided into one of three incubation groups (L 36.7 C; M 37.6 C; and H 38.3 C) stored for seven days, incubated 12 days then candled and broken open to identify fertility and incidences of embryo death. Fertility in the hatching eggs was 96.6% and 83.9% in the cull eggs. For all three incubation groups combined, total embryo mortality was 15.9% for hatching eggs and 47.2% for the cull eggs. There was also a significant effect of incubation temperature on embryo livability in both groups of hatching eggs. The second trial was set up similarly with a different flock of commercial breeders. Hatching eggs were again selected by the grower and sent to the hatchery for four weeks with the smallest eggs removed at the hatchery and placed in a small egg group. Fertility for the hatching eggs was 94.3% and 90.5% for the small eggs. Embryo mortality for the four week trial was 8.5% for the hatching eggs and 15.6% for the small eggs. Both the H and L incubation temperatures had a significant effect on embryo livability in the small eggs while the H temperature did not affect embryo livability in the hatching eggs.

Key Words: Hatchability, Egg size, Incubation temperature

71 Effect upon embryos and chicks of the differing moisture losses in eggs from a single breeder flock. M.J. Wineland1, V.L. Christensen1, B.D. Fairchild1, and I. Yildirim2, 1North Carolina State University, Raleigh, NC, 2University of Selcuk, Konya, Turkey.

The eggs produced by a flock of broiler breeders exhibit different eggshell conductances in a normal distribution curve. The amount of moisture loss from eggs can vary from 6 to 20%, even though the average may be 12%. Exactly what effect this has upon the developing embryo has not been elucidated in the broiler breeder. 2000 eggs (average ± 1 S.D.) from a commercial broiler breeder flock were incubated under typical conditions. Moisture loss was determined for each egg, and at transfer the eggs were separated into 3 groups (low, average and high moisture loss). Embryos or chicks were examined at 18 d, external pipping, and at hatch(21d)for body weight, yolk weight, heart weight, liver weight and jejunum weight and length. Hatch time was determined with the eggs examined at the youngest conductance to hatch the slowest. Chick weight. Body weights minus residual yolk were significantly greater for the average group at 18 and 21 d. The percent residual yolk was significantly greater for the low group at 18 and 21 d. The percent of heart was significantly less at 18 d and pipping but not at 21 d for the high group. The percent liver was significantly less for the low group compared to average group at 18 and 21 d. Intestine was significantly greater for the average group at 21 d. This information provides evidence that the variation in moisture loss normally observed in eggs from a breeder flock can also influence the results in differences of organ systems of the embryos and hatchlings.

Key Words: Incubation, Moisture loss, Relative humidity

72 Prevalence of Campylobacter and Salmonella spp. in California Asian live fowl and free-range flocks. B. A. McCrea*, E. R. Atwill, and J. S. Jeffrey, University of California, Davis, Veterinary Medicine Teaching and Research Center, Tulare, CA, USA.

Campylobacter and Salmonella spp. are common causes of food borne human gastroenteritis. Previous research documents prevalence rates for these pathogens in large-scale commercial operations. Little research has been done to determine prevalence in specialty poultry such as free-range and Asian live fowl under various management systems. Twelve free-range and 18 Asian live fowl chicken farms were surveyed and 20 cloacal swabs were cultured for bacteria from each farm. Asian live fowl were 52% positive for Campylobacter and less than 1% positive positive.
for Salmonella; free-range chickens were 55% and 4% positive, respectively. Statistical correlations between management variables and bacterial prevalence were determined by logistic regression. Management variables associated with an increase in Campylobacter spp. in turkeys, live fowl were age at sampling, rodent control, not raising an additional avian species, and off-site sale of birds. Higher prevalences of Campylobacter in free-range birds were associated with feeder tanks on water lines, curtained-sided houses, and allowing more birds outside access. Variables associated with Salmonella positive status in free-range birds in a univariate model included, biosecurity measures such as rodent control, chick feed source, all-in-all-out systems, source of new birds, cleaning pens, water disinfection, fans, cattle and quality assurance training.

Key Words: Salmonella, Campylobacter, Prevalence, Free-range, Specialty poultry


Immustim® a feed grade β-1,3/1,6-glucan, is a helical polysaccharide (polyl-glucon) derived from the cell wall of Saccharomyces cerevisiae that has immunomodulating activities. The objective of this study was to determine the effects of dietary supplementation with Immustim® on disease resistance in turkeys challenged with Escherichia coli both with and without dexamethasone (DEX) immunosuppression. Male pouls (320) were housed in battery-brooders from day of age and fed a standard turkey starter diet containing either 0, 10, 20, 40, or 80g/ton of Immustim®. At 4 wk, birds from each Immustim® dosage were treated with 3 injections of 2 mg/kg DEX on alternating days. On the day of the third DEX injection they were challenged with 50-100 cfu of a serotype O2, non-motile strain of E. coli. Treatments also included non-challenged controls and birds challenged with E. coli alone. Main effect mean BW was increased by Immustim® treatment (P=0.006). Both 10 and 20 g/ton significantly increased BW in control birds while 20 g/ton also increased BW in E. coli challenged birds. Treatment with 10 g/ton increased the heterophils/lymphocyte ratio in controls birds. Treatment with 20 g/ton increased total WBC counts and numbers of monocytes and basophils in DEX/E. coli challenged birds, the number and percentage of eosinophils in E. coli only, and the percentage of eosinophils in controls. The main effect means for both eosinophil numbers and percentages were increased by Immustim® treatment. The 20 g/ton treatment also resulted in an increase in the spleen and a decrease in the bursa of Fabricius weights relative to BW. The relative weight of the bursa of Fabricius was also decreased by 40 and 80 g/ton. There were no protective effects of Immustim® on air sacculitis scores or incidence of mortality, however both were increased by 40 and 80 g/ton fed to birds challenged with both DEX and E. coli. While Immustim® did not improve challenge resistance in this challenge, these data suggest that 10 and 20 g Immustim®/ton can affect peripheral blood leukocyte profiles and function as a growth promoter in young turkeys.

Key Words: β-glucan, Turkeys, Growth promoter

74 The effect of an experimental cholera product on Salmonella recovery of turkey pouls. R. W. Moore*1, J. A. Byrd1, K. D. Knape2, R. C. Anderson1, L. F. Kubena3, and D. J. Nisbet1, 1 USDA-ARS, SPARC, Food and Feed Safety Research Unit, College Station, TX, 2 Texas A&M University, College Station, TX.

Previous reports have observed that cholrte compounds reduce E. coli and Salmonella infections in swine, broilers, and market-age turkeys. The following studies were performed to investigate the effects of an experimental cholrra product (ECP) on Salmonella typhimurium(ST) infections of day-of-hatch turkey pouls. In all trials, day of hatch turkey pouls were challenged with ST and administered ECP in the drinking water for 4 days. After the treatment period, treatments were replaced with normal water for a 7 day period. Pouls were then re-collected and cultured for ST. In trial 1, day-of-hatch turkey pouls were challenged with 1×10⁸ cfu of ST and administered either 0, 1X, 2X, 3X, or 4X of the ECP (a 1X concentration is equivalent to a 7.5 mM chloride ion concentration). For all treatment concentrations in trial 1, turkeys provided ECP had significantly (P<0.05) lower populations (> 1.2 log reduction) and incidences of ceca ST as compared to control birds (2.1 log ST). Trial 2 was performed similar to trial 1 with the exception that pouls were challenged with 2×10⁵ cfu of ST. In trial 2, 1X and 4X concentrations of the ECP had significantly (P<0.05) lower populations (> 1.4 log reduction) and incidences of ceca ST as compared to control birds (1.4 log ST). These experiments suggest that the experimental cholrra compound significantly reduces Salmonella colonization in day-of-hatch commercial turkeys pouls.

Key Words: Chlorate, Turkey, Salmonella typhimurium

75 Effect of dietary calcium chelate on the reproductive performance of large white turkey breeder hens. J. L. Grimes*1, S. Noll2, J. Brannon2, J. L. Godwin1, and J. C. Smith1, 1 NC State University, Raleigh, NC USA, 2 University of Minnesota, Minneapolis, MN USA.

Absorption of inorganic minerals is generally poor. Researchers have reported that organic mineral complexes can have increased availability. Two studies were conducted to examine the inclusion of a calcium chelate (CC) in turkey breeder hen diets and its effect on their reproductive performance. Study A was conducted in Minnesota (A) and Study B in North Carolina. Typical corn and soybean meal diets without animal-by-product meals were used as the control diets (CD). Calculated nutrient values; Study A CD: 15% CP, 2.75% Ca, 0.45% Av P; Study B CD: 16% CP, 2.74% Ca, 0.49% Av P. The diets contained limestone and high-calcium phosphates as the calcium source. P. Study A used LW Hybrid hens in 8 pens (24 hens/pen) with two treatments: CD & CC (500 ppm Ca from CC). Study B used LW Hybrid hens in 24 pens (8 hens/pen) with three treatments: CD, CC1 (250 ppm Ca from CC), and CC2 (500 ppm Ca from CC). Hens in study A were photostimulated at 30 wk of age in December with 15L:9D for a 24 wk lay period while hens in study B were photostimulated after an induced molt in January with 15L:8.5D for a 24 wk lay period. Hens were inseminated 3 times the first week and then once weekly. Eggs were collected for weekly hatches in Study A. In Study B, eggs were collected bi-weekly with one collection of eggs set per month for a total of six hatches. Shell quality (SQ) was assessed during both studies. In Study A, progeny were observed to 4 wk. In Study B, progeny were weighed and unhatched eggs broken for observation. In both studies the pen was the experimental unit. ANOVA (A) and linear regression (B) were used to determine the effect of diet on BW, feed consumption (FD), egg production (EP), SQ, egg fertility (EF), egg weight (EW), percent hatchability of fertile eggs (EH), and progeny characteristics (P<0.05). In Study A, hens fed CC had a slightly higher proportion of the eggs classified as soft-shell. Percent EH was improved for the last 4 wk of production for CC. Hens fed CC had lower EW during some periods. In Study B, EH was improved by diet for 19 & 20 wk of lay (CD 50.9± CCI 68.2±, CCI 66.4± ± 5.3%). It was concluded that chelated calcium improved egg hatchability during the latter period of egg production.

Key Words: Chelated calcium, Turkey breeder hens, Reproductive performance, Egg hatchability, Organic minerals

76 Effect of chopped Bermuda grass hay and microbiological treatment of litter on performance of turkey hens. J. C. Smith*, C. M. Williams, and J. L. Grimes, NC State University, Raleigh, NC USA.

The objectives of this project were to determine if chopped Bermuda grass hay could be an alternative litter material equal to that of pine shavings (PS) and to evaluate the effect of a microbiological agent (MA) as a litter treatment. Turkey hen pouls were housed in a curtain-sided house with 48 pens (30 birds per pen). Six litter treatments were used: 1) control-new PS, 2) 50/50 PS/hay, 3) 100% hay, 4) 100% PS treated w/MA, 5) 100% hay treated w/MA. These litter treatments were placed on 48 floor pens in a randomized complete block to provide 8 replicates/pen. The density of PS and hay were: 13.7 and 5.5 lbs/ft³ - loose pack, 16.9 and 7.3 lbs/ft³ - packed, and 18.9 and 9.8 lbs/ft³ - tight pack, respectively. The average moisture content of the PS was 9.5% and hay was 7.4%. Body weight and feed consumption were determined at 3, 6, and 14 wk, while microbiological profile was determined at 0, 6, and 14 wk. Data were recorded on a pen basis. Data were analyzed using General Linear Models Procedures of SAS, 1989. At 14 wk, BW (7.7kg±0.06) and feed conversion (2.2kgc/±0.04) were not affected by treatment. Total heterotrophs and fecal coliforms were not different due to treatment except for yeast and molds at wk 14, PS-log 3.28, hay-log 0.92, and 50/50-log 0.05. There was no aspergillus fumigatus found in any litter. Litter pH was significantly lower than normal.
different between all litter types at wk 0; hay: 6.23\(^{a}\), 50/50-5.76\(^{a}\), and PS-4.72\(^{b}\) (p<0.05), but at 14 wk there were no differences. Moisture content was not significantly different at wk 0, but there was a litter X MA interaction at 14 wks; 1) 22.5\%\(^{ab}\), 2) 28.1\%\(^{b}\), 3) 23.8\%\(^b\), 4) 25.0\%\(^b\), 5) 23.3\%\(^a\), and 6) 28.3\%\(^{a}\) (p<0.05). At 14 wk, treatment 5 had significantly higher ammonia levels, 1,40ppm\(^b\), 2) 2.9ppm\(^b\), 3) 3.3ppm\(^b\), 4) 3.9ppm\(^b\), 5) 7.7ppm\(^a\), 6) 3.8ppm\(^b\). Forage analysis showed no difference between TDN among all litter types at 14 wks. Total caked litter was significantly different by litter X MA (p<0.05): 1) 221.0kg\(^{ab}\), 2) 244.1kg\(^b\), 3) 192.6kg\(^b\), 4) 225.1kg\(^b\), 5) 191.1kg\(^b\), 6) 231.5kg\(^{ab}\). It was concluded that Bermuda grass hay is suitable as a litter material.

**Key Words:** Litter, Litter alternatives, Hay, Pine shavings, Turkey

### 77 Effects of nutrient intake and time of photostimulation on fast and slow feathering turkey hens. V. R. Sim\(^{a}\), F. E. Robinson\(^{a}\), D. R. Korver\(^{a}\), R. A. Renema\(^{a}\), and M. J. Zuidhof\(^{a}\), 1 University of Alberta, 2 Alberta Agriculture, Food and Rural Development.

Chickens have been sexed on the basis of feather growth for many years, but the slow feathering gene has only recently been incorporated into a line of turkeys. This study was conducted to compare fast and slow feathering turkey females in regard to body weight (BW) gain, carcass composition and reproductive fitness. A total of 864 fast-feathering (FF) and slow-feathering (SF) pouls were reared on either a control (CON) or a high-energy, high-protein (HIGH) diet. Birds were photostimulated at 29 or 31 wk. Body weight was measured weekly to 4 wk of age and biweekly to 31 wk of age. Carcass characteristics (girth, shank, keel, breast width, breast muscle, fatpad, liver, ovary and oviduct) were assessed in 96 turkeys at each of 6 wk; 12 wk of age and at photostimulation (PSTIM). The HIGH diet increased BW gain in both strains from 4 d to 28 wk of age to a maximum increase of 16.9% in FF and 7.9% in SF birds, at 12 wk. Overall BW of FF birds was greater than SF birds from 4 d to PSTIM, to a maximum increase of 10.4% at 26 WK. Strain did not affect BW in CON-fed birds until after 16 wk when FF birds were 3.1% heavier than SF birds. At 6 wk and 12 wk, FF birds fed the HIGH diet had increased girth (6.0%, 7.0%), keel (5.4%, 6.2%), breast width (10.6%, 11.8%), back weight (11.3%, 23.5%) and decreased liver wt (10.2%, 25.9%) than those fed the CON diet. At 12 wk, SF birds fed the HIGH diet had increased girth (2.8%), keel (2.1%), breast weight (5.6%) and breast weight (14.3%), while percent liver wt decreased 11.0% compared to those fed the CON diet. Strain differences included a 14.1% increase in breast muscle weight in SF over FF birds fed the CON diet at 6 wk, and a 17.3% and 7.4% breast muscle weight increase in SF birds fed CON and HIGH diets, respectively, when compared to FF birds. Girth was increased at 6 and 12 wk (3.0%, 3.5%) in FF over SF birds fed the HIGH diet, and % liver weight was increased (0.19%, 0.12%) in SF over FF birds fed the HIGH diet. At PSTIM, FF birds had increased shank length (2.8%) and breast width (5.2%) when compared to SF birds. These data suggest that SF turkeys grow at a reduced rate during rearing, however, carcass growth can catch-up by 12 wk with increased nutrient intake. The percent breast muscle is increased in SF compared to FF birds.

**Key Words:** Turkeys, Feather sexing, Carcass composition, Growth rate

### 78 Production and Utilization of Poultry Litter in Tennessee. C. Goan\(^{a}\), L. Warren, B. Park, and R. Roberts, University of Tennessee, Knoxville, Tennessee, USA.

A survey was conducted in 2001 to determine (1) number of Tennessee poultry farms, (2) bird capacity per farm, (3) tons of litter produced, (4) tons of litter used on farm, (5) tons of litter transported off farm by farm owner, (6) tons of litter transported off farm by nearby farmers and (7) tons of litter transported off farm by litter haulers. Poultry company field technical representatives assisted with the survey by obtaining information from poultry farmers under their supervision. The survey revealed there were 727 poultry farms which produced approximately 232,535 tons of litter. Approximately 52 percent of the litter produced was utilized in the poultry farm owner’s operation, while 21 percent of the litter was removed from the farm by poultry litter haulers, 16 percent of the manure was removed from the farm by the owner and 10 percent of the litter was removed and used by nearby farmers. With respect to EPA's proposed CAFO regulations, the survey revealed that in the proposed two tier structure, there were 502 poultry farms with less than 50,000 chickens and 225 farms with 50,000 or more chickens. In the proposed three-tier structure, there were 291 farms with less than 30,000 chickens, 381 farms with 30,000 - 99,999 chickens and 55 farms with 100,000 or more chickens. The number of farms that would be affected by the proposed CAFO regulations is far greater than EPA’s estimate.

**Key Words:** poultry litter, CAFO regulations

### 79 Effects of Applying Air Velocity Under the Slats of a Commercial Broiler Breeder House on Manure Characteristics. W. A. Dozier, III\(^{a}\), M. Czarick, J. L. Wilson, C. Ritz, and W. Merka, The University of Georgia Athens, GA.

Broiler breeder manure contains approximately 60% moisture at the end of the production cycle. The high moisture content of manure limits the application to cropland because of its poor handling characteristics. As a result, it is not uncommon for contract growers to store the manure for long periods potentially creating environmental and biosecurity concerns. A study was conducted in a commercial broiler breeder house to examine the effects of air velocity on manure characteristics during a production cycle. Prior to bird placement, a fan (1/10 HP, RPM = 1,625) was placed on top of the litter and an 18.3 m polyethylene tube was attached to the fan. Five-cm holes were located on the sides of the tube and the holes were spaced on 61 cm intervals. Manure temperature, manure height, and manure moisture were measured at 4 d, 6 wk, 12 wk, and 15 wk. Sub-samples were collected on 3.0 m intervals approximately 20.3 cm from the tube. Six sub-samples were also collected in a similar manner at a location in the house where forced-air was not applied, which served as the control. The duration of the study was intended for 45 wk; however, the manure collapsed the tube by 15 wk resulting in terminating the experiment. At 4 d, manure temperature and manure height were similar between the two treatments, but the area receiving air velocity had less manure moisture (33.9 vs. 45.0%). In parallel to data collected on 4 d, manure moisture at 6 wk was reduced with the air velocity treatment (47.9 vs. 55.6%). However, samples taken at 12 and 15 wk subjected to the air velocity had reduced litter temperature (16.4 vs. 18.0\(^{\circ}\) C; 15.0 vs. 18.2\(^{\circ}\) C) and decreased litter moisture (37.8 vs. 45.9%; 21.2 vs. 44.3%), respectively. These results demonstrate that applying air velocity for 15 wks reduces manure moisture by 47% in a commercial broiler breeder house. Additional research is warranted to determine an effective setup using a fan with a polyethylene tube throughout the 45 wk production cycle.

**Key Words:** Broiler Breeder, Environment, Manure

### 80 Political and public concern outweigh scientific recommendations when developing policy to reduce eggborne salmonellosis due to *Salmonella* Enteritidis. N. H. Elsalawy\(^{a}\) and A. M. Thaler, Animal and Egg Production Food Safety Staff, Food Safety and Inspection Service, USDA.

In 1999, the President’s Council on Food Safety commissioned an Egg Safety Action Plan to eliminate all eggborne *Salmonella* Enteritidis (SE) salmonellosis human illness by 2010. The Egg Safety Action Plan strongly emphasizes reducing on-farm SE contamination of eggs, unless the eggs are destined for a process that includes a step to eliminate SE. Science does not support that further on-farm action/regulation will significantly reduce egg contamination or the incidence of human salmonellosis. Many egg producers have taken all known reasonable precautions to prevent SE infection of their flocks; several states have implemented strong measures to prevent SE infection of their flocks; several states have implemented successful, voluntary Egg Quality Assurance Plans to this end. Because there are environmental, biological, and production factors over which egg producers have no control, the risk for on-farm SE egg contamination can never be reduced to zero using current technology. Although there is some risk for ingesting eggborne salmonellosis, aware and proactive individuals can eliminate their risk of developing salmonellosis during food preparation. Without education that successfully dispels perceived risk and conveys actual risk, people will remain unaware that consistently taking simple precautions, such as properly storing and thoroughly cooking eggs, will eliminate any risk of salmonellosis. Efforts and resources