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## SYMPOSIA AND ORAL SESSIONS

### Environment and Management: Broilers and Turkeys

#### 11 Effect of egg position and turning frequency during storage and incubation on hatchability of broiler hatching eggs.

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A series of experiments was conducted with broiler hatching eggs to learn more about egg position during storage and egg turning during both storage and incubation. Broiler breeder flocks at 62 wk of age supplied eggs that were stored for either 3 d or 14 d at 18 C and 75% RH in either the large end up (LEU) or small end up (SEU) position and then turned 24 (24X) or 96 (96X) times per day to 18 d of incubation in Experiment 1. Experiment 2 was conducted similarly with eggs from a 60-wk-old flock. The longer storage period decreased fertile hatchability due to an increased percentage early and late embryonic mortality. Storage in the SEU position improved fertile hatchability. There was a significant storage position by storage period interaction due to better fertile hatchability for the SEU eggs stored 14 d but not 3 d. There was a significant interaction of storage period with turning frequency found in Experiment 1 due to an increased fertile hatchability with 96X turning in incubation after 14 d, but not 3 d, of storage. Although this interaction was not repeated statistically in Experiment 2, fertile hatchability was improved by 96X turning as compared to 24X turning (74.1% versus 71.0%). This effect was due primarily to reduced early embryonic mortality. The data of Experiments 1 and 2 suggested that long storage in the SEU position or turning LEU stored eggs 96X daily produced similar results. Eggs from broiler breeder flocks at 64 and 58 wk of age were then stored for either 3 d or 14 d at 18 C and 75% RH in either the LEU or SEU position and turned 0 (0X) or 4 (4X) times daily during storage in Experiments 3 and 4. The longer storage period decreased fertile hatchability in Experiments 3 and 4, as expected. Although SEU storage or turning 4X daily in storage significantly improved fertile hatchability in Experiment 3 only, there was a significant storage position by storage turning interaction in both Experiments 3 and 4 due to lower fertile hatchability for the unturned LEU eggs when compared to the other combinations. The data of Experiments 3 and 4 suggested that turning LEU eggs 4X daily during storage was equivalent to storing eggs SEU with or without turning.

**Key Words:** egg turning, hatchability, egg storage length

#### 12 Effect of restricted and normal ventilation on broiler hatching egg temperature and embryonic development.

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Historically, incubator air and egg temperatures have been assumed to be similar. However, recent investigations have found eggs to exhibit temperatures above those of the machine air temperature set point. Egg

temperatures in excess of the optimum have been shown to adversely affect embryonic development. Since egg temperature has been closely related to ventilation rate and egg capacity within the incubator, it was hypothesized that altering the ventilation pattern or number of eggs within hatching baskets might ameliorate the adverse effects of high egg temperatures on embryonic development. An experiment was conducted to evaluate the effects of ventilation pattern and egg number on embryological development. Ross 344 x Ross 508 SF broiler eggs were incubated to maintain an internal egg temperature of 37.6C and then transferred on E17 to two hatchers. Four treatments that consisted of combinations of restricted or normal ventilation patterns and high or low egg stocking densities were utilized. The restricted ventilation treatment was created by applying tape to the top perimeter of each basket (TT) while also inserting a cardboard divider above the eggs in the basket such that air could only pass through the tray at the level of the eggs. The normal ventilation treatment (CN) utilized standard hatching baskets with no modifications. Egg density was either 90 or 180 eggs in each basket. There were four replicate baskets per treatment. Egg temperatures were monitored daily from E17 to hatching using a Braun Thermoscan infrared thermometer. At hatching, BW, and weights of the yolk, heart, liver, proventriculus, gizzard, and small intestines were determined. In spite of the absence of a significant effect on BW and yolk weight, the chicks from the TT-180 treatment consistently exhibited lower relative heart, gizzard, proventriculus, and small intestines weights while higher relative organ weights were generally observed in the TT-90 treatments.

**Key Words:** oragans, ventillation, egg temperature

#### 13 Genetic strain, egg size, and flock age influences hatchability and broiler performance.

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The impact of genetic strain, egg size, and flock age on hatching egg characteristics, fertility, hatchability, and broiler growth were analyzed. Eggs were collected from two strains (Ross308 (R), Cobb500 (C)) (n=1380/strain) and three egg sizes (small (S), medium (M), large (L)) (n=460/strain/weight) from 29 wk old flocks. Thirty eggs/strain/egg size were used to assess egg characteristics with remaining eggs incubated. After 21.5 d of incubation, all saleable chicks were weighed, and unhatched eggs broken open to calculate fertility and hatchability. Two groups of 119 chicks/strain/egg size were grown out on floor pens for 6 wk. Daily mortality and 3 and 6 wk feed consumption and body weights were recorded. Data were analyzed using SAS proc Mixed ( $P \leq 0.05$ ). The R eggs had greater specific gravity (R=1.079±0.0005; C=1.069±0.0005), wet (R=15.4±0.1g; C=14.9±0.1g) and dry (R=8.09±0.07g; C=7.48±0.07g) yolk weights, and wet (R=5.33±0.04g; C=4.76±0.04g) and dry (R=5.3±0.04g; C=4.71±0.04g) shell

weights. Large eggs had greater specific gravity (L=1.075±0.0006; M=1.075±0.0006; S=1.072±0.0006), wet (L=16±0.1g; M=15.2±0.1g; S=14.4±0.1g) and dry (L=8.25±0.09g; M=7.74±0.08g; S=7.36±0.08g) yolk weights, and wet (L=5.44±0.05g; M=5.08±0.05g; S=4.61±0.05g) and dry (L=5.41±0.05g; M=5.02±0.05g; S=4.58±0.05g) shell weights. The R eggs were heavier (R=57.7±0.1g; C=53.8±0.1g) and had better fertility (R=96.8±0.9%; C=76.7±0.9%) and hatchability (R=81±1.3%; C=64.7±1.3%). Large eggs also had better fertility (L=89.1±1.1%; M=85.9±1.1% S=85.1±1.1%), but higher late embryonic mortality (L=10.8±1.1%; M=6.5±1.1%; S=3.6±1.1%) than other egg sizes. Heavier chicks hatched from R (R=39.44±0.09g; C=37.35±0.09g) and L (L=41.8±0.1g; M=38.2±0.1g, S=35±0.1g) eggs. The R broilers had greater early average broiler body weight gains (R=718.18±7.2g; C=679.83±7.2g). The data show that strain and egg size influence hatchability and broiler growth. Future studies should examine incubation conditions that are tailored to each strain and egg size in order to improve hatchability and broiler production.

**Key Words:** genetic strain, egg size, chick quality

**14 Influence of egg weight on the uptake of residual yolk in Ross 708 broilers.** R. A. Renema\*, N. J. Wolanski, and F. E. Robinson, *University of Alberta, Edmonton, AB, Canada.*

Residual yolk sac in a chick is affected by factors such as maternal age and egg size. It is less clear if it positively affects growth. The impact of egg size on residual yolk sac size and utilization was examined. Ross 708 hatching eggs from a single collection were weighed and sorted into 3 g size ranges (52-54, 55-57, 58-60, 61-63, and 64-66 g) (1200 eggs total). Three incubation trays of each size were incubated and hatched (252 eggs/size). Hatchability traits were determined. Chicks were weighed and assigned to a processing age (0, 1, 2, 4, 6, 8, or 10 d of age) and divided among 3 pens. At each processing age, chicks were weighed, and residual yolk sac and gut weight determined. Sex of chicks was determined at processing.

Hatch of fertile did not differ among egg sizes. However, chick weight differed for all size ranges, from a high of 45.8 g from 64-66 g eggs to a low of 36.7 g from 52-54 g eggs. The 27% greater size of the chicks from these larger eggs did not last — stabilizing at an approximately 15% size advantage through to 10 d of age, when 64-66 g egg chicks weighed 215 g compared with 186 g for chicks from 52-54 g eggs. Female BW was greater than male BW by 4 d of age, which is typical for high-breast yield strains. At Day 0, residual yolk sac correlated well with chick wt. ( $r=0.63$ ). By Day 2 the relationship was much weaker ( $r=0.27$ ) and after 6 d there was no relationship. Residual yolk sac weight was more strongly correlated with original chick weight than with processing BW already by 1 d of age. At hatch, residual yolk as a % of egg weight increased with egg size. This likely reflects a larger proportion of yolk in the larger egg sizes. Residual yolk sac weight became similar among chicks from all egg size groups at 2 d of age and stabilized at approximately 0.1 g at 10 d of age. Whereas large chicks had a larger yolk sac, it did not appear to deliver a growth advantage. Chicks from 52-60 g eggs increased BW 5.1-fold by 10 d compared to a 4.6-fold increase by chicks from 61-66 g eggs. Chick size appears to affect growth rate more than residual yolk sac does.

**Key Words:** chick quality, growth rate, residual yolk sac

**15 Foot pad lesions, pasture condition, and bacterial pathogens in free range heritage vs. commercial turkey varieties.** B. McCrea<sup>\*1</sup>, M. Leslie<sup>2</sup>, L. Stevenson<sup>2</sup>, K. Macklin<sup>2</sup>, L. Bauermeister<sup>2</sup>, and J. Hess<sup>2</sup>, <sup>1</sup>*University of California, Davis*, <sup>2</sup>*Auburn University, Auburn, Alabama.*

A study was performed to compare the performance of heritage (Bourbon Red, BR) and commercial (Broad Breasted White, BBW) turkey varieties in a free-range management system. Before bird placement, pens were seeded with a mixture of Tall Fescue and Bermuda Grass. The turkeys were maintained in 4.27 m x 21.34 m pens and processed at 17 weeks of age. For each variety, sixty-six straight run turkeys were divided equally into 3 pens. Poults were brooded indoors to four weeks of age and then moved outdoors into pens for the remainder of the growout period. Foot pad lesions were scored at 4, 7, 10, 13, and 17 weeks of age. Cloacal swabs were taken from a subset of each variety and used to assess the presence of both *Salmonella* and *Campylobacter*. In addition to the pathogens already listed, carcass rinsate was cultured to determine aerobic and enteric bacteria counts as well as the presence of *Clostridium perfringens*.

There were no significant differences between foot pad lesion scores for the two varieties at 7, 10, and 13 weeks. At 4 and 17 weeks of age, BR turkeys had a significantly lower number of birds with mild foot pad lesions than BBW turkeys. The majority of Bourbon Red turkeys never acquired foot pad lesions and no birds of this variety acquired severe lesions.

For *Campylobacter* recovery, cloacal swabs and rinsate were both enriched and direct plated. All *Salmonella* samples were enriched with tetrathionate-Hajna broth. *Salmonella* was not recovered from cloacal swabs or carcass rinses. *Campylobacter* was recovered from enriched carcass rinsate in both BBW (n=5) and BR (n=5) turkeys. Blood agar plates yielded a significant difference between BBW and BR turkeys with  $3.07 \times 10^4$  cfu/ml and  $1.20 \times 10^5$  cfu/ml, respectively. *C. perfringens* was recovered from 58.3% of BBW carcasses but BR carcasses did not yield the organism. The average recovery of total enterics from BBW and BR turkeys was  $8.79 \times 10^2$  cfu/ml and  $4.54 \times 10^3$  cfu/ml, respectively. The results indicate that there is very little difference between turkey varieties with regard to foot pad lesions and microbial load on carcasses.

**Key Words:** turkey, free range, heritage

**16 Feed conversion, growth rate, and carcass yield in free range heritage vs. commercial turkey varieties.** L. M. Stevenson<sup>\*1</sup>, M. A. Leslie<sup>1</sup>, B. A. McCrea<sup>2</sup>, K. S. Macklin<sup>1</sup>, L. J. Bauermeister<sup>1</sup>, and J. B. Hess<sup>1</sup>, <sup>1</sup>*Auburn University, Auburn, Alabama*, <sup>2</sup>*University of California, Davis.*

A study was performed to compare the performance of heritage (Bourbon Red, BR) and commercial (Broad Breasted White, BBW) turkey varieties in a free-range management system. Before bird placement, pens were seeded with a mixture of Tall Fescue and Bermuda Grass. The turkeys were maintained in 4.27 m x 21.34 m pens with 4.14 m<sup>2</sup>/bird. For each variety, sixty-six straight run turkeys were divided equally into 3 pens. Poults were brooded indoors to four weeks of age and then moved outdoors into pens for the remainder of the growout period. The sex of the birds in the BR treatment could not be determined until 17 weeks of age. The birds were weighed at four weeks of age and every three weeks thereafter. Period and cumulative BW gain, feed intake and feed conversion were compared at 7, 10,

13 and 17 weeks of age. The BBW turkeys had higher feed intake, weight gain and BW than the BR turkeys for each of the age periods ( $p \leq 0.05$ ). The feed conversion in the BBW turkeys was better than the BR turkeys for all of the age periods except the thirteen to seventeen week period. There was no difference during this period. Turkeys were processed at seventeen weeks of age. The final live weight, carcass weight, and carcass yield were compared for both strains and sexes of turkeys. The BBW turkeys had higher live weights (13.81 kg vs. 4.80 kg), carcass weights (10.90 kg vs. 3.38 kg), and carcass yields (79.11 % vs. 71.52 %) than the BR turkeys ( $p \leq 0.05$ ). There were significant differences between the sexes for live weight and carcass weight, but not carcass yield ( $p \leq 0.05$ ). There were significant strain by sex interactions for live weight, carcass weight, and carcass yield ( $p \leq 0.05$ ). The BBW males were the highest for all three measurements. The BR females had the lowest live weight and carcass weight, while the BR males had the lowest carcass yield. These results indicate that there are large differences between turkey varieties with regard to live performance and carcass data, but not overall carcass yield.

**Key Words:** turkey, free range, live performance

#### 17 Withdrawn by author.

**18 Use of a feed-grade enzyme in broiler diets to reduce paw burns.** M Nagaraj\*, J. B Hess, and S. F Bilgili, *Auburn University, Auburn, Alabama.*

Nutritional and management interventions are needed to reduce the incidence of paw burns in poultry. In this study, enzyme (Allzyme Vegpro, Alltech, Nicholasville, KY) supplementation of corn-soybean based broiler diets was evaluated in an effort to reduce total and ammonia nitrogen excretion and its impact on paw quality in broiler chickens. A total of 1600 mixed sex chicks were raised on floor pens in a design involving 2x2x2 arrangement of protein level [PL; high (HP) or low (LP)], protein source [PS; all vegetable (V) or vegetable plus animal (V+A)], and enzyme [with or without enzyme supplementation (0.06%)], on a four stage feeding program (four replicate pens per treatment; 50 birds per pen). Body weight, feed conversion and mortality were determined on 14, 28, 42 and 57 d of age. The feet were scored for paw burns on all birds on 28, 42, and 57 d and the severity was recorded as: none (no ulcerating lesion), mild (lesions of <1.5 cm), and severe (lesions of >1.5cm). Pooled gut samples were collected at 57 d to determine viscosities of fore- and hind-gut contents. Pooled litter samples were analyzed for total and ammonia nitrogen at 14, 28, 42 and 57d.

Live performance of birds did not vary among the treatments ( $P > 0.05$ ). Paw burns were significantly affected by PS at 42 d ( $P < 0.05$ ), with birds fed all V diets showing higher incidence and severity than those fed V+A diets. At 57 d of age, birds reared on V diets with enzyme supplementation showed a lower incidence of mild paw burns compared to other treatments. Fore-gut and hind-gut viscosities were higher in birds fed V diets than those fed V+A diets. Enzyme supplementation reduced viscosity of the gut contents irrespective of the PL or PS. Higher levels of litter total and ammonia nitrogen were observed with HP diets (28 and 42d), V diets (28d) and with enzyme supplementation (28 and 42d). A significant PL by PS interaction at 28 d of age showed highest litter ammonia nitrogen in birds reared on HP and V diets as compared to other treatments. In this study, enzyme supplementation reduced viscosity of the gut contents, but

had little effect on litter total & ammonia nitrogen levels and paw burns in broilers.

**Key Words:** broiler, paw quality, enzyme

**19 Dietary modifications to reduce nitrogen consumption and excretion in broilers.** R. Angel\*<sup>1</sup>, W. Powers<sup>2</sup>, S. Zamzow<sup>2</sup>, and T. Applegate<sup>3</sup>, <sup>1</sup>University of Maryland, College Park, <sup>2</sup>Iowa State University, Ames, <sup>3</sup>Purdue University, West Lafayette, Indiana.

The impact of feeding broilers reduced protein (LP) and control (C) corn-soy type diets with industry protein concentrations on broiler performance, breast yield and litter nitrogen (N) content were determined. Ross 308 male broilers were allocated to chambers (8) and grown from hatch to 42 d. Three sequential experiments were conducted; each constituting one flock (F). C treatment (Trt) broilers were fed based on a 4 phase feeding program: starter (St), grower (Gr), finisher (Fn), and withdrawal (Wd) diets. LP Trt broilers were fed based on a 6 phase feeding program: prestarter, St, Gr1, Gr2, Fn, and Wd diets. Formulated protein concentrations were 22.1, 20.0, 17.2, and 16.6% for the C Trt St, Gr, Fn, and Wd diets, respectively while those for the LP Trt PreSt, St, Gr1, Gr2, Fn, and Wd diets were 22.0, 18.6, 18.1, 17.3, 15.8, and 15.0%, respectively. Synthetic Lys, Met, Ile, Thr, Arg, Trp, and Val were included where needed to meet minimum requirements in the LP diets while only Met and Lys were needed in the formulation of the C diets. Concentrations of Lys, Met, Ile, Thr, Trp, Arg, and Val, in the St, Gr1, Gr2, Fn, and Wd LP diets were: 1.22, 0.59, 0.85, 0.82, 0.24, 1.40, 0.90%; 1.14, 0.51, 0.82, 0.68, 0.23, 1.25, 0.90%; 1.06, 0.49, 0.75, 0.74, 0.22, 0.83%; 1.01, 0.49, 0.71, 0.68, 0.20, 0.80%; and 0.96, 0.43, 0.70, 0.68, 0.19, 0.76%, respectively. Performance was determined at the end of each phase and litter weighed and sampled at the start of F 1 and after each F. Litter was analyzed for DM, N and minerals. Broilers on the C Trt weighed more ( $P < 0.05$ ) at 42 d over three F (2.78 kg) than those fed the LP Trt (2.69 kg) but feed/gain ratio was similar. Twenty broilers per chamber were sampled for yield determination in F 3. Dress percent and breast yields were not affected by Trt. Based on analyzed concentrations and data analyzed over the three F, N consumed was 5.1% less and litter N 16.6% less in LP vs. C chambers.

**Key Words:** broiler, protein, litter

**20 Comparison of methods for weighing broilers – manual vs. computerized scales.** K. Budgell\*<sup>1</sup>, J. MacIsaac<sup>2</sup>, and B. Rathgeber<sup>3</sup>, <sup>1</sup>Nova Scotia Agricultural College, Truro, NS, Canada, <sup>2</sup>Atlantic Poultry Research Institute, Truro, NS, Canada, <sup>3</sup>Agriculture & Agri-Food Canada, Truro, NS, Canada.

Accurate and reliable measurement of broiler body weight is a valuable tool for broiler management. In practice, the average weight of the flock is determined by manually weighing a random sample of birds or through automatic weighing using computerized scales. The objective of this study was to determine if using computerized bird scales in a research environment reflected the true weight of broiler chickens. A total of 1824 broiler chicks, 912 each of male and female, were randomly allocated to 48 pens at a stocking density of 0.073m<sup>2</sup>. Birds were grown to 38 days of age. Daily body weights were recorded by computerized platform scales placed in the center of each pen. Each pen of birds was also caught and weighed on a table top scale at 14,

24 and 38 days of age. The body weight at 14 days of age was the same regardless of method used to determine it. By day 24 the weights recorded by the scales positioned within the pens (846g) were heavier ( $p < 0.001$ ) than those for the same birds caught and weighed the traditional way (776g). This effect carried through to 38 days of age ( $p < 0.05$ ) where birds weighed manually appeared to be smaller (1954g) than those recorded by computerized scale (2000g). Larger birds may spend more time resting on the platform as they age, giving smaller birds less opportunity to use the scale. From this study it appears that using bird scales in small research pens results in an overestimation of actual bird weight near market age. These computerized scales are a fast and useful tool for producers to estimate flock weight when determining market age in commercial production facilities but may be less useful in a research environment where a smaller sometimes less uniform population is monitored and bird movement is restricted.

**Key Words:** broiler chicken, body weight, computerized scale

**21 Varying dietary protein level during rearing affects carcass and reproductive traits of broiler breeder hens at sexual maturity.**

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A total of 250 female broiler breeders of a classic (Ross 308) and a high breast yield strain (Ross 708) were reared to determine the effects of three relative dietary balanced protein (DBP) levels (HIGH = +3%, STANDARD = Control, and LOW = -3%) during one of four periods (1 to 6, 7 to 12, 13 to 18, or 19 to 24 wk of age) on fleshing, frame size, fat deposition and reproductive development at sexual maturity (SM). The STANDARD DBP was fed during the remaining periods. Weights of reproductive organs, breast muscle, abdominal fat pad, liver weight and the number of large ovarian follicles were collected at first egg. Shank and keel length were measured to assess frame size. Each period was analyzed separately, with DBP and strain as main factors in the factorial design.

Changing DBP from 1 to 6 wk resulted in changes that approached significance for relative breast weight ( $P=0.057$ ) and oviduct weight ( $P=0.056$ ) at SM. When fed 7 to 12 wk, DBP affected relative weight of liver ( $P=0.046$ ) and ovary weight ( $P=0.022$ ) at SM, when ovary weight was lower (51 g) in LOW DBP than in HIGH DBP (62 g) birds. However, ovarian follicle size was only lower in LOW DBP birds of the Ross 708 strain. When DBP changed from 13 to 18 wk, relative abdominal fat pad weight of LOW DBP birds was greater than that of STANDARD or HIGH birds, while BW was lower in LOW than in STANDARD birds ( $P=0.009$ ). Overall, frame, age at first egg, and large yellow follicle counts were not affected by DBP during rearing. Varying DBP at the beginning of rearing period had no clear effects on sexual development and fleshing, whereas varying DBP at the end of rearing had not affect on SM parameters. When fed from 7 to 12 wk, DBP level affected traits associated with reproductive development, and DBP from 13 to 18 wk affected BW and composition at SM.

**Key Words:** broiler breeders, dietary protein, fleshing

**22 Factors affecting egg properties of broiler breeder hens:**

**Egg colour, egg quality, egg shape.** M. E. Rustad\*<sup>1</sup>, F. E. Robinson<sup>1</sup>, M. J. Zuidhof<sup>2</sup>, and R. A. Renema<sup>1</sup>, <sup>1</sup>University of Alberta, Edmonton, AB, Canada, <sup>2</sup>Alberta Agriculture, Food and Rural Development, Edmonton, AB, Canada.

The feeding regime of broiler breeder (BB) hens can impact egg quality. Feed restriction (R) or over-feeding (OF) results in a difference in shell quality, yolk and albumen weights. Strain effects on egg shape, relationship of egg shape with internal quality, and change in time are less clear. This study characterized the relationship between feeding level and strain on egg quality and external traits. A total of 5 eggs were collected at 32, 43, and 54 weeks of age from 288 hens of 8 strains (36 birds/strain). Feed allocation of the 144 OF hens was 20% above R levels from 18 to 56 wk of age. Fresh egg weights were taken and the specific gravity, egg colour (L, a, b scale), shape, albumen height and weight, yolk weight, and shell thickness were assessed the next day.

As hens aged, egg weight increased 14.3% and those from OF hens were 2.67% (1.7g) heavier than the R group. Yolk weight also increased with hen age (5.1g, 3.5%) while albumen decreased. Yolk weight and %yolk were greater in OF hens. Strains 1, 3, 6, and 7 had the highest %yolk. This is due likely to these strains having superior ability to transfer excess nutrients to yolk development. The OF strain 7 had a larger increase in albumen weight (7.8%) than R hens (13.3%). This was a larger increase than the other strain averages. Shell weight increases and thickness decreases with age. The OF strain 2 had the lowest % shell, while the R strain 2 group had the highest. This may be indicative of an inability to maintain shell deposition as the eggs grew larger with age. Shell thickness was only affected by age. The OF eggs had a higher L value (lighter brown color, 56.9) than the R (56.1), which may relate to differences in egg size. Strains 1 and 9 had significantly darker shells than other strains, but were not different from each other. Egg shape decreases as hens age (eggs becoming less round) and is smaller for OF group than R (0.83 vs 0.84). Further study will determine how this change affects hatchability.

**Key Words:** broiler breeder, egg quality, egg shape

**23 Characterization of relationships among broiler breeder male growth, variability, and mortality.**

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Breeder males cost a hatching egg producer \$6.52 CDN/chick. Recent work has demonstrated that breeder males display high levels of aggression toward flock mates resulting in mortality losses. This project explores the potential relationships between chick quality and growth traits on potential success of males in the breeder barn. At hatch 550 males were neck tagged and measured for chick length, shank length and an estimation of residual yolk mass. Male body weight at hatch, 4, 8, 12, and 16 wk was recorded. Males were also weighed prior to transfer into the breeder barn at 18 wk of age. All mortality was collected and frozen for analysis at a later date. Postmortems were performed to determine the cause of death. Growth history and chick traits of males which died were compared to that of males which survived past 38 wk.

Mean hatch BW was 42.6 g with a CV of 7.9 %. Hatch weight was a poor measure of growth potential as indicated by the low correlation between hatch BW and 4 wk BW ( $r = 0.13$ ). By 4 wk of age BW correlated more strongly with all subsequent weights ( $r = 0.46$  at 18

wk). Birds grew 819 g during the 4 to 8wk period (CV = 15.0 %), as compared to only 389 g in the 8 to 12 wk period (CV = 15.3 %). Although there was no difference in the variation on a population basis, drastic changes are apparent when data was expressed in relative gains. The variation for relative gains ranged from a low of 17.2 % in the 4 to 8 wk period to a high of 41.0 % in the 16 to 18 wk period. Males which died had a 5 % lower growth trajectory by 4 wk of age as compared to males which survived past 38 wk. The mortality prior to 18 wk was low (total of 2 %). By 38 wk of age, mortality or culling now represented 19.5 % of the 550 males which had been placed. The major causes of death were male kills and septicemia. Growth profile during rearing may have a role in determining which males will survive in the breeder barn.

**Key Words:** growth profile, relative growth, male mortality

**24 Growth characteristics as a predictor of male quality in broiler breeders.** A. Herron\*<sup>1</sup>, R. A. Renema<sup>1</sup>, F. E. Robinson<sup>1</sup>, and J. L. Wilson<sup>2</sup>, <sup>1</sup>University of Alberta, Edmonton, AB, Canada, <sup>2</sup>University of Georgia, Athens.

Selecting quality-breeding males for broiler breeder flock placement is difficult. Understanding growth patterns of male broiler breeders and how they relate to sexual characteristics may help in the pre-selection of males for the breeding barn. In this study broiler breeder males were tracked from hatch to 58 wk to monitor growth and maturation. A total of 165 Ross males were reared according to industry standards and photo-stimulated at 23 wk. Males had BW, keel girth, shank length and width measured at day zero, wk 5, 10, 15 and 20. Males were randomly divided into three kill groups: wk 23, 30 and 58. Carcass morphology and reproductive parameters were measured at each time. Both the hatch measurements and subsequent measurements up to wk 15 were not useful in determining male quality. There was considerable variability in individual growth trajectories during the first 15 wk. The substantial shifts in BW after week 23 can likely be explained by hormonal changes due to photo-stimulation and individual behaviour such as aggression to access or protect food and/or females. Following dissection, it was found that the right and left testes were positively correlated with BW at wk 15 (P<0.028 and P<0.003) and BW at wk 20 (P<0.002 and P<0.001). This suggests that male broiler breeders are beginning to become set in their growth trajectory around wk 15 of growth. Larger males at wk 15 and 20 had larger testes throughout the experiment. Males at 23 wk of age had the largest amount of abdominal fat (0.15% of BW) and breast muscle (19.4% of BW)

than 58 wk males (0.04% and 16.8 %, respectively). Males cannot be pre-selected for the breeding barn until wk 15 at the earliest. Selecting larger BW males suggest that producers will be selecting a male with larger testis weights.

**Key Words:** growth rate, male selection, broiler breeders

**25 Comparing the economics of protein and energy levels in full fed molting procedures.** P. L. Ruszler\* and C. L. Novak, Virginia Polytechnic Institute and State University, Blacksburg.

Certain levels of protein and energy should be met in order to achieve optimum performance after molting with or without feed withdrawal (FW). In order to determine the economic impact of achieving these levels, 1152 hens were housed 3 per cage at 464 sq cm/hen. Four strains; Bovans, Hyline W-98, Hyline W-36 and Lohmann were compared. Molt diets used were: A=9.7% CP/1100 Kcal, B=9.7% CP/1430 Kcal, C=11.85% CP/2105 Kcal and D=14% CP/2780 Kcal of energy. The layer diet used was 17% CP/2845 Kcal of energy. The 4 strains were equally assigned to diets A & B for the first two weeks. The first one-third of the A & B diets was changed to the C diet for weeks 3 & 4. The second one-third of the A & B diets was changed to the D diet during the fourth week while the last third remained on the A & B diets. All hens were placed on the D diet during week 5. The original third of the hens remained on the D diet during week 6 while the other two thirds went on the layer diet. All hens were fed the layer diet starting the seventh week through the end of the trial at 24 weeks. Water was given ad libitum. A loss of 20 to 23% BW occurred in the third week. Egg production reached zero during the 2nd week and lasted 2 ½ weeks. It returned to 50% during the eighth week and peaked from 85 to 93% during the eleventh week. The protein needed per bird was 545 to 590g CP to reach 50% production and 1060 to 1090g CP to reach peak production compared to 590 and 1090g CP respectively for 4d FW molting. The energy needed per bird was 9800 to 10200 Kcal to reach 50% production and 18200 to reach peak production compared to 10800 and 19800 Kcal respectively for 4d FW molting. One treatment consumed significantly less energy and produced fewer eggs/hen than the others resulting in a significantly higher cost/doz of 11.3¢ vs. the others averaging 10.7¢. This shows that different formulations can achieve optimal economic performance provided the nutrients are highly digestible and readily available at optimum levels for the hen.

**Key Words:** molting, economics, energy/protein

## Metabolism and Nutrition: Nutrition A - Minerals and Vitamins

**26 Does vitamin U have potential to improve feed efficiency or strengthen the intestinal tract of broilers?** A. L. Shaw\*<sup>1</sup>, K. S. Macklin<sup>1</sup>, J. P. Blake<sup>1</sup>, W. V. Narvaez-Solarte<sup>2</sup>, and P. K. Gunawardana<sup>1</sup>, <sup>1</sup>Auburn University, Auburn, Alabama, <sup>2</sup>Universidad de Caldas, Caldas, Columbia.

Vitamin U (DL-methionine methylsulfonium chloride) has previously been found to modulate the immune system and to protect the membrane systems of living cells within the intestinal tracts of humans

and swine. Two separate trials were run to determine the effect of Vitamin U on growth performance, feed efficiency, and gut integrity on healthy birds (Trial 1) and coccidia challenged birds (Trial 2). The three Eimeria that made up the cocci cocktail administered in Trial 2 were *E. acervulina* (125,000/ml), *E. maxima* (25,000/ml), and *E. tenella* (15,000/ml). The birds were administered 1 ml of this cocktail on day 10 via oral gavage. For each trial, 384 commercial day-old broiler chicks were randomly allotted to six treatments with eight pens per treatment and eight birds per pen. A corn-soybean meal basal diet