ABSTRACTS
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S1 Effects of Pre-peak Feeding Program on Early Egg Production by Groups of Nonuniform Broiler Breeder Hens. B.P. Hudson*, R.J. Lien, and J.B. Hess, Poultry Science Department and Alabama Agricultural Experiment Station, Auburn University, AL 36849.

To determine effects on BW uniformity and reproductive performance through peak production, groups of breeder hens with low uniformity were provided different pre-peak feeding programs. At 20 wk of age, 600 Cobb-500 hens were selected and housed in floor pens according to BW to achieve low uniformity in each pen. Half of the birds in each pen weighed between 1.54 and 1.72 kg (light), and the other half weighed between 2.18 and 2.32 kg (heavy) at 20 wk. Three different pre-peak feeding programs were provided. Birds were subject to either typical (T) or fast (F) increases in pre-peak feed allotments, or skip-a-day (S) feeding to 25 wk. Treatment T received peak feed allotments of 154 g/bird/day at 28 wk of age, while treatment F received the same peak allotments at 26 wk. Treatment S birds received similar allotments as treatment T, but skip-a-day feeding was prolonged to 25 wk. All treatments received identical feed allotments from 29 to 35 wk. During the prelay and early production periods, BW was greatest in treatment F and lowest in treatment S. Uniformities were generally similar from 21 to 30 wk. From 31 to 35 wk, treatment F had the highest uniformity, while treatment T had the lowest. Rapid increases in uniformity occurred for all treatments during the early production period. Flock uniformity increased from 61% at 24 wk to 85% at 28 wk. Although BW uniformity was continuously low and distributions were initially bimodal in all treatments, egg weight distributions were generally normal. Onset of lay was delayed in treatment S, but weekly hen-day production levels recovered by 29 wk. Cumulative egg production to 35 wk was decreased and average egg weight was increased in treatment S as a result of delayed onset of lay. Early egg production was stimulated in treatment F, but hen-day production levels were numerically lowest in this treatment from 30 to 32 wk. This may have occurred because hens in this treatment exceeded target BW.

Results indicate that modifications to pre-peak feeding programs may improve uniformity as well as performance in nonuniform flocks.

Key Words: Broiler Breeder Hen, Body Weight Uniformity, Feeding Program

S2 Effect of Alternative Day Versus Everyday Feed Restriction of Broiler Breeders During the Grower and Prebreeder Period. S. D. Peak* and J. Brake, North Carolina State University, Raleigh, NC.

Several studies have compared alternative day feeding (e.g. skip-a-day) to everyday feeding programs during the growing period. These studies agree that alternate day feeding produces birds with lower BW and similar flock performance when compared to everyday feeding. In addition, these studies suggest that alternative day feeding can improve flock uniformity due to the increased feed time. However, none of these studies investigated the importance of feed restriction during the prebreeder period (housing to 25 wk). In the current study, 4 pens of 60 males were fed either a 4/3 (feed birds 4 days per wk) or everyday (ED) feeding program during the rearing period (1-21 wk). Males on the 4/3 program had significantly lower BW and significantly better BW uniformity through 19 wk. The differences in uniformity were not evident after this time period. Females on ED feeding weighed significantly more at 24 wk, but this difference diminished by 28 wk. There was no difference in egg production or fertility among any of the treatment groups. The feeding schedule had the greatest impact on male mortality. Males going from 4/3 to ED or ED to 5/2 exhibited mortality rates 3 to 4 times higher from 25-33 wk than males going from 4/3 to 5/2 or ED to ED. This effect persisted throughout the laying period. These results confirmed the previous findings that feeding...
on an alternative day basis will yield lower and more uniform male body weights through the growing period. The feeding schedule “switched” to at housing may have a tremendous impact on male livability, but only a minimal impact on other aspects of flock performance.

**Key Words**: Broiler breeder, Male livability, Flock performance, Uniformity, Feed restriction

**S3** Influence of dietary protein level, feeder space, and age at photostimulation on growth, flock uniformity, and egg production of female broiler breeders. E.E. Franzoi-Siewerdt* and J. Brake, North Carolina State University, Raleigh, NC.

This experiment was conducted to compare the effect of two different feeder space allocations, two starter diets, and three ages at photostimulation on growth, flock uniformity, and egg production of female broiler breeders. Seventy-day-old birds were placed in each of eight floor pens. Birds were fed starter diets with either 15% or 20% CP from placement to 4 wk. Birds were fed thereafter a diet with 15% CP and 2.93 kcal ME/g on a 4/3 feeding regimen up to start of lay. BW were taken at 0, 4, 8, 12, 15, 17, and 20 wk of age. Feeder space was reduced in half of the pens from 13 to 20 wk, with feed equally distributed between either four (6.9 cm of feeder space/bird) or six (10.3 cm/bird) feeders. Photostimulation was at either 133, 147, or 161 d of age as birds were moved from floor pens to individual cages. Birds from three distinct BW strata: small, medium, and large were selected from each pen for use in the cages. Data were analyzed with a model that included the effects of dietary protein, feeder space, BW strata at housing, age at photostimulation and interactions. Flock uniformity was evaluated by comparing proportions of birds with BW falling within 10, 12, and 15% of the respective treatment means. Flock uniformity at 4, 8, 12, 15, 17, and 20 wk of age was not affected by dietary protein or feeder space. Birds fed the 15% CP starter diet had smaller BW at 4 and 8 wk, but no residual effect was found at 12, 15, 17, or 20 wk. In general, onset of egg production was delayed by later photostimulation. Dietary protein in the starter diet had no effect on age at first egg but the 20% CP diet reduced age at the fifth and tenth egg for 133 and 147 d of photostimulation, but produced the opposite effect for 161 d of photostimulation. As age of photostimulation increased, the delay in onset of egg production (first, fifth, tenth egg) due to low feeder space in combination with the 15% CP starter diet was negated.

**Key Words**: Uniformity, broiler breeder, feeder space, sexual maturity

**S4** The relationship between eggshell color and egg specific gravity in broiler breeders. L.F. Hatten, III* and D.R. Ingram, Louisiana Agriculture Experiment Station, Louisiana State University Agricultural Center.

An experiment was conducted on 4246 broiler breeder eggs to determine the relationship between broiler breeder eggshell color and eggshell quality. Eggshell color was measured using a Hunter Labs Labscan II Spectrophotometer. The measurements taken on the eggshell were L, the shade of white to black; a, the shade of red to green; and b, the shade of yellow to blue. Then E, the color, was calculated. Eggshell quality was determined by obtaining the specific gravity of the eggs using Archimedes’ method. Two commercial strains of broiler breeders were used with three different age groups within each strain to determine any strain and age effects. All data were analyzed using the General Linear Models procedure in SAS and Pearson correlation coefficients were calculated. A low but highly significant correlation between eggshell color and eggshell quality was found. As eggshell color became darker, egg specific gravity increased, indicating improved shell quality. Strain and age within strain effects were found to be highly significant in regards to the color of the eggshell as well as the specific gravity of the egg.

**Key Words**: Eggshell Color, Eggshell Quality, Broiler Breeders, Hatching Eggs

**S5** Effects of Pekin Duck Breeder Age on Fertility and Hatchability. Christie Braun*1 and Mickey Latour1, 1Purdue University.

The purpose of this study was to evaluate the effects of duck breeder age (young, 24 wk vs. mature, 31 wk) on egg weight, fertility, hatchability, and newly hatched duckling body weight. Young breeders laid eggs that were significantly smaller (13%) then those laid by mature breeders. Fertility and hatchability were also significantly affected by breeder age. More specifically, young breeders had significantly fewer fertile eggs when compared to mature breeders (65.81% vs. 90.5%). In addition, hatch of fertile was effected by breeder age such that mature breeders exhibited an increase in hatch rate when compared to those from young breeders (93.69% vs. 82.69%). In contrast, the number of ducklings that failed to hatch from fertile eggs was significantly higher in young breeders (16.22% vs. 5.35%). Newly hatched ducklings from young breeders exhibited significantly lower yolk free body weights (40.49g) when compared to ducklings from mature breeders (47.69g). These data would indicate that breeder duck age strongly influences egg size, fertility, hatchability, and body weight.

**Key Words**: duck, hatchability, growth, fertility

**S6** The role of seminal plasma in heat stress infertility of broiler breeder males. A. G. Karaca*, H. M. Parker, J. B. Yeatman, C. D. Schultz, C. D. Zumwalt, and C. D. McDaniel, Mississippi State University, Miss. State, MS.

The present research was undertaken to determine the role of seminal plasma in heat stress (H) infertility. Males were placed in individual cages in six temperature controlled rooms. Three rooms were heated to 32°C for 8 h daily and served as H replications. Three rooms were maintained as controls (C) at a constant 21°C. Seminal plasma was removed from the semen of both H and C males and reconstituted with either sperm of the original semen sample or sperm of the opposite temperature treatment creating four final treatments: C sperm + C plasma (CC), C sperm + H plasma (CH), H sperm + C plasma (HH), and H sperm + C plasma (HC). Hens were artificially inseminated for fertility observations. The sperm motility index of H males was lower than that of C males. Seminal plasma from H males diminished fertility of C sperm, and C seminal plasma did not improve fertility of H sperm. Therefore, regardless of seminal plasma source, H sperm had a lower fertilization rate than C sperm. Also, the plasma from semen samples with H sperm (HH and HC) contained less Ca, Na, and Cl concentrations than seminal plasma from semen samples with C sperm (CC and CH). When H seminal plasma was mixed with C sperm, plasma ion concentrations increased indicating an influx of ions from the C sperm to the H seminal plasma. On the other hand, when C seminal plasma was mixed with H sperm, plasma ion concentrations decreased indicating an influx of ions from the C seminal plasma to the H sperm. Therefore, C sperm appear to have higher intracellular ion concentrations than the sperm from H males. In conclusion, these results suggest that high temperatures might decrease male fertility by decreasing seminal plasma ion concentrations.

**Key Words**: heat stress, broiler breeder, seminal plasma, fertility, ion

**S7** Effects of stress on commercial layer pellet performance and stress-response. D.L. Jones1, M.H. Fosnaught1, and K.E. Anderson1, North Carolina State University.

Stress accrued during the rearing phase of commercial laying hens is often regarded as acute and of little consequence during the subsequent laying phase. To study this, pullets stressed during the rearing phase would need to be evaluated for stress-response and growth performance so that these results could later be correlated to the laying phase performance. Therefore, objectives of this study were 1) to verify the stress-response and 2) to measure pellet performance in the rearing phase of unstressed and stressed pullets. A total of 1,980 day-old, Hy-line W-36 pullets were randomly allotted to cages (310 cm2/pullet) in an environmentally controlled brood-grow house and reared until 17 wk of age. The 2 treatments (33 replicates/treatment, 30 pullets/replicate) included the control (C) or unstressed pullets and stressed pullets (S) which were injected at 13 wk of age with an intramuscular, killed, oil-emulsion cocktail of 4 pathogens. After injection, blood was collected at Day 0, .5, 1, 2, 3, 4, 7 and 14, and as a measure of stress-response, each sample was analyzed for heterophil:lymphocyte ratio (HLR), corticosterone, T7 and T4 levels.

Stress-response was verified in the treated pullets. HLR was significantly (P<.001) elevated due to the S treatment except at Day 0. Disparity between the HLR of the two treatments increased with time until Day 14 at which time the HLR for C=6.08 and for S=3.90. At Day 5, corticosterone levels dramatically (P<.001) increased (C=4.62 vs. S=9.78 ng/ml) while T3 and T4 levels significantly (P<.05) decreased (C=.51 vs. S=.35 ng/ml and C=6.07 vs. S=5.26ng/ml, respectively) which is indicative of an acute stress-response. Overall, the S treatment generally increased corticosterone and decreased T3 and T4. Pellet performance was not effected by treatment as livability (C=95.4% vs. S=98.4%), gain
Poultry are increasingly being associated with carriage of multiresistant organisms that may cause disease in humans. Among these organisms are the enterococci, now regarded as a chief cause of nosocomial infections. Enterococcus spp. are model organisms for the assessment of the dynamics of resistance because they are frequently found in the enteric tracts of poultry and humans, rapidly acquire resistance elements, and efficiently exchange these elements. The use of antibiotics for growth promotion in poultry production environments may facilitate the dissemination of resistance to Enterococcus spp. that have the potential to be clinically significant. In order to descriptively assess the degree of multiresistant enterococci in the poultry environment of the Delmarva region, litter samples from regional commercial poultry houses and transport container swabs from a processing facility were cultured for Enterococcus spp. Using a microtiter plate adaptation of a conventional biochemical screen, the predominant species isolated were E. faecalis (61.2%), E. faecium (18.6%), and E. gallinarum (2.4%). Resistance to the cephalosporin, macrolide, and tetracycline classes of antibiotics was uniform with broader resistance to penicillin and derivatives present in a majority of E. faecalis isolates. High-level streptomycin resistance was evident in close to 30% of all isolates with a majority of E. faecalis variants possessing resistance. High-level gentamicin resistance was detected at a low frequency (2.6%) only within the E. faecalis group with resistance present in minimal gentamicin levels present in a majority of both the E. faecalis group and subsets of E. faecium. No unexpected vancomycin resistance was detected. Of particular interest, resistance to the streptogramin, quinupristin-dalfopristin (Synercid), was present in 70.4% of E. faecium and E. faecalis variants. While antibiotic resistant enterococcal isolates from poultry have not been definitively proven to be distributed within the human population in the U.S., the finding of multiple resistance in enterococci from the poultry environment warrants a more thorough genetic characterization of these organisms to determine the possibility of clonal distribution elsewhere.

Key Words: Enterococcus, Antibiotic Resistance, Vancomycin, Strep-togramin, Gentamicin

The effects of 254 nm ultraviolet light (UV) radiation on aerobic plate counts (APC), populations of Salmonella typhimurium, and conductivity of egg shells were investigated. In all experiments, eggs were exposed to UV treatment of 14 µW/cm² for 3 minutes. In the first experiment, forty-two eggs were placed on an egg flat and passed through a chamber equipped with UV lights and a conveyor system to carry the egg flat. Seven eggs were collected, one from each row and aseptically placed into sterile plastic bags containing 50 ml of sterile phosphate buffered solution. Serial dilutions of the phosphate buffer solution were plated on aerobic plate count agar and placed in an incubator at 37°C for 48 hours. The treatments were administered in three replicate trials. UV treated eggs had APC reduction of 1.3 log compared to the untreated eggs. In the second experiment, Salmonella typhimurium was inoculated on 14 unwashed clean eggs. Seven eggs inoculated with Salmonella typhimurium were placed on the egg flat, surrounded with other unwashed clean eggs, and placed through the UV light chamber on the conveyor system. Sample size, and dilution methods were as described for Experiment 1. Serial dilutions of the phosphate buffer solution were plated on brilliant green agar (BGA). Three trials were conducted and there was a significant 4 log reduction between the Salmonella typhimurium inoculated UV treated eggs compared to the untreated Salmonella typhimurium inoculated eggs. In the third experiment, egg conductivity was measured to determine if UV treatment had an effect to moisture loss through the shell. A total of 45 eggs- 20 control, 20 UV treated, 5 with the cuticle removed by sodium hypochlorite solution were placed in a desiccator and incubated at 37°C for 3 days. There was no significant difference among the treatments in all three trials. The results of these studies show that APC, and Salmonella typhimurium levels were significantly reduced. Also, egg shell conductivity was not affected by UV treatment.

Key Words: UV, Salmonella typhimurium, APC, Conductivity, Egg Shell

Sanitation of hatching eggs is an important area of research due to the need for an effective, economical, and safe method of egg sanitation. Improved hatching egg sanitation is an important part of an overall pathogen reduction program within integrated poultry operations. This must be accomplished without disturbing the cuticle of the egg, which can decrease hatchability. The ability of ultraviolet light to kill bacteria on eggshell surfaces has been well documented. Experiments were conducted to test the impact of UV light on the exposure of hatching eggs on hatchability. To accomplish the task of treating the eggs in a method that could be commercially implemented, a cabinet was constructed in which ultraviolet lights were placed. A conveyor system was used to carry a hatching egg flat containing 42 eggs through the cabinet for a period of three minutes. Intensities within the cabinet reached a maximum of 14 W/cm². In three trials, a total of 1561 brown-shelled, fertile, broiler chicken eggs were treated with ultraviolet light and then aseptically placed into incubators. A total of 776 fertile untreated eggs were used as controls. Eggs were candled at 10 and 18 days of incubation, and infertile eggs and eggs with dead embryos were removed. Eggs containing dead embryos or eggs that remained unpipped after 21 days of incubation were broken-out and cultured for bacterial contamination. Each egg was dipped in an iodine solution for one minute to sanitize the exterior of the shell, and then aseptically removed from the iodine and broken-out into a sterile petri dish. A sterile cotton swab was then used to sample the contents of the egg. Separate swabs were used to streak the sampled contents onto MacConkey Agar and Blood Agar. The plates were then placed into an incubator at 37°C. After 24 hours, the plates were examined for bacterial colony formation. Hatchability of treated eggs improved overall by 0.34%. No statistically significant differences were observed in early embryo mortality, hatchability or in the number of eggs with bacterial contamination (P > .05).

Key Words: UV light, Hatching eggs, Sanitation, Hatchability, Contamination

The present study was designed to evaluate the effect of the individual or simultaneous application of two commercially available products, PREEMPT™ or MeganVac 1, for bioefficacy in reducing Salmonella colonization in broiler chicks following experimental challenge. In EXP 1, when either PREEMPT™ or MeganVac 1 were individually applied to neonatal broiler chickens on day-of-hatch and chicks were experimentally challenged with ST 48 hours post-hatch, ST was recovered from the cecal contents of control chicks at a level of 3.84 Log10 cfu/g and 12 of 19 or 63.15% positive cecal tonsil samples following selective enrichment. In chicks receiving PREEMPT™ by spray application on day of hatch, a numerical reduction in the number of ST recovered from cecal contents (2.63 Log10 cfu/gram) and a significant reduction (P < 0.05) in recovery from of ST from cecal tonsils following selective enrichment (4/18 or 22.2%), was observed when these values were compared to non-treated controls. Significant effects (P < 0.05) on the present parameters of ST cecal colonization in MeganVac 1 treated chicks were not observed in EXP 1. In EXP 2, chicks received day-of-hatch spray-application of either PREEMPT™ alone, MeganVac 1 alone, or PREEMPT™ and MeganVac 1 as a combined application separated by 30 minutes, immediately prior to chick placement. When chicks were experimentally challenged with ST 48 hours post-hatch, significant reductions (P < 0.05) in cecal colonization by ST were observed when each experimental group was compared to non-treated controls.
These data suggest that both commercially available products, alone or in combination, are efficacious in reducing cecal colonization in broiler chicks challenged with paratyphoid salmonelae.

Key Words: Salmonella, CE Culture, Salmonella Vaccine, Chickens


Finding a reliable source of shavings for broiler bedding at an acceptable cost is often difficult. LitterPlus® is a bedding material produced from recycled wood pallets through patented grinding and processing systems. The objective of this study was to compare pine shavings and LitterPlus® for use as broiler bedding material. Two broiler trials were conducted. In the first trial, male broilers were grown in litter floor pens with either 2 or 5 cm of either pine shavings or LitterPlus® (LP). There were 32 pens (50 birds per pen) with 8 replicate pens per treatment. All birds were fed the same feeding program: starter from 0-3 wk, grower from 3 to 6 wk and finisher from 6 to 7 wk. Feed consumption and bird weights (BW) was measured between 3 and 7 wk. Mean BW and feed conversion (FC) were calculated. A sample of birds (n=10) from each pen was evaluated for hock (H) and foot pad (FP) condition and breast blister index (BI). Each pen was evaluated at the end of the trial for cake index (CI). At the completion of trial 1, all litter was removed from each pen and stored separately by type (PS & LP) until the next trial. In trial 2, the stored litter was equally spread, by type, into 18 pens. The stored litter was then “top dressed” with new material. Male broilers were placed in each pen (50 birds per pen) and reared to 7 wk of age as in trial 1. There were two treatments in trial 2; PS and LP, with 18 replicate pens per treatment. Data were collected as in trial 1. Ammonia (NH3) levels were determined in each pen at the end of each trial. All data were analyzed using the General Linear Models program of SAS (SAS, 1989). In trial 1, the effects of litter depth and type and the interaction on BW, FC, CI, HI, FP, BI, and NH3 were determined. In trial 2, the effect of litter type was determined on these same measurements. Means were separated using least significant difference (P<0.05). In trial 1, birds reared on 2 cm of bedding had higher (more discoloration) HI than those reared on 5 cm of bedding. Pens with LP had a higher CI (more cake) litter than those with PS at the end of trial 1. There were no other differences in bird performance or litter evaluation for trials 1 or 2. In conclusion, broilers reared on LitterPlus® perform as well as those reared on pine shavings.

Key Words: Litter, Pine shavings, LitterPlus, Broilers, Performance


The presence of Salmonella and/or Campylobacter in poultry litter may contribute to contaminated processed carcasses by increasing the bacterial load of skin and feathers and/or by providing a source for upper gastrointestinal contamination during preharvest feed withdrawal. Presently, we evaluated the effect of 5, 10, or 20% added lime on survival of Salmonella enteritidis in used poultry litter during room temperature incubations of 24, 48, or 96 hrs. Addition of any concentration of lime evaluated markedly increased pH (control: 8.36; 5%: 12.13; 10%: 12.53; 20%: 12.57). In experiment one, addition of lime at any concentration reduced Salmonella recovery from artificially-contaminated litter by more than 5 log 10 units to undetectable levels based on direct plating within 24 hr. In experiment 2, litter was experimentally inoculated with 10⁸ cfu/g Salmonella enteritidis and 5g samples were pH-corrected to neutral prior to tetrathionate enrichment (24 hr) and BGA plating (24 hr) for detection of positive or negative samples. At 24 or 48 hr, 10/10 (100%) of untreated (control) litter samples were positive for Salmonella. Addition of lime resulted in significantly reduced Salmonella recovery incidence (5%: 5/10; 10%: 4/10; 20%: 1/10) at 24 hr. Interestingly, no further time-associated reduction in Salmonella recovery was observed at 48 hr. These data suggest that the addition of hydrated lime can markedly reduce Salmonella recovery in a relatively short time (<24 hr) period. The apparent lack of continued Salmonella reduction over time may be related to small numbers of organisms that are physically protected from the applied treatment. The effect and persistence of lime-associated pH reductions under commercial conditions remains to be evaluated.

Key Words: Salmonella, Lime, Litter, Feed Withdrawal

S14 The Utilization of Alkaline Poultry By-product Meal as a Feed Additive. T. P. Niemeyer*, R. P. Burgess, and J. B. Carey, Texas A&M University, College Station, Texas.

Previous research has shown that alkaline hydroxides can be used as a preservation method for on farm storage of broiler mortalities. Farm storage of broiler mortalities using this method creates two by-products. The first product is an alkaline poultry by-product meal (APBPM), which can be used as a feed additive. The second is a residual alkaline effluent, which can be used as a soil amendment for acidic soils. The APBPM was added to a broiler starter diet at 0 and 5% for evaluation of the apparent metabolizable energy (AME), with 0.5% acid insoluble ash added to each diet as a marker. The primary battery trial included 90 birds with three treatment groups and three control groups each containing 15 birds. During the trial the feed consumption was monitored on a daily basis while bird weights were observed and the excreta samples were taken on days 7, 14 and 21. Neither body weight or feed consumption of the 5% APBPM groups were not significantly different from that of the 0% APBPM groups on any sample date. Excreta moisture was not significantly different between the treatment groups at day 7, but on days 14 and 21 the excreta moisture for the 5% APBPM groups was significantly higher than that of the 0% APBPM groups. There were a total of three mortalities experienced during this trial. Two of the mortalities occurred within the 5% APBPM groups, but there is no direct evidence of the APBPM being a factor. The AME of the APBPM at day 7 was 5106 kcal/kg, 5353 kcal/kg on 14 d, and 5609 kcal/kg at day 21. This data indicates that the APBPM has considerable AME value and can be used effectively in commercial broiler diets.

Key Words: Mortality, Alkaline, Preservation, Broiler, AME

S15 Performance of chicks as influenced by body temperature at hatch. M.L. Mooney*, R.G. Teeter, and S.L. Vanhooser, Oklahoma State University Stillwater, OK.

ABSTRACT: Previous studies conducted in our laboratory suggests that initial chick body temperature (at hatch) is positively correlated with live weight gain, gain/feed ratio and ascites resistance. In this regard three experiments were conducted to evaluate effects of body temperature, at hatching (HT), on subsequent broiler performance under varying combinations of feeding and ambient temperature (30, 32 C). Chicks were initially divided into two groups according to falling above or below mean body temperature at hatch. Whether these effects are the result of innate chick characteristics and/or the hatch environment is under current investigation.

Key Words: Broiler, Metabolism, Chick quality, Body temperature
S16 An examination of electrolyte, virgiamycin, and betaine effects on performance, compensatory growth and body temperature of male broilers exposed to high cycling ambient temperature. M. A. Qureshi* and R. G. Teeter, Oklahoma State University Stillwater, OK.

Five hundred and sixty cob and cob male broilers were fed a corn-soy starter fortified with two betaine levels (0, 0.05 %) to the 18th day of age. On day 18, 560 birds were transferred to environmental chambers housed at 24 or cycling 24-37C. At 33 days heat stressed (HS) birds were moved to 24 C for housing to day 48 such that compensatory gain (CG) effects might be estimated. In addition to environment, treatments included drinking water electrolytes low (EL, 0.16%), high (EH, 0.32%) and betaine low (BL, 0.05), high (0.1%) with and without ration virgiamycin (VM, 20 PPM). Additional variables included body weight gain (BWG), final body weight (FWT), survivability (SURV), feed consumption (FC), body temperature (BT), fat gain (FG), percentage of body weight (FP), lean % (LN), bone mass (BM) and serum chemistries, chloride (CL), magnesium (MG), uric acid (UA), phosphate (P) and calcium (Ca). CG was detected at 40 and 48 days of age for HS chicks moved to TN and VM further enhanced (P < 0.05) CG. Despite greater growth, CG occurred with less (P < 0.05) feed. BT decreased (P < 0.05) with EL. FG was increased (P < 0.05) with VM20, BL and EH while FG and LN was elevated (P < 0.05) for previously HS chicks than continuous TN. Serum chemistries were impacted by VM and CG. BMC was higher (P < 0.05) with CG chicks than TN. In conclusion, chick exposure to high cycling ambient temperature have the potential to "catch-up" if environmental conditions return to TN. However, such gains are associated with greater carcass fat.

Key Words: Heat stress, Virgiamycin, Betaine, Electrolyte

S17 Dietary vitamin E, vitamin C and drinking water electrolyte effects on broiler performance and immunity during exposure to high cycling ambient temperature. M. A. Qureshi*, S. L. Vanhooser, and R. G. Teeter, Oklahoma State University Stillwater, OK.

One thousand five hundred and sixty male Cobb X Cobb broilers were placed in a cycling ambient temperature (24-37 C) environment following rearing to 18 days with and without 0.1% betaine. Sixty chicks were selected on day 18 and blood samples collected to determine the antibody titer against New Castle and Infectious bursal disease. Beneficial betaine effects were noted for feed efficiency during the starter period. During the grower phase, supplementation of vitamin C (VC) and vitamin E (VE) was via feed while electrolyte low (EL, 0.16%) and high (EH, 0.32%) as well as betaine (B, 0.1%) were offered through drinking water. The cycling temperature stress occurred for 20 days to day 42 of age. Weight gain (WG), daily gain (DG) final body weight (FWT), feed conversion (FC), feed conversion ratio (FCR), antibodies for new castle disease (NDT) and infectious bursal disease (IBD), body temperature (BT), hematocrit, carcass composition, and various serum chemistries were determined. Supplementation of B increased (P < 0.05) WG, DG, FWT and FC compared with controls and protected (P < 0.05) chicks from environment effects on spleen weight. There was no significant effect on survivability but EL, EH, VC, and VE showed 2.26%, 1.09%, 1.60% and 1.32% as well as betaine EF (0.1%) increases in the presence of EL or EH. In conclusion, it can be suggested that betaine vitamin E and electrolyte supplementation have therapeutic effects. Further, inconsistent literature regarding VC efficacy may be due to electrolyte exposure, presumably water balance mediated, being the first limiting nutrient for growth during high cycling temperature stress. In this study VC effect was noted only with EL or EH.

Key Words: Heat stress, Vitamin E, Vitamin C, Betaine, Electrolyte

S18 Effects of virginiamycin, betaine, and electrolytes on the performance of male broilers exposed to chronic heat stress. M. A. Qureshi* and R. G. Teeter, Oklahoma State University Stillwater, OK.

An experiment was conducted to determine the ability of virginiamycin (VM), two levels of Betain (BET; 0.05 and 0.10 %) and two levels of electrolyte (EL; 0.16 and 0.32%) to alleviate the effects of acute heat stress. Seven hundred male broilers (Cobb 500) were reared in thermoneutral conditions to 18 d of age either fed a control diet or one containing 0.05 % BET. At 18 d of age, birds were placed in cages in a cycling heat stress (HS) environment (24 to 37 C) and given diets with or without 20 PPM VM and drinking water low or with two levels of EL from 18 to 48 d of age. Performance, carcass fat, breast yield, mortality, and body temperature (BT) were recorded from 18 to 48 d of age. Cage level and other factors (EL, BET, and VM) interacted. Mortality attributed to HS was highest in the top level of cages, as was reduction in BW gain. Supplementation with EL improved BW gain in the top level of cages. Mortality was reduced by VM and BET supplementation in the top level. Carcass fat was higher in the combination of 0.1% BET and VM than for other combinations of BET and VM. The BT of birds was not affected by the treatments used in this experiment. The results of this study indicate that VM, BET, and EL may have beneficial effects on broilers exposed to acute HS.

Key Words: Virginiamycin, Betaine, Electrolyte, Performance, Heat stress

S19 The effect of fasting on body temperature and livability of birds with varying dietary history. M. A. Qureshi* and R. G. Teeter, Oklahoma State University, Stillwater, OK.

An experiment was conducted to examine the effect of fasting, and supplementation with either two levels of betain (BET; 0.05 and 0.10%) or electrolyte (EL; 0.16 and 0.32%) on livability and body temperature (BT). Birds were reared to 7 wk of age fed diets with three levels of energy, two levels of protein, and two levels of virgiamycin (VM) in a 3 x 2 x 2 factorial arrangement. Birds were moved to battery cages and exposed to cycling heat stress (HS: 24 to 37 C). In the battery house, birds were either fed a diet calculated to contain 3170 Kcal/ Kg M.E., 21% crude protein, and no VM or were fasted for 3 d. Daily survivability, (SURV1, SURV2, SURV3) and mean survivability (SURV), weight loss (WLOS), final body weight (FWT), feed consumption (PCO), water consumption (WC), daily dead weight (DWT1, DWT2, DWT3), and mean dead weight (DWT), and body temperature (BT) were recorded. BT of fasted birds with the 0.05 % BET was lower (P < 0.05) than of fasted birds given 0.16 % EL. The combination of 0.16 % EL and 0.05 % BET increased BT. The WC of fed birds was more (P < 0.05) than that of fasted birds. Supplementation with 0.16 % EL increased WC compared to control birds. Birds previously fed VM had higher WC than those not previously fed VM. Fasting improved livability, but overall livability was not effected by BET, EL, or VM history. In conclusion the results of this experiment suggests that VM history, fasting, EL and BE may be beneficial tools to achieve more productivity and livability during acute heat stress.

Key Words: Virginiamycin, Betaine, Electrolyte, Heat stress, Fasting

S20 Effect of Drinking Water Administration of Selected Peracids on Salmonella Crop Contamination Following Prolonged Prolargation Feed Withdrawal, K.L. Herron**, D.Y. Caldwell1, J.A. Byrd2, D.J. Caldwell5, K.S. McKenzie5, and B.M. Hargis1, 2Texas A&M University, 3USDA-ARS, SPARC, 5Lynntech Inc.

Our laboratories have provided evidence implicating upper gastrointestinal (crop) content as a major cause of broiler carcass contamination. Recently, we have demonstrated that selected organic acids, administered during the preslaughter feed withdrawal period, can significantly reduce crop contamination and pre-chill carcass contamination at commercial processing. Presently, we evaluated the effect of selected concentrations of peracetic, percrilic or perchilic acid on Salmonella killing in the presence of organic matter in extrabodily water. Our laboratories have provided evidence implicating upper gastrointestinal (crop) content as a major cause of broiler carcass contamination. Recently, we have demonstrated that selected organic acids, administered during the preslaughter feed withdrawal period, can significantly reduce crop contamination and pre-chill carcass contamination at commercial processing. Presently, we evaluated the effect of selected concentrations of peracetic, percrilic or perchilic acid on Salmonella killing in the presence of organic matter in extrabody water. In vivo by drinking water administration to market age broilers during simulated 8 hour pre-slaughter feed withdrawal. During a 1 hr incubation in a 25% wet/vol. feed slurry at 40 C, the effect of 31, 63 or 125 ppm (final concentration) of each peracid on Salmonella enteridis killing was evaluated. Peracetic acid reduced by 1 Log only at the highest concentration evaluated, while peracetic acid did not result in a 10x reduction at tested concentrations in this assay. However, peracetic acid resulted in 3.2 Log reduction (125 ppm), with substantial reductions observed at the lowest concentrations tested. Preliminary evaluations indicated that market age broilers would readily consume concentrations of 31 ppm percrilic acid or 125 ppm perchilic acid, with reduced consumption occurring with 63 ppm percrilic acid. Each of these peracid concentrations resulted in marked (> 1.3 Log) killing of Salmonella when administered to market-age broilers during 8 hrs feed withdrawal. These data suggest that peracid administration
during preslaughter feed withdrawal may provide a cost-effective intervention for this critical control point.

Key Words: Salmonella, Crops, Broilers, Contamination, Peracids

S21 A link between heat stress-associated myopathy and “PSE” meat in broiler chickens1. D. A. Sandercock, R. R. Hunter, P. M. Hocking, and M. A. Mitchell, 2 Roslin Institute, Roslin, Midlothian, UK.

The problem of pale soft exudative (PSE) meat is becoming more common in current broiler lines with its incidence increasing in response to elevated temperatures. Its aetiology may be similar to that reported in pigs where muscle damage and PSE meat in acutely stressed pigs are believed to be caused by alterations in muscle intracellular calcium (Ca2+) homeostasis. Studies in the authors’ laboratory have shown that myopathy in broilers, associated with selection for fast growth rate and acute heat stress (AHS) is similarly attributable to derangements in muscle Ca2+ regulation. Correlations between the degree of heat stress-associated myopathy (HAM) and changes in meat quality attributes were therefore investigated in broilers exposed to AHS. Two groups of 12 male broilers (45d) were held under AHS (31°C/85%RH) or control conditions (21°C/50%RH) for 2 hours in climate chambers. Deep body temperature, blood pCO2 and pH were measured as indices of thermoregulatory success and effort. HAM was determined by measuring plasma creatine kinase (CK) activity. Breast muscle pH, colour and haemorrhage scores and drip loss were measured as indices of poultry meat quality. Birds subjected to AHS exhibited significant hyperthermia and hypocapnic alkalosis. Exposure to AHS induced muscle damage (HAM) as reflected by a marked increase in plasma CK activity. AHS produced a lower breast muscle pH 15-min post slaughter but had no effect upon the decrease in pH 24 hours later. Muscle haemorrhage scores were significantly higher and drip loss was markedly elevated in AHS birds. Lighter coloured muscle was associated with AHS but did not reach significance. Thus the myopathy appeared to be associated with paler more exudative meat. It is proposed that Ca2+-mediated alterations in muscle membrane integrity induced by acute heat stress may result in a “PSE-like” meat condition. It is therefore suggested that myopathy induced by stressful pre-slaughter procedures may precede or mediate alterations in broiler meat quality attributes.

Key Words: Myopathy, Calcium, PSE

S22 Effect of in ovo gentamicin on efficacy of mucosal competitive exclusionTM to control Salmonella in broiler chickens. J.S. Bailey1 and J.E. Line1. 1USDA, ARS, Russell Research Center.

Approximately 80% of the U.S. chicken industry uses in ovo Marek’s vaccine with an accompanying antibiotic treatment, most often gentamicin. Reports indicate that the use of gentamicin in ovo substantially reduces the effectiveness of some competitive exclusion products. In these studies, the effect of in ovo gentamicin alone, mucosal competitive exclusion (MSCTM) alone, or the combination of in ovo gentamicin followed by MSC on Salmonella colonization of broiler chickens was determined. Three replicate trials were conducted for both the scenario where chicks received Salmonella before MSC treatment and where chicks received Salmonella after MSC treatment. When Salmonella was given after MSC treatment, the MSC alone reducedecal colonization from Log10 6.01 to Log10 1.99, compared to Log10 1.42 for the combination of gentamicin and MSC. When Salmonella was given before MSC treatment, the MSC alone reducedecal colonization from Log10 6.31 to Log10 4.69 compared to Log10 0.83 for the combination of gentamicin and MSC. The use of in ovo gentamicin did not reduce the effectiveness of MSC as had been reported for other products, and the combination of gentamicin and MSC was very effective in preventing Salmonella colonization when the chicks were exposed to the Salmonella before the MSC.

Key Words: Salmonella, Competitive Exclusion, Gentamicin, In Ovo


One hundred day-old guineas, French variety, were used in a completely randomized design to determine the dietary energy requirements for growing guineas. They were randomly assigned to 5 treatment groups, two replicates/treatment. Five dietary energy levels used were 2800, 2900, 3000, 3100 and 3200 kcal/kg from 1-4 weeks and 2850, 2950, 3050, 3150 and 3250 kcal/kg from 5-8 weeks for groups 1, 2, 3, 4 and 5, respectively. Experimental rations were isonitrogenous containing 23 and 21 percent protein for the first and second 4-week periods, respectively. Feed and water were given at free choice. A continuous lighting program was provided. Results indicated that dietary energy level had a significant (P<0.05) effect on weight gain. Average 8-week body weights were 1140.7, 1169.8, 1211.3, 1256.3 and 1223.5 g for groups 1, 2, 3, 4 and 5, respectively. The best feed conversion was obtained in the group receiving 3150 kcal/kg during the first and second 4-week periods. Mortality was not significantly affected. Based on these results, the dietary energy levels of 3100 and 3150 kcal/kg were optimal for guineas during the first and second 4-week growing periods.

Key Words: Guinea fowl, Dietary energy, Growth

S24 Detection of Campylobacter spp. in ceca and crops with and without enrichment. M. T. Musgrove1,2, M. E. Berang2, J. A. Byrd3, and N. J. Stem1. 1 USDA, ARS, Poultry Micro Safety, Russell Research Center., 2 Athens, GA 30605, BUSDA, ARS, Poultry Meat Quality, Russell Research Center, Athens, GA 30605, 3 USDA, ARS, Food Animal Protection, 2881 F & B Road, College Station, TX.

The purpose of this experiment was to determine how sampling method (direct plating or enrichment) affected the rate of Campylobacter spp. isolation from crop and cecal samples. In 4 separate trials, 32 New York dressed broiler carcasses were obtained from commercial plants (n = 128). Crop and cecal samples were removed aseptically, directly plated and enriched. Direct plating of samples was on Campy-Cefex plates which were incubated at 42°C for 36-48 hours in microaerobic atmosphere (5 % O2, 10 % CO2, 85 % N2). Following direct plating, samples were enriched in Bolton broth at 37°C for 4 hours and 42°C for 20 hours in microaerobic atmosphere before plating onto Campy-Cefex plates. Campylobacter spp. was detected in 95.3% direct plated and 99.2% of enriched crop samples and in 100% of direct plated and 63.3% of enriched cecal samples. All 128 crop and cecal samples were positive for the organism by one or both methods. Mean counts of Campylobacter spp. were 3.63 log10 cfu per g of crop sample and 6.78 log10 cfu per g of cecal sample. For these two sample types, both of which tend to be contaminated with large numbers of viable cells, direct plating is sufficient for isolation of Campylobacter spp. Direct plating also provides an estimate of contamination level. The large numbers of non-campylobacter species which inhabit the intestinal tract may out-compete Campylobacter during enrichment, confounding detection.

Key Words: Campylobacter, crop, ceca

S25 Survey of Microbial Flora Found in Composted Broiler Mortalities. R. P. Burgess*, K. D. Knape, and J. B. Carey, Department of Poultry Science, Texas A&M University, College Station, TX 77843-2472.

The use of composting for management of poultry mortalities has been an accepted method of disposal. However, the possibility of pathogens surviving the heat cycles of compost is apparent. Single-stage, multi-stage and windrow composters were field surveyed to identify pathogens commonly found in poultry compost. Composter stacks were sampled at 0-6 inches, 6-12 inches, and 12-24 inches. Three 2-3 gram sub-samples were taken from a single stage stack composter of 60 cubic (TSI) and incubated for 24 h at 37°C. Colonies were also picked for gram staining. Samples were enriched in a cooked meat medium, under anaerobic conditions, for 48 h at 37°C. Colonies were also picked for gram staining. Samples were also enriched in a cooked meat medium, under anaerobic conditions, for 48 h at 37°C and then at room temperature for an additional 4 d. The enriched solution was then plated on BGA, MAC and EM agar plus anaerobic brucella blood agar for 48 h at 37°C. Samples from a 38 d unturned windrow, with a temperature of 111°F at sampling, were positive for E. coli at 0-6 and 6-12 inches. The same windrow also contained Gram positive and negative cocci at all three levels. A second windrow, 52 d of age which had been turned, with an interior temperature at sampling of 125°F, produced Gram positive cocci at the 0-6 and 12-24 inches of depth and Gram positive bacilli at 6-12 inches. Samples were also taken from a single stage stack composter of 60 d and 132°F internal temperature at sampling. In this stack the sample
取自0-6英寸的生长了正的和非的和的和，深度为6-12和12-24英寸的生长了正的和非的和。每个这些堆的堆的内容死亡是会先在添加到的堆的堆。这些结果使 apparencant supports the argument that pathogens are capable of surviving the heat processes of composting. It is therefore necessary for some safety precautions to be considered for the daily handling and ultimate use of the composted material.

**Key Words:** Compost, Litter, Mortality, Broiler, Microbiology

### S26 Biological safety of phosphoric acid-preserved poultry mortality.
Brian Sheldon, 1, Peter Ferlet, 1, and Teena Middleton, 1
North Carolina State University, Raleigh, NC, 1 Ag Pro-Vision, Reavisburg, NC.

The US poultry industry generates over 650,000 tons of mortality annually. Many of the current disposal options may risk environmental safety, cause nuisance odors and pests at disposal sites, and spread pathogenic organisms. Recycling poultry mortality into feed nutrients offers many advantages if economical on-farm preservation methods such as freezing, fermentation, or acid stabilization strategies are available. The objective of this study was to evaluate the efficacy of phosphoric acid (0, 5, 6, 7%) to inactivate Salmonella typhimurium and Listeria innocua populations in ground whole turkey and chicken mortality samples. In the first trial (3 reps.), the total aerobic bacterial population for the 2-week phosphoric acid-preserved ground turkey samples (22°C) averaged log 7.53, 2.35, 1.20, and 1.04 cfu/gm, respectively. For the 0, 5, 6, and 7% phosphoric acid treatments. For S. typhimurium, the 2-week surviving populations averaged log 5.87, 2.22, 0.33, and 1.58 cfu/gm, respectively. Two-week Enterobacteriaceae populations averaged log 5.26, 1.64, 2.05, and 1.40 cfu/gm, respectively. In the second trial (3 reps.), L. innocua was inoculated into ground chicken mortality and treated as described above. In comparison to the control, the two-week L. innocua population reductions averaged 4.78, 7.08, and 7.45, respectively, for the 5, 6, and 7% phosphoric acid treatments. These findings demonstrate that phosphoric acid preservation of poultry mortality does effectively reduce bacterial pathogen populations to more acceptable levels.

**Key Words:** Phosphoric Acid, Poultry Mortality, Preservation

### S27 Evaluation of rice hull ash as a litter material for broiler chickens.
T. N. Chambless, 1, B. Yeatman, 1, Clayton Hackett, 1, and Ken Phillips, 1
1 Mississippi State University, Mississippi State, MS, 2 Southern Ionics, Inc., West Point, MS.

Three trials were conducted to examine the efficacy of rice hull ash as a litter material for broiler chickens. Each 42-day trial utilized the following litter materials: pine shavings, rice hull ash treated with liquid alum, rice hull ash treated with sulfuric acid, rice hull ash that received no chemical treatment, rice hull ash treated with liquid alum blended with pine shavings, rice hull ash treated with sulfuric acid blended with pine shavings and rice hull ash that received no chemical treatment blended with pine shavings. Broiler parameters measured were body weight, feed conversion and mortality. Litter ammonia release and litter temperatures were determined. Litter pH and the N-P-K fertilizer value of the litter were assayed at the end of the trial. When compared to pine shavings, rice hull ash in any form did not affect body weights, feed conversion, mortality, or litter pH. Litter temperatures were not consistently affected by any of the litter treatments. When compared with pine shavings litter, a reduction in litter ammonia release was observed in litter consisting of rice hull ash treated with sulfuric acid and blended with pine shavings. In addition, an increase in total litter nitrogen was observed in litter consisting of rice hull ash treated with sulfuric acid and blended with pine shavings when compared with pine shavings litter. Litter consisting of rice hull ash with sulfuric acid blended with pine shavings or litter consisting of rice hull ash treated with liquid alum blended with pine shavings increased litter potash levels. Rice hull ash caused some discoloration of the bird’s feathers, but no discoloration of the feet or skin was observed during processing. Chemically treated rice hull ash in combination with pine shavings could provide a broiler litter that has a high fertilizer value with no adverse affects on broiler performance.

**Key Words:** Broiler litter, Rice hull ash, Litter ammonia, Litter fertilizer value

### S28 Performance of broilers rear ed on bedding manufactured from recycled organic products.
T. A. Carter, 1, J. L. Grimes, and J. L. Godwin, North Carolina State University.

An experiment was conducted comparing the performance of broilers reared on bedding material manufactured from paper and other recyclable organs. Three different formulas of the manufactured bedding with high, medium, and low pH characteristics were compared with kiln-dried pine shavings control. Fifty day-old male broilers were assigned to each of eight pens for each treatment and control. The chicks were placed on June 23, 1999 and grown for 49 days. Body weight, feed conversion, and mortality were recorded at 3 and 7 weeks of age. A sample of the broilers were evaluated at 7 weeks of age for foot pad and hock condition and breath blisters. Litter was evaluated for moisture, pH at the beginning and end of the trial and the amount of caked litter at the end of the trial. There was no significant differences in bird performance, or any of the three external carcass evaluations. Significant differences (P < .05) were found between the controlled and high pH treatment for litter caking with most of the caking found around the fountain type waterers. In summary, broilers reared on the manufactured bedding performed as well as those on pine shavings.

**Key Words:** Broilers, Litter, Performance, Body weight, Feed conversion

### S29 Effect of moisture and water activity on the presence of salmonellae in broiler litter.
J. A. deGraft-Hansford, 1, L. E. Carr, 1, and V. E. Boyd, 1
1 University of Maryland Eastern Shore, Princess Anne, MD, USA, 2 University of Maryland, College Park, MD, USA.

Litter samples were collected in two broiler houses during the life cycles of different flocks and analyzed for moisture content, water activity (Aw) and presence of Salmonellae. Samples were collected before placement and at two week intervals to the end of the growing cycle (49-53 days), placed in whirl pak bags and transported to the laboratory for analyses. 1:10 dilutions of samples in buffered peptone water were incubated at 35°C overnight and 0.1 ml transferred to tetrahydrofuran Hainbra broth for incubation overnight at 42°C. These were then transferred to Rappaport-Vassiliadis broth and after overnight incubation at 35°C were streaked for isolated colonies onto each of brilliant green sulfa diazine and modified lysine iron (each with 15 μg/L novobiocin) and xylene lysine tertitol 4 agar. All plates were incubated at 37°C for 48 hours and presumptive colonies transferred to triple sugar iron agar slants. Cultures showing typical biochemical characteristics were purified and confirmed using Salmonella polyvalent antisera for determination of somatic antigens. Samples positive for Salmonella had consistently high Aw levels and corresponding high moisture contents. Positive samples had moisture levels above 21% and Aw levels above 0.84. In some cases where moisture levels were not significantly different, samples were still positive for Salmonellae when Aw levels were high. This indicates that though high moisture levels contribute to the presence of the pathogen it is the actual Aw of litter which determines the presence or absence of pathogens such as Salmonellae.

**Key Words:** Litter, Moisture, Salmonellae

### S30 The Effect of High Air Velocity on Broiler Performance.
B. D. Lott, 1, J. D. Simmons, and J. D. May, USDA, Agricultural Research Service, South Central Poultry Research Laboratory.

Previous work at our unit demonstrated improvements in body weight gain and feed conversion due to an air velocity of 120 m/min as compared with still air. In order to study the effects of higher air velocities, two trials with 742 male broilers per trial were used. Broilers were reared in a common environment with normal brooding practices and fed a basal diet through three weeks of age. Two wind tunnels with four pens per tunnel were located inside an environmentally controlled house. Air velocities of 180 or 120 m/min were used. Six conventional floor pens in the same house were used for still air controls (<15 m/min). Each pen was stocked with 53 3-week old birds. The temperature was a diurnal cycle of 25°C at 25°C with a constant 23°C dew point. The experiment period in the tunnel was four weeks. Weekly body weight gains and feed data were collected. The data indicate male broilers less than 2000 g had no significant improvement in body weight gains at 180 m/min versus 120 m/min air velocities. Significant improvements were noted in both air velocities as compared with still air. With body weights above 2400 g, an air velocity of 180 m/min improved body weight gains and feed conversions as compared with 120 m/min. When body weights were between...
2000 and 2400g, body weight gains were approximately 30g greater at 180 m/min than at 120 m/min.

Key Words: Wind Speed, Feed:gain, Chickens

S31 Evaluation of Tylan on feed efficiency of layers. S Sohail*, M Bryant1, and D Roland1, 1Auburn University, Auburn, Alabama.

Tylan is an approved antibiotic for the control and treatment of mycoplasmosis in poultry. Field trials have indicated that Tylan also improves feed efficiency (FC) in broilers. In the U.S. it is approved at 20 to 50 g/ton to improve FC. This study was conducted as a 3 x 3 factorial to determine if Tylan improves performance particularly FC of healthy commercial layers. Hyline W36 hens (n=1152; 21 wk of age), managed and fed according to standard husbandry practices were housed in a controlled environment. Three levels of Tylan (0, 25 and 50 g/ton feed) with 3 protein levels (15.6, 16.7 and 18.1%) were randomly assigned to 8 replicates/treatment (replicate = 20 hens) in a randomized complete block design for 20 weeks. As protein level increased from 15.6 to 18.1% a significant linear beneficial effect of protein was observed on feed consumption (FC), egg production (EP), egg weight (EW) and FE. Tylan supplementation, however, had no significant influence on FC, EP or EW. Although, not significant Tylan numerically improved EP and EW, and reduced FC. The cumulative effect of these numerical differences due to Tylan resulted in a significant linear effect on FE of hens after an initial adjustment period of 5 wk. These results suggest that Tylan may have a significant beneficial effect on FE of commercial layers.

Key Words: Feed efficiency, Layers, Tylan

S32 Responses of Full- and Slow-Feathering Male Broilers to Low and Adequate Dietary Threonine Concentrations from 42 to 56 Days of Age. W.A. Dozier, III*, E.T. Moran, Jr., and M.T. Kidd, 1Auburn University, 2Nutri-Quest, Inc.

Threonine content of feathers is high and feather formation may influence dietary threonine need. This study examined the response of full- and slow-feathering male broilers to feeds adequate (0.74%) and deficient (0.56%) in dietary threonine. Extent of feathering was represented with two genetic sources that were factorially arranged with two threonine concentrations (2 x 2 x 2) using 32 floor pens (50 birds/pen). Birds were fed a common feeding regimen from placement until six weeks of age, then a corn-peanut meal diet containing 0.56% threonine was compared with one having 0.18% of supplemental L-threonine (0.74% total). Increasing threonine from 0.56 to 0.74% improved (P<0.01) growth rate with full-feathered broilers (85 vs. 91 g/d) but not slow-feathered broilers (89 vs. 88 g/d). Additional threonine also improved feed/gain (2.39 vs. 2.27; P<0.01); however, birds differing in feathering responded similarly. Dietary threonine did not alter the amount of abdominal fat, but slow-feathered broilers had less abdominal fat that full-feathered broilers. Incidence of defects affecting carcass grade was similar among treatments. Chilled carcass weight responded to additional threonine commensurate with the increase in live weight (2469 vs. 2507 g; P<0.05) as did the absolute amount of the breast fillet (555 vs. 571 g; P<0.01) and its proportion (22.5 vs. 22.8%; P<0.05); however, these were not differentially influenced by the extent of feathering. Slow-feathered broilers had advantages with the weight and percentage of breast fillets and tenders compared with full-feathered broiler. Threonine need of full-feathered broilers is increased for optimum body weight gain during 42 to 56 days of age, but carcass characteristics were unaffected.

Key Words: Amino acid, Broiler, Threonine

S33 Why the NRC and Commonly Recommended M+C/Lysine Ratio for Commercial Leghorns is Incorrect: No. 1. David A. Roland*, Sashidhar Yadalam1, and Mary Bryant1, 1Auburn University, Auburn, AL USA.

The purpose of this paper is to explain why the commonly used and NRC recommended M+C/Lysine ratio of .83 to .85 is incorrect, present data to support that conclusion and demonstrate the significant implications of this research on producer’s profit. In Expt. 1, a 3x2 factorial of three lysine levels (.92, .83 and .75) and two M+C/Lysine ratios (.83 and .77) were fed to W-36 hens from 21 to 34 wks of age. In Expt. 2, a 2x5 factorial of two lysine levels (.92 and .83) and five M+C/Lysine ratios (.77, .79, .81, .83 and .85) were fed to molted hens (80 wks of age) for 10 weeks. The criteria measured were egg production (EP), egg weight (EW) and feed consumption (FC). Results of Expt. 1 indicated a significant lysine effect on EW but no significant M+C/Lysine ratio effect. A significant lysine and M+C/lysine interaction on egg production indicated that the M+C/Lysine ratio had no effect on EP in hens fed the two higher levels of lysine but reducing the ratio significantly reduced EP in hens fed diets containing .75% lysine. In Expt. 2, the M+C/lysine ratio or lysine had no significant effect on EW, EP or FC. Results of both Expts. indicated that the current NRC recommended M+C/Lysine ratio is incorrect. It was concluded that many hens may be fed diets containing $1 to $2/Ton excess methionine. However, much more significant than feeding excess methionine, many producers may be wasting the equivalent of an additional $5/Ton or more by not altering dietary lysine (protein) levels correctly as price of eggs (spread due to size) and feed (protein and energy) change.

Key Words: methionine, lysine, ratio, commercial layers

S34 Optimal M+C/lysine ratio for first cycle phase 1 commercial Leghorns: No. 2. A. Bateman*, M. Bryant1, and D.A. Roland, Sr., 1Auburn University.

A study was conducted to determine the optimal M+C/lysine ratio in diets of phase1 Hy-Line W-36 hens (weeks 21-34). One-thousand, nine hundred and twenty 21-week old hens were randomly divided into 12 groups of 160 hens per group (20 hens x 8 reps for each treatment). Three levels of lysine (0.79%, 0.87% and 0.97%) with four M+C/lysine ratios (0.71, 0.75, 0.79 and 0.83) were used. The criteria were egg production, feed consumption and egg weight. A significant (P<0.001) interaction was found between lysine level and M+C/lysine ratio in egg production, feed consumption, and egg weight. Lowering the M+C/lysine ratio in the lowest lysine diet (0.79%) had a significant adverse effect on egg production, feed consumption, and egg weight, while there was little or no effect on these parameters in the diets containing the two higher lysine levels (0.87% and 0.97%). An economic analysis indicated that the optimal M+C/lysine ratios for diets containing 0.97, 0.87 and 0.79% lysine were 0.71, 0.75 and 0.83 respectively. These results indicate that the current National Research Council (NRC) recommendation of 0.83 for the M+C/lysine ratio is too high for diets containing the higher lysine (protein) levels currently required for low consuming hens at peak production. Many egg producers may be overfeeding synthetic methionine by as much as one pound or more per ton of feed.

Key Words: Methionine, lysine, commercial layers, egg production, egg weight

S35 Optimal M+C/lysine ratio for molted Phase 1 Hy-line W-36 hens: No.3. S. Yadalam, M.M. Bryant, and D.A. Roland, 1Auburn University.

Optimal M+C/lysine ratio for molted Phase 1 Hy-line W-36 hens: No.3 S. Yadalam*, M.M.Bryant and D.A.Roland. Sr., Dept of Poultry Sciences, Auburn University, Auburn, AL.

A ten week feeding trial was conducted to determine the optimal M+C/lysine ratio in molted Hy-Line W-36 hens (phase 1) weeks 69-79. One thousand four hundred and forty hens were randomly allocated to 9 treatments in a 3 x 3 factorial arrangement. The levels of lysine were 0.97, 0.87 and 0.79% and the M+C/lysine ratios were 0.71, 0.75 and 0.79. Egg production (EP), feed consumption (FC) and egg weights (EW) were the criteria measured. A significant lysine and M+C/lysine ratio interaction was observed for egg production. Reducing the M+C/lysine ratio in the lowest lysine diet (0.79) had a significant adverse effect on egg production but reducing the ratio had little or no effect on hens fed diets containing 0.97 and 0.87% lysine. Reducing lysine had a significant adverse effect on EW and FC. The M+C/lysine ratio had no influence on EW and FC. An economic analysis indicated that the M+C/lysine ratio for maximum profits was 0.71 for diets containing 0.97% lysine and 0.75 for diets containing 0.87 and 0.79% lysine respectively. These results suggest that the current recommendation of M+C/lysine ratio of 0.83 by NRC is incorrect and that many producers may be overfeeding methionine.

Key Words: cysteine, egg production, egg weights, feed consumption, lysine, methionine
S36 The effect of phytase addition on metabolizable energy in diets for chicks. S. L. Johnston* and L. L. Southern, Louisiana State University Agricultural Center.

Two experiments were conducted to determine the effect of phytase on energy bioavailability in corn-soybean meal diets for chicks. The diets were adequate in all nutrients except metabolizable energy. Average initial and final body weights were 88 and 139 g in Exp. 1 and 72 and 136 g in Exp. 2, respectively; and the experimental periods were 6 to 14 and 5 to 21 d post-hatching. In the first experiment, 120 commercial male broilers were allotted to four treatments with six replications of five chicks each. Treatments were three ME levels as a standard curve (2,917, 2,972, 3,027 kcal/kg) from increasing the amount of corn in the diet. Diets in the standard curve contained 1.0% Ca and .45% P. Phytase (600 FTU) was added and Ca and P were reduced by 0.1% in the test diet. In the second experiment, 60 chicks were used and the 2,972 kcal/kg treatment in the standard curve was omitted. Multiple linear regression of average daily gain (ADG) or gain/feed (G:F) on dietary ME level was conducted to obtain estimates of the value of phytase to affect energy bioavailability. In Exp. 1, phytase provided the equivalent of 81.3 or 68.9 kcal ME/kg of feed based on ADG and G:F respectively. In Exp. 2, ADG and G:F provided the equivalent of .4 and 32.2 kcal/kg, respectively. The average of both experiments and of the estimates from ADG and G:F suggest that 600 FTU of phytase from Natuphos® provided 45.7 kcal ME/kg of feed.

Key Words: Energy, Phytase, Chicken


Phytate, a predominant form of phosphorus [P] in plants, forms a variable component in animal diets. Despite the fact that it contributes a major portion of dietary P the consensus is that phytate is mostly unavailable to non-ruminants. The ability of chickens to utilize phytate P is controversial. Environmental concerns in recent years has prompted studies on phytate utilization. The thrust has been on the use of exogenous microbial phytase based on the assumption that chickens are unable to use natural phytate. The goal of this study was to determine phytate P utilization in broiler chickens from day-old to 6 weeks of age. Four pens of chicks with five birds per pen were fed a corn-soy diet. The droppings from each pen were collected every two days weighed and dried. Samples from each pen were pooled by week for analysis. Feed and excreta samples were ground, phytate P determined and phytate P retention calculated. Phytate P retention from 1 to 3 weeks of age averaged 39.3% on the starter diet. From 3 to 6 weeks of age the birds were fed a grower diet and phytate P retention ranged from 59.4 to 61.3% with a mean retention of 60.3%. The enhanced utilization during the 3 to 6 week period may be an age effect or may be induced by alterations in dietary calcium and P. The results showed that broiler chicks can utilize natural phytate P in practical diets and age or dietary factors are determinants of utilization.

Key Words: Chicken, Phytate, Phosphorus, Phytate phosphorus retention

S38 Effect of Hemicell® on the growth performance of turkeys fed diets containing 44% and 48% C.P. soybean meal. N. H. Odetalah*, F. P. Ferket1, J. L. Grimes1, and J. L. McNab2, 1North Carolina State University, Raleigh, NC, 2PARC Institute, Easton, MD.

Soybean meal (SBM) contains heat-resistant Mannans, which are intensely anti-nutritional due to their highly viscous properties. Domesticated turkeys are sensitive to Mannans because of the high inclusion rate of SBM in their diets, causing reduced feed conversion. Three experiments of similar design were conducted to determine the effect of mannann-end-1,4-β-mannosidase supplementation of corn-SBM diets on market turkeys. Experiment 1 was conducted at NCSU using Nicholas hens raised from 1 to 98 days of age. Experiments 2 and 3 were conducted at PARC Institute Inc., using BUTA turkey toms raised from 1 to 126 days of age. Birds received either four (exp. 1), or five (exp. 2 and 3) phase feed regimen ad libitum. In each experiment, birds were randomly assigned to litter floor pens providing 0.24 m²/bird (exp. 1) and 0.36 m²/bird (exp. 2 and 3). Each pen was assigned to one of four experimental treatments in 2 x 2 factorial arrangement of 2 basal diets containing 44% CP and 48% CP SBM with or without 100 BU Hemicell®/ton (1 BU = 10² enzyme activity units). Weekly body weight (BW) and feed consumption were recorded. Feed conversion ratio (FCR) corrected for mortality was calculated at coterminous feed-phase intervals. Birds fed the SBM-44 had lower final BW (14.9 vs. 14.56 kg 18 wk BW/tom; 7.66 vs. 7.46 kg 14 wk BW/tom, P<0.05) and higher final cumulative FCR than those fed the SBM-48. Hemicell® supplementation generally improved performance of all birds, with a greater response in birds fed SBM-44. Hemicell® improved BW and FCR by 1 and 3% in hens and 2.5 and 4% in toms, respectively. The results of these experiments indicate that some of the adverse effects of SBM antinutritional factors on turkey growth performance can be alleviated by dietary mannann-end-1,4-β-mannosidase supplementation.

Key Words: Turkeys, Soybean meal, Enzyme, Mannann-end-1,4-β-mannosidase, Growth performance

S39 An evaluation of beta-mannanase (Hemicell®) supplementation on broiler performance, and energy utilization in diets varying in beta-mannan content. M. Daskiran1, R. G. Teeter1, D. Fodge2, and H. Y. Hsiao1, 1Oklahoma State University, Stillwater, OK, 2ChemGen Corp. Gaithersburg, MD.

Two experiments were conducted to evaluate the efficacy and optimum inclusion level of a commercial beta-mannanase (Hemicell®) in broiler diets varying in beta-mannan levels. Guar gum was used to alter the beta-mannan level in a corn-soy based diets and both experiments were terminated at 14 d of age. In Experiment 1, guar gum was added at 0, 0.5, 1, and 2%, either with or without (0.5%) beta-mannanase. Two percent guar gum inclusion resulted in approximately a 16% reduction in body weight at 14 d. compared to control group. Increasing guar gum levels gradually decreased feed efficiency while enzyme supplementation improved (p<0.01) feed efficiency at each guar gum level with the highest improvement at 2% (p<0.0001). In general, guar gum inclusion increased the feed:gain ratio, and neither guar gum nor enzyme inclusion impacted blood hematocrit values. In experiment two, beta-mannanase was added at 0, 0.5, 1, and 1.5% to a corn-soy based diet containing 1% guar gum. Increasing beta-mannanase level did not affect body weight or body weight gain, but improved feed:gain ratio. The improvement in feed:gain ratio was quadratic. As the enzyme concentration increased, feed:gain ratio gradually declined, presumably due to increasing proportion of beta-mannan degradation. Enzyme efficiency on feed:gain ratio also declined with increasing enzyme concentrations. Data suggests that diets containing 1% guar gum require up to 1% beta-mannanase (Hemicell®) supplementation. These results indicate that beta-mannanase (Hemicell®) supplementation may improve the utilization of nutrients from diets high in beta-mannan content.

Key Words: Enzymes, Beta-mannan, Feed efficiency, Guar gum, Broiler

S40 Digestible Lysine Requirements for Maintenance in the Turkey During the Starter Period. J. M. Brown*1 and J.D. Firman1, 1University of Missouri-Columbia.

In order to develop an effective model for the precise feeding of turkeys, maintenance requirements for amino acids must be determined. These experiments were designed to determine the maintenance requirement for lysine in turkeys aged 0-3 weeks. Stainless steel batteries housed the 192 birds used in each of the two trials to provide for six replications of eight treatments. Treatment diets were formulated to contain the following percentages of digestible lysine: .114, .214, .314, .414, .514, .614, .714, .814. All other amino acids were provided at 15% excess relative to lysine based on the Missouri Ideal Turkey Ratio. Birds were maintained on experimental diets for seven days. In the first experiment, body weight gain responded linearly (p<.001) to lysine intake (r²=.95). The lysine requirement for maintenance in the starting turkey was determined to be 28.6 mg/day, based on body weight gain. Samples are currently being analyzed to determine the requirements for maintenance of lysine and whole body protein. This data and the accompanying results from a second experiment will be presented.

Key Words: Turkey, Lysine, Maintenance, Requirement, Amino Acids

S41 Dietary protein level and variable TSAAs: Lysine ratios: Effects on laying hens performance. H. Yakout*, C. Novak1, and S. Scheideler1, 1University of Nebraska-Lincoln.

An experiment was conducted to determine the effects of varying protein diets with amino acid supplementation on performance of Hyline W-98®
hens during early egg production (18 to 40 wks). A 3 X 3 factorial arrangement was utilized, in which birds were fed 18, 16, 14% crude protein and TSAA:Lys ratios of 0.71, 0.81 and 0.91. Diet lysine level was maintained constant at 6% of the diet, while TSAA:Lys was elevated at 640, 730 and 820 mg/kg diet in order to reach the desired TSAA:Lys ratios. Synthetic lysine, methionine, threonine and tryptophan were added to lower protein diets (14 and 16%). Diets were formulated according to breeder recommendation utilizing the Degussa prediction model for digestible amino acids. Feed consumption (FC) and egg production (EP) were recorded daily, while egg weights (EW) were recorded on a weekly basis. Hens were weighed monthly, egg quality measurements (specific gravity, yolks, albumen and shell) were done biweekly. Overall, EP, EW and egg mass (EM) were not significantly affected by dietary treatments. EP averages were 87.9, 89.6 and 89.1%, and 88.4, 88.3 and 89.9% for 18, 16 and 14% crude protein, and 0.71, 0.81 and 0.91 TSAA:Lys ratios respectively. EP significantly increased (p<0.01) as crude protein increased. Feed conversion approached significance at p<0.09. Feed conversion was 1.72, 1.76 and 1.73 for 0.71, 0.81 and 0.91 TSAA:Lys ratios respectively. Both specific gravity and shell showed significant effects (p<0.05, p<0.001, respectively), as they were increased with increasing TSAA:Lys ratios. Yolk solids significantly decreased (p<0.08) with increasing crude protein levels, being 55.92, 55.89 and 55.86% for 14, 16 and 18% protein. Yolk solids also revealed a crude protein X ratio significant interaction effect (p<0.03) as lower protein (14%) with high TSAA:Lys ratio and lower ratio with higher protein had the highest solids. In summary, low protein diets adequately supported egg production and egg weights in this strain of hens at the amino acid levels tested.

Key Words: TSAA:Lys ratio, Protein level, Layers, Egg components

S42 Iron overload and ascorbic acid synthesis in chickens. Jennifer J Cosgrove and D. V. Maurice, Department of Animal & Veterinary Sciences, Clemson University, Clemson, SC 29634-0361.

Research has shown a distinct interrelationship between iron and ascorbic acid. The majority of studies that examined the relationship focused on humans and guinea pigs, neither of which can synthesize ascorbic acid. Experiments conducted on animals that synthesize ascorbic acid are mostly on rats; there is very little research with avian models. The purpose of this study was to determine the effect of high dietary iron on hepatic iron accumulation and ascorbic acid metabolism. Three-week old broiler chicks were randomly assigned to floor pens in a open-sided poultry house. The control birds received a corn-soy grower diet that contained 264 mg/kg iron. The two experimental diets, based on the poultry house, were supplemented with ferrous sulfate and contained 2000 mg/kg and 3500 mg/kg iron. Feed and water were provided ad libitum. At seven weeks of age blood samples were drawn and the birds killed by exposure to carbon dioxide. Liver and kidney samples were collected. Hepatic iron concentration was increased as dietary iron increased. Histological analyses, using a 0-4 grading scheme to quantitate hepatic iron infiltration (HII), showed that HII score was positively correlated to ingested iron. Plasma ascorbic acid concentration was decreased [p<0.01] by 13 and 31% respectively in birds fed excess iron. Ascorbic acid synthesis, as measured by gulonolactone oxidase activity, was increased [p<0.01] on the average by 44% in birds fed the high iron diets. The results showed that excess iron reduces plasma concentration of ascorbic acid and stimulates biosynthesis.

Key Words: Ascorbic acid biosynthesis, Chicken, Dietary iron, Hepatic iron, Plasma ascorbic acid

S43 Aflatoxin, Ochratoxin and Hydrated Sodium Calcium Alumino Silicate Effects on Broiler Performance. A. Corzo1, R. G. Teeter1, and S. L. Vanhooser2, 1Animal Science Department, Oklahoma State University, 2Oklahoma Animal Disease Diagnostic Laboratory, Oklahoma State University.

An experiment was conducted to determine the effects of a hydrated sodium calcium alumino silicate (AS) Aflatoxin binder added to feed. Aflatoxin A (A) and ochratoxin A (Oc) effects in male broilers to 21 days of age. Concentrations utilized included 2 ppm of each mycotoxin with and without AS at 2.5kg/ton in a 2x2x2 factorial. 21-day body weight was depressed (p<0.01) in the presence of Oc at day 21 by 5.3%. The addition of the adsorbent produced an increase (p<0.01) on body weight by 5.1% compared to birds consuming diets without it. When As was present in the feed, total feed consumption (TFC) was almost 8% higher (p<0.01) in birds consuming diets with adsorbent. When birds were fed no adsorbent at all for any of the treatments, feed consumption was depressed (p<0.01) by 5%. As a main effect also reduced TFC by almost 7% (p<0.05). Body temperature of the birds was higher (p<0.05) when As was present. Total Water Consumption was higher (p<0.05) by almost 7% when adsorbent was present. As reduced the hematocrit values (p<0.05) by more than 4% compared to birds that consumed feed without it. Lymphoid organ weights were reduced with the presence of mycotoxins in the experimental diets. Liver weights were increased (p<0.01) by the presence of As in the feed. Birds supplemented to mycotoxin containing diets had a higher heat production, thus affecting net energy retention values. Birds in the As treatments consumed almost 9% more net energy than birds in treatments without it. In conclusion, data suggests that the adsorbent provide a therapeutic alternative for the prevention of mycotoxicosis in broiler flocks.

Key Words: Aflatoxin, Ochratoxin, Adsorbent, Mycotoxin, Broiler

S44 Safety of a hydrated sodium calcium aluminosilicate when fed in broiler diets at higher than recommended levels. R. K. Plunsky*, C.W. Comer, and R.D. Miles, University of Florida, Gainesville, Florida/USA.

Four experiments were conducted with a hydrated sodium calcium aluminosilicate, Milbond-TX (M-TX), to determine its safety in broiler diets when added at dietary concentrations higher than recommended by the manufacturer. In experiment one, six isocaloric and isonitrogenous diets were formulated to contain 0, 0.25, 0.50, 1.0, 1.5 and 2.0% M-TX, respectively. Experiment two was designed such that M-TX was added at dietary levels of 0, 1.0 and 2.0% to isocaloric diets deficient in sulfur amino acids. Experiment three consisted of M-TX added at levels of 0, 1.0 and 2.0% to isonitrogenous diets containing varying energy levels. In the fourth experiment, M-TX was added at dietary levels of 0, 1.0 and 2.0% to isocaloric/nitrogenous diets containing 1% calcium with levels of available phosphorus in the diet of either 0.22, 0.32 and 0.42%, respectively. All experiments were conducted in Pasteurine batteries, in temperature controlled rooms. Day-old male broilers were allowed ad-libitum access to feed and water throughout the entire three-week experimental period in all experiments. A 24-hour lighting regime was used. Prior to being allocated to the respective replicates of each treatment, all chicks were weighed individually and allocated to replicate pens such that all treatment replicates were equal in initial body weight. Data collected in each experiment were: body weight, feed consumption, feed conversion, toe ash and fecal moisture. Results of these four experiments provided data which indicated that M-TX did not have any adverse effect on any of the above performance parameters and is a safe agent when added to broiler diets at levels used in these experiments.

Key Words: Broilers, Aluminosilicate, Safety, Performance


Concerns over the safety of antibiotic growth promotants has sparked an interest in antibiotic alternatives. Mannanooligosaccharides, derived from yeast cell walls, may prevent the adhesion of certain bacteria to the enterocyte cell wall, thus enhancing performance under some rearing conditions. A study was conducted to evaluate the effects of Bio-Mos® (Alltech, Nicholasville, KY), Flavomycin® (Hoechst Rousell Vet, Somerville, NJ) and Stafac® (Pfizer Animal Health, New York, NY) on the growth performance of male turkeys. Hybrid Large White (Broiler, Conver- ter) male pouls were assigned to six dietary treatments: Control, Bio-Mos® (B), Flavomycin® (F), Stafac® (S), B & F (BF), and B & S (BS). All treatment diets were formulated to meet NRC (1994) nutrient requirements. There were eight replicate floor pens per treatment with 20 birds per pen reared from 1 to 140 days of age. Individual BW and feed consumption, by pen, were recorded at 3 wk intervals. Mortality and morbidity were monitored. Differences in BW at wk 3, 6, and 9. Mean BW for B approached significance at wk 15 (p=0.08) and 18 (p=0.07). F significantly (p<0.05) improved BW at wk 12 compared to control while S improved BW at wk 12 and 15 (p<0.05). Birds fed BF had significantly greater BW compared to control fed birds at wk 18 (15.43 vs. 15.07 kg, p<0.05). B significantly improved period feed/gain (F/G) from 15-18 wk (3.11 vs. 3.35, p<0.05) while F improved F/G from wk 0-3 (1.41 vs. 1.49, p<0.05) compared to the control diet. These results indicate that the beneficial effects of antibiotics are not related to increased growth, but rather to improved feed efficiency.
Four experiments were conducted to evaluate growth performance of different breeds of male broiler chicks fed diets containing either soybean meal (SBM) or soy protein isolate (SPI). Cornish x Plymouth Rock (C-PR) and New Hampshire x Columbian (NH-C) were used. The chicks were 6 to 10 d old at the start of the experiments. Initial weights were 194.9, 96.0, and 102.1 g in Exp. 1, 2, and 3, and 84.1 (C-PR) or 85.3 g (NH-C) in Exp. 4. A completely random design was used in all experiments, and each treatment was replicated four to six times with four or five chicks each. All diets were formulated to meet the NRC nutrient requirements for chicks. In Exp. 1 (C-PR chicks) and 2 (NH-C chicks), ADG and GF were increased (P < 0.01) in chicks fed the C-SBM diet compared with chicks fed the SPI-dextrose diet, but the difference between the diets was much greater in the C-PR chicks than in the NH-C chicks. In Exp. 3, C-PR chicks were fed a C-SBM diet, the LSU SPI-dextrose (dextrose:cornstarch, 1:1) diet, or a similar SPI diet (dextrose:cornstarch, 0.5:1) formulated by the University of Illinois. Daily gain, ADFI, and GF were increased (P < 0.01) in chicks fed the C-SBM diet relative to chicks fed the two SPI diets, and there were minor differences between the two SPI diets (ADG, P > 0.10). In Exp. 4, the C-PR and NH-C chicks were fed the same diets used in Exp. 3. Daily gain and ADFI were increased in C-PR and NH-C chicks fed the C-SBM diet relative to chicks fed the SPI diets (P < 0.01), but the increase in ADG and ADFI for the C-SBM diet was much greater in the C-PR chicks than in the NH-C chicks (diet x breed, P < 0.01). Daily gain, ADFI, and GF were increased in C-PR chicks compared with NH-C chicks (P < 0.01). Variable effects of diet on growth of chicks are affected by breed of chicks.

Key Words: chicks, protein source, breed

**S47** Effect of bird age on heat production in broiler breeder hens. S. J. Dixon, R. G. Teeter, and C. Wiernusz, 1 Oklahoma State University, 2 Cobb-Vantress, Inc.

Trial design provided for quantification of heat production (HP) through indirect calorimetry for both the fed and fasted states in broiler breeder hens over a range of ages. One-hundred four Cobb X Cobb broiler breeder hens, representing 10 age groups ranging from 5 to 50 weeks of age (at 5 week intervals), were allocated to individual metabolic chambers such that feeding, age, and body size effects on heat production might be quantified by indirect calorimetry. Birds were fed according to breeder recommendations. Oxygen consumed and CO₂ produced was recorded three times per hour, with HP estimated using the equation for HP developed by Brouwer (HP in kcal/kg = [(O₂ consumed) (16.184/4.184)] + [(CO₂ produced) (5.02/4.184)])]. Basal metabolic rate (BMR) quantification found that a 36-5% faster with birds housed in the dark. Heat production declined (P < 0.05), within each age group, as the birds transitioned from the fed state to the BMR state. Heat production (kcal/kg/kg BW) for the fed period averaged: 8.8, 6.1, 4.8, 3.6, 3.5, 4.1, 3.8, 4.0, 3.3 and for the BMR period averaged: 3.8; 2.8; 2.2; 1.8; 1.8; 2.0; 1.8; 2.0; 1.8 for bird ages 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 weeks respectively. Regressing log HP on log body weight (R = .997) yielded an estimate of 0.56 for converting body size to metabolic body size in birds from 5 to 20 weeks of age. The equation derived for heat production (kcal/kg/kg BW) during BMR period was: Log HP/kg BW = 1.066602 - 0.346201(Log kg BW) when all ages of birds were considered. The equation derived for heat production (kcal/kg/kg BW) during the fed state was: Log HP/kg BW = 1.789379 - 0.441974(Log kg BW). Heat production/kg BW declined (p < 0.05) as bird age increased through 20 weeks. Heat production/kg BW tended to increase as the birds matured through 40 weeks of age, presumably due to energy expended for egg production. In conclusion, indirect calorimetry was utilized to establish equations enabling computation of HP in fed and fasted birds from 5 to 50 weeks of age.

Key Words: Heat Production, Broiler Breeder Hens, Basal Metabolic Rate, Energy

**S48** Interrelationship of threonine and lysine in diets for growing broilers. C.A. Fritts, E.A. Oviedo-Rondon, G.F. Erf, and P.W. Walldroup, Poultry Science Department, University of Arkansas, Fayetteville, AR 72701.

The recent development of commercially-available threonine supplement for poultry feeds has renewed interest in studies on this amino acid as it appears to be second- or third-limiting in corn-soybean meal based diets for broilers. Thr recommendations for young chicks are based on fairly substantial research, the NRC requirements after 3 wks are based primarily on computer modelling. Two trials of identical design were conducted to evaluate the needs for supplemental Thr in corn-soybean meal type broiler diets. Some recent research has suggested a possible interaction between Thr and Lys; therefore Lys status of the diet was also examined. A base diet was formulated using corn and soybean meal of known composition to provide 105% of all essential amino acids other than Thr and Lys. The test diets for each period (0-3 wk, 3-6 wk, 6-9 wk) were calculated to be 0.20% deficient in Lys and 0.08 to 0.12% deficient in Thr; analysis of total and supplemental amino acid content verified these levels. Using a common basal diet, test diets were formulated to provide a 3 x 5 factorial arrangement of treatments with three levels of added Thr (0, 0.10, 0.20% and five levels of added Lys (0, 0.1, 0.2, 0.3, and 0.4%)). Positive control diets containing 105% essential amino acids with a minimum CP were fed along with test diets. In each trial, 25 male chicks of a commercial strain were placed in each of 96 litter-floor pens; six pens were assigned to each dietary treatment in each of the two trials. Birds were grown to 49 d; samples were processed to determine carcass yield. Body weight and feed conversion at 49 d were significantly influenced by Lys level but not by Thr with no interaction between these two amino acids. Increasing levels of Lys but not Thr also significantly increased breast meat yield with no interaction between Lys and Thr levels. Addition of 0.20% Lys, equivalent to the NRC recommendations, was sufficient to optimize BW, FCR, and breast meat yield in both studies. The present NRC recommendation for Thr appears to provide adequate margin of safety for this amino acid in corn-soybean meal based broiler diets.

Key Words: Broilers, Amino acids, Lysine, Threonine, Interaction


Many breeder companies provide nutrient standards for their bird. These are often in excess of those supported by research. The objective of this study was to compare performance of different high-yielding strains of broilers fed diets formulated to breeder guidelines as compared to more moderate standards. Males from three strains were obtained (Cobb 500, Ross 308, Hubbard Hi-Y). The intent of the study was not to compare strains but to determine if they responded differently to the dietary treatments. Four different feeding programs were used, including each of the breeder standards plus diets based on University of Maryland (UM) standards. Some programs were based on fixed amounts of feeds while others were based on time intervals. Diets varied considerably in both ME and CP. Because feeds were offered for varying lengths of time, all diets were fed in mash form. Each of the 3 strains was fed each of the 4 dietary regimes in a 3 x 4 factorial. Fifty males of each strain were placed in each of 16 pens in each of two successive trials. Four pens of each strain were fed each type of diet per trial. Birds were weighed at 28, 42, 56, and 63 days and feed consumption determined. At 42, 56, and 63 d five

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**Key Words:** Threonine, Lysine, Nutrient, Interrelationship.
birds from each pen were processed and parts yield determined. Significant differences were noted among strains for virtually every parameter including BW, feed conversion, and breast meat yield, and among feeding programs for BW and breast yield. However, there were no significant interactions between strain of bird and feeding programs, indicating that strain differences were basically similar regardless of type of feeding program. Birds fed the diets formulated to the breeder guidelines typically had higher percentage of breast yield than those fed the diets based on the UM standards, reflecting the higher amino acid content of these diets. No comparison was made regarding the economic differences among the different feeding programs.

Key Words: Broilers, Strain comparison, Feeding programs, Breast yield

**S50** Minimizing crude protein levels in broiler diets through amino acid supplementation. 1. Extent to which crude protein may be reduced in corn-soybean meal broiler diets through amino acid supplementation. J. Stål1, C.A. Fritts1, P.W. Waldroup1, and D.J. Burnham2. 1Poultry Science Department, University of Arkansas, Fayetteville, AR 72701, 2Heartland Lysine, Chicago, IL 60631.

Since the 1950’s methionine and lysine have been used in poultry diets with a reduction in crude protein levels. With the development of additional dietary ingredients to meet the potential energy needs of the chicken at CP even further. Reduction of N excretion in feeds may be a primary consideration for feed formulation in the future. This study was conducted to explore the extent to which CP can be reduced in corn-soybean meal broiler starter diets by amino acid supplementation while maintaining adequate performance. Using corn and soybean meal of known composition, diets were formulated using a minimum of 107.5% of NRC (1994) amino acid recommendation. No minimum CP was required; as each amino acid became limiting crystalline sources were provided. In sequence these were Met, Thr, Lys, Val, Ile, Arg, Phe, and Trp, resulting in 8 treatments ranging from 22.48% to 16.61% CP. All diets contained 0.3% sodium bi-carbonate and 0.2% aluminum hydroxide as buffer and antidote. Three additional treatments utilized potassium sulfate to maintain a minimum DEB of 250 meq/kg. Each treatment was fed to 6 replicate groups of 6 chicks from 1 to 21 d. Reducing CP below 20% while providing indispensible amino acids resulted in a significant reduction in BW and FCR. Crude protein content of freeze-dried carcasses defined and fat content increased as diet CP decreased. Feather content (weight (% of BW) was not affected until the CP was reduced to less than 18%. Maintaining DEB at 250 meq/kg in reduced CP diets had no significant effect on any parameter.

Key Words: Broilers, Crude protein, Nitrogen pollution, Carcass content

**S51** Minimizing crude protein levels in broiler diets through amino acid supplementation. 2. Effects of Tryptophan: Large netural acid ratios and overall amino acid levels on performance and composition of broilers. J. Stål1, C.A. Fritts1, P.W. Waldroup1, and D.J. Burnham2. 1Poultry Science Department, University of Arkansas, Fayetteville, AR 72701, 2Heartland Lysine, Chicago, IL 60631.

Reduction of dietary CP in broiler diets by amino acid supplementation has been successful, but at some point reduced performance occurs even when one has theoretically met requirements for those amino acids considered indispensible. It has been suggested that inadequate ratios of Trp to large neutral amino acids (LNAAs; sum of Ile, Val, Leu, Phe, and Tyr) may inhibit feed intake of animals fed low CP diets. Because little research has been done on many of the amino acids other than Met or Lys it is also possible that current recommendations are not adequate. This study was conducted to examine these potential contributors to the reduced performance at low levels of CP. Using corn and soybean meal of known composition, diets were formulated to provide a minimum of 100 and 110% of NRC (1994) amino acid requirements with 22, 20, 18, and 16% CP. At each level aP had considerably less fecal P than the 22% CP diets did not differ significantly from that of chicks fed the positive control. Chicks fed diets with less than 22% CP had significantly lower BW and increased FCR regardless of level of AA supplementation. There was no significant effect of Met status on performance, indicating that corn-soybean meal diets do not appear to be deficient in Cys and do not respond to levels of Met greater than that needed to meet minimum NRC recommendations for Met. Excess levels of Met did not appear to contribute to the reduced performance at low CP levels.

Key Words: Broilers, amino acid balance, methionine, nitrogen pollution

**S52** Minimizing crude protein levels in broiler diets through amino acid supplementation. 3. Effects of excess methionine from meeting needs for total sulfur containing amino acids. J. Stål1, C.A. Fritts1, P.W. Waldroup11, and D. J. Burnham2. 1Poultry Science Department, University of Arkansas, Fayetteville, AR, 2Heartland Lysine, Chicago, IL.

Failure to obtain optimum performance of broilers fed low CP diets supplemented with amino acids (AA) may be due to a number of factors, including potential toxic effects of AA in excess of requirements. To provide for TSAA needs, methionine is usually added a levels greater than that needed to meet needs for Met per se. Studies have demonstrated that Met is one of the most toxic of the AA, but these trials have usually considered levels in excess of 2 to 3%. The objective of the present study was to evaluate the effects of excess levels of Met on performance of broilers fed low CP diets. A CP diet of normal soybean meal of known composition were used to formulate diets with 22, 20, 18, and 16% CP with 100 and 110% of NRC AA recommendations. DL methionine was used to meet Met and TSAA requirements; the dietary levels of Met exceeded minimum needs. Within each CP level, two additional series were prepared. For one series, only the amount needed to reach Met requirement was added leaving a calculated deficit in TSAA. For a second series, excess Met was replaced with sufficient cysteine to meet both Met and TSAA exactly. Each of the test diets and a 23% CP positive control was fed to 6 replicate pens of 6 male broiler chicks from 1 to 21 d of age. Performance of birds fed the 22% CP diets did not differ significantly from that of chicks fed the positive control. Chicks fed diets with less than 22% CP had significantly lower BW and increased FCR regardless of level of AA supplementation. There was no significant effect of Met status on performance, indicating that corn-soybean meal diets do not appear to be deficient in Cys and do not respond to levels of Met greater than that needed to meet minimum NRC recommendations for Met. Excess levels of Met did not appear to contribute to the reduced performance at low CP levels.

Key Words: Broilers, Crude protein, Nitrogen pollution, Tryptophan


Due to concerns about effect of P on eutrophication of surface waters there is a need to provide adequate diet P for growth and skeletal development while reducing excretion. A corn mutation with low phytate P and high available P (aP) has been developed by USDA and bred into a hybrid by a major seed company using the low phytic acid 1-1 (lpaI-1) allele of the corn LPA1 gene. This hybrid, designated as “high available P corn” (HAPC), contains about 0.27% total P and 0.17% aP. A normal corn (NC) hybrid contains similar total P but only about 0.03% aP. The objective of this study was to evaluate the ability of young turkeys to utilize the P from HAPC and NC, and to determine the extent to which phytase can reduce aP needs. Diets were formulated with both NC and HAPC to provide all essential nutrients other than P. Low-P and high-P diets were formulated with each type of corn, analyzed for Ca and P, and blended to provide diets ranging from 0.12 to 0.72% aP for NC and 0.18 to 0.72% aP for HAPC. Sublots of each diet were supplemented with 1000 pU/kg of phytase (Natuphos, BASF). Each diet was fed to 6 pens with 6 turkeys per pen (15 d male and 18 d female) for 4 weeks. Birds were weighed, and two birds per pen were killed for tibia ash determination. Body weight gain, feed conversion, and livability were all optimized at aP levels far less than the 0.6% suggested by NRC with the greatest aP demand for maximum tibia ash. For both NC and HAPC diets without phytase, tibia ash was maximized at 0.5 to 0.55%. When phytase was added, aP needs were reduced to approximately 0.35% for both corn sources. Poults fed this level of aP had considerably less fecal P than this reduction in performance and in fact may have contributed to reduced performance of chicks fed diets containing 16% CP. The ratio of Trp to LNAAs had no significant effect on any of the parameters measured; therefore the reduced performance at lower CP levels does not appear to be due to a deficiency of Trp or to an imbalance among these amino acids.

Key Words: Broilers, Crude protein, Nitrogen pollution, Tryptophan
birds fed diets with 0.60% or more, typical of commercial turkey diets. The use of HAPC in reduced P diets with phytase supplementation can markedly reduce fecal P without loss of performance in young growing turkeys.

Key Words: Turkeys, High available phosphorus corn, Phytase, Eutrophication


Val requirement in a corn-soybean meal diet. Eight experimental diets were fed with Val levels of 0.700, 0.665, 0.630, 0.595, 0.560 and 0.525%. All other amino acids were added to a level that ensured that Val was first limiting. A positive control (0.765% Val) with only Met supplementation was fed. Egg production was increased by the addition of Val to 0.630%. Egg weight was increased by the addition of Val to 0.655%. Broken-line regression indicated a daily Val requirement of 592.5, 697.7 and 619.0 mg/h/d for EP, EW and EC, respectively. This was a requirement of 13.1 mg per g of EC.

Key Words: Laying hens, Egg production, Valine, Amino acids

555 Effects of unhydrolyzed vegetable sucrose polyester on hen performance, hatchability and yolk color. B.L. Dameron*, S.K. Williams, and H.R. Wilson, University of Florida, IFAS, Dairy & Poultry Sciences.

An experiment of 112 days duration was conducted using White Leghorn hens to determine any adverse effects resulting from the feeding of unhydrolyzed vegetable sucrose polyester (UVSP) provided through snack chips. Dietary treatments consisted of 0, 2,000, 4,000, 6,000, 8,000, or 10,000 ppm UVSP substituted into a corn-soy diet. Seven replicate pens of five individually caged hens received each treatment. Individual egg production was recorded daily, and pen-average egg weight and specific gravity were determined on three consecutive days egg production at the end of each 28-day period. Feed consumption was measured for 28-day intervals and the calculation of daily feed intake and feed efficiency. Five eggs from each replicate pen were individually evaluated for yolk color monthly using a Minolta Chroma meter. All hens were inseminated weekly during the third through sixth and twelfth through fifteenth weeks of the study using pooled semen from control males in order to measure any effects on fertility or hatchability. Body weight change was evaluated by individual weights taken at the beginning and end of the experiment. 10,000 ppm UVSP in the diets of laying hens over a 112-day period had no adverse or beneficial effects on daily feed intake, hen-day egg production, feed efficiency, egg specific gravity, body weight change, egg weight, yolk color, fertility, hatch of fertile eggs, or hatchability of eggs set.

Key Words: Sucrose polyester, Hatchability, Yolk color, Hens


Recently, Miles et al. (1998; Poultry Sci. 77:416-425) reported, using broiler chicks fed corn-soy based diets, that copper from TBCC™ was 106 and 112 percent as bioavailable as copper from copper sulfate in a battery brooder and a litter pen trial, respectively. TBCC™ and copper sulfate have 58.0 and 25.2 percent copper, respectively. Further evaluation of copper bioavailability is reported herein, and live performance is described in an accompanying abstract. Experiment 1 was on used litter with Candida albicans inoculation at day 3 to determine 21-day copper bioavailability with three levels of added copper (0, 125, or 250 mg/kg) from each source. There were 5 pens of 10 mixed-sex Cobb x Cobb chicks per treatment. There were significant (P<0.01) source, level, and source x level effects for copper in liver, mg/kg. Based on common intercept slope ratios from multiple linear regression, regressing liver copper (log base 10 transformed) on added copper intakes (mg/chick) by source, TBCC™ had a relative copper bioavailability of 113 percent (P<0.01; r²=0.87) with copper sulfate set at 100 percent. Experiment 2 was a 21-day battery brooder trial with 8 pens of 10 male Ross x Ross broiler chicks per treatment. Added copper levels were 0, 125, 187.5, or 250 mg/kg per source. Significant (P<0.01) source, level, and source x level effects were found for liver copper, mg/kg. Using three nonzero added copper levels per source, separate simple linear regression lines were determined by regressing liver copper (log base 10 transformed) on added copper intakes (mg/chick), and a slope ratio was calculated to estimate copper bioavailability. Copper from TBCC™ had a relative bioavailability of 113 percent. Therefore, the relative bioavailabilities of 113 and 122 percent, respectively, for copper from TBCC™ in these two studies, compared to copper from copper sulfate (100 percent), were similar to those of Miles et al. (1998) and indicate improved copper bioavailability from TBCC™. Based on the four estimates (106 and 112 percent, previously and 113 and 122 percent, herein), an overall bioavailability of 113 percent is indicated for copper from TBCC™ relative to copper sulfate.

Key Words: Broiler, Copper bioavailability, Copper sulfate, Liver copper, Tribasic copper chloride

557 Bioavailability of copper from tribasic copper chloride (TBCC™) compared to copper sulfate pentahydrate in broiler chicken diets. D. M. Hooge*1, F. A. Steward2, and J. L. McNaughton3, 1 Hooge Consulting Service, Inc., Eagle Mountain, UT, 2 Micronutrients, Inc., Indianapolis, IN, 2 PARC Institute, Inc., Easton, MD.

Currently, Miles et al. (1998; Poultry Sci. 77:416-425) reported, using broiler chicks fed corn-soy based diets, that copper from TBCC™ was 106 and 112 percent as bioavailable as copper from copper sulfate in a battery brooder and a litter pen trial, respectively. TBCC™ and copper sulfate have 58.0 and 25.2 percent copper, respectively. Further evaluation of copper bioavailability is reported herein, and live performance is described in an accompanying abstract. Experiment 1 was on used litter with Candida albicans inoculation at day 3 to determine 21-day copper bioavailability with three levels of added copper (0, 125, or 250 mg/kg) from each source. There were 5 pens of 10 mixed-sex Cobb x Cobb chicks per treatment. There were significant (P<0.01) source, level, and source x level effects for copper in liver, mg/kg. Based on common intercept slope ratios from multiple linear regression, regressing liver copper (log base 10 transformed) on added copper intakes (mg/chick) by source, TBCC™ had a relative copper bioavailability of 113 percent (P<0.01; r²=0.87) with copper sulfate set at 100 percent. Experiment 2 was a 21-day battery brooder trial with 8 pens of 10 male Ross x Ross broiler chicks per treatment. Added copper levels were 0, 125, 187.5, or 250 mg/kg per source. Significant (P<0.01) source, level, and source x level effects were found for liver copper, mg/kg. Using three nonzero added copper levels per source, separate simple linear regression lines were determined by regressing liver copper (log base 10 transformed) on added copper intakes (mg/chick), and a slope ratio was calculated to estimate copper bioavailability. Copper from TBCC™ had a relative bioavailability of 113 percent. Therefore, the relative bioavailabilities of 113 and 122 percent, respectively, for copper from TBCC™ in these two studies, compared to copper from copper sulfate (100 percent), were similar to those of Miles et al. (1998) and indicate improved copper bioavailability from TBCC™. Based on the four estimates (106 and 112 percent, previously and 113 and 122 percent, herein), an overall bioavailability of 113 percent is indicated for copper from TBCC™ relative to copper sulfate.

Key Words: Broiler, Copper bioavailability, Copper sulfate, Liver copper, Tribasic copper chloride

558 Response of heat-stressed broilers to removing lysine and methionine supplements from, or adding arginine to, a low-protein finisher diet. J. Chen1, D. Balnave1, and J. Brake2, 1 University of Sydney, Camden, NSW, Australia, 2 North Carolina State University, Raleigh, NC USA.

Four experiments were carried out to examine the responses of broilers at 30 °C to the removal of lysine and/or methionine supplements from, or the addition of arginine to, a low-protein finisher diet that met recom-
by the addition of arginine from the finisher diet mirrored those observed from the removal of lysine which suggested the Arg:Lys ratio per se was of more importance than was the concentration of the individual amino acids. Maintaining the methionine supplement in concert with the lysine provided no additional benefit and tended to have an adverse effect on performance in some cases. These data showed that widening the Arg:Lys ratio of the finisher diet during heat stress either by adding arginine or removing lysine has beneficial effects on broiler performance.

Key Words: Arginine:lysine ratio, Lysine, Methionine, Broilers, Heat stress

**S59 The Tryptophan Requirement of Two Broiler Genotypes: Classic and High-Yield.** A. P. Rosa1,2, G. M. Pest1, H. M. Edwards, Jr., 1, and R. I. Bakal1, 1Department of Poultry Science, The University of Georgia, Athens, GA 30602-2772, 2Universidade Federal de Santa Maria and CAPES Foundation, Brazil.

An experiment was conducted to determine the tryptophan requirement and evaluate the performance of two broiler genotypes fed different tryptophan (TRP) levels. A factorial design experiment was conducted from 1 to 18 days of age in battery brooders to evaluate the effects of six levels of TRP (0.09, 0.12, 0.15, 0.18, 0.21, and 0.24% of the diet) and two broiler chicken strains (Arbor Acres Classic and High Yield) on performance. The 6 x 2 factorial design had four replicate pens of eight males birds each. The basal diet was composed of corn (70.79%), corn gluten meal (17.41%), gelatin by product, poultry fat, DL-methionine, L-lysine, L-arginine, and L-threonine. Nutrient requirement limits were provided in all diets except varying levels of tryptophan (23% of crude protein and 3.34 kcal/g of metabolizable energy). At 18 days of age three birds by replicate were killed and liver and fat pads were taken. The performance of the two strains was similar. Body weight gain and feed conversion ratio (FCR) of broilers (0-9 and 0-18 days) were significantly affected by the TRP levels. The 0.2% reduction in tryptophan resulted in the poorest performing birds (P<0.0001). Liver and fat pad weights (as a percentage of body weight) were decreased in birds fed with 0.09% of TRP in the diets. The levels of TRP did not affect % liver lipids or % bone ash (P greater than 0.05). The broken-line linear model was used to estimate the chicks TRP requirement [response=max+rc*(req-x)*], where max=plateau, rc=rate constant, req= requirement, x=level, and l=1 when x greater than req, otherwise l=0. The TRP requirements differed for gain; they were 0.152 plus or minus 0.002% and 0.139 plus or minus 0.0022% for Classic and High Yield, respectively (P less than 0.05). The levels of tryptophan required based on feed conversion for Classic and High Yield were 0.131 plus or minus 0.004% and 0.134 plus or minus 0.0022%, respectively (P greater than 0.05).

Key Words: Tryptophan, Corn Gluten Meal, Broiler

**S60 Estimation of the calcium and phosphorus requirements of 4.5 to 12 kg commercial tom turkeys.** K. D. Roberson1 and R. M. Fulton, Michigan State University, East Lansing, MI.

A trial was conducted to estimate the calcium and phosphorus requirements of a commercial strain of large white turkeys during the grower period. Practical pre-starter and starter diets which contained calcium and nonphytate phosphorus (npP) at the NRC (1994) requirements and all other nutrients at or above NRC recommendations were fed until the birds were 8 wk old. Corn-soybean meal based diets were then fed to 3 replicate pens of 23 Nicholas males/pen. Calculated npP levels were 0.23, 0.28, 0.34, 0.40 or 0.455% from 8 to 11 wk (avg BW=4.5 to 8.0 kg) and 0.20, 0.25, 0.30, 0.35, or 0.40% from 11 to 14 wk of age (avg BW= 8.0 to 12.1 kg) which provided 60, 75, 90, 105 or 120% of the NRC requirement. The 1 wk exposure in Experiment 3. The data show that semduramicin produced no adverse effects in breeders or egg production variables when administered for one week. Changes in egg production, percentage shell and hatchability were observed only after more extended exposure. Typical exposures would be of no greater duration than one week as freshly milled feed is delivered weekly.

Key Words: Broiler breeders, Hatchability, Semduramicin, Anticoccidial

**S61 Effects of the ionophore anticoccidial semduramicin on broiler breeders.** J. Braile1, T. S. Cummings2, C. R. Pinedo6, and K. W. Bafundo2, 1North Carolina State University, Raleigh, NC USA, 2Pfizer Animal Health, Exton, PA.

Three experiments were conducted to assess the effects on broiler breeders of contamination of feed with the ionophore anticoccidial semduramicin. In Experiment 1, individually caged females received 0, 12.5, or 25 mg/kg diet for 3 wk from 48 to 50 wk of age. In Experiment 2, males and females in floor pens received 0, 12.5, or 25 mg/kg diet for 3 wk from 63 to 65 wk of age. In Experiment 3, individually caged males and females received 0, 3, 6, or 25 mg/kg diet for 1 wk only at 31 wk of age and were mated using artificial insemination. There was a dose-related decrease in cumulative egg production and percentage shell in Experiment 1 after more than 1 wk exposure but this was not observed in the other experiments. There was a decrease in cumulative fertile hatchability and a dose-related decrease after 3 wk exposure due to an increase in early embryonic mortality in Experiment 2 but this was not observed during the 1 wk exposure in Experiment 3. The data show that semduramicin produced no adverse effects in breeders or egg production variables when administered for one week. Changes in egg production, percentage shell and hatchability were observed only after more extended exposure. Typical exposures would be of no greater duration than one week as freshly milled feed is delivered weekly.

Key Words: Broiler breeders, Hatchability, Semduramicin, Anticoccidial

**S62 Effects of F-strain Mycoplasma gallisepticum on egg production and egg characteristics of commercial laying hens.** M. R. Burnham4, E. D. Peebles1, S. Whitmash, and S. Branton2, 1Mississippi State University, 2USDA, ARS, SCPRL, Mississippi State, MS.

The effects of F-strain Mycoplasma gallisepticum (FMG) on egg production and egg characteristics in commercial laying hens was investigated through 54 wk of age (34 wk of lay). Ten hens were assigned to each of eight negative pressure biological isolation units. Birds in four units served as unoinoculated controls and those in four other units were inoculated with FMG at 12 wk of age. Variables tested were BW, egg weight (BW), shell thickness (ST), egg grade (EG), and percentage eggshell weight (PSW), yolk weight (PYW), albumen weight (PAW), yolk moisture content (PYM), and yolk lipid content (PYL). Onset of lay was delayed 1 wk in FMG birds relative to controls. Main effects due to bird age were observed for BW, EW, PSW, PYW, PAW, and PYM. PAW was reduced by FMG across bird age. Total EP per hen was not affected by FMG; however, FMG reduced rate of EP (% hen-day) after 45 wk. FMG treatment also decreased percentages of pea- wee sized eggs prior to 25 wk and at 39 wk, and increased percentages of small sized eggs to 25, 39, and 53 wk. Furthermore, PYL was increased by FMG at Weeks 32 and 44. These data suggest that FMG inoculation at 12 wk may alter EG and PYL and cause a forward shift in EP away from the mid post peak period in commercial layers.

Key Words: Albumen, Egg production, Layers, Mycoplasma gallisepticum, Yolk

**S63 Effect of vitamin A deficiency on local and systemic immune responses of broiler chickens.** R. A. Dallo1, H. S. Lillehoj2, and J.A. Doer1, 1University of Maryland, College Park, MD/USA, 2USDA-ARS, Beltsville, MD/USA.

Broiler chickens were examined for the effect of vitamin A (Vit A) deficiency on different immune parameters. Day-old male broilers (Ross x Ross) were fed milo-soybean meal diets with 8000 IU Vit A/kg feed (CON) or without added Vit A (A-def). At 25 days of age a group of randomly selected birds from each diet was inoculated orally with a dose of Eimeria acervulina (EA) oocysts (10⁴/bird) and kept on the same diets. Changes in intestinal intraepithelial lymphocyte (IEL) subpopulations were assessed by flow cytometry at 35 days in both infected and non-infected birds. Whether challenged or not, birds on the A-def diet had fewer IEL expressing the surface markers CD3, CD4, CD8,
TCR1, and TCR2 than those on the CON diet. While CD8+ IEL increased in the CON group in response to EA, no change was found in IEL of A-def birds, suggesting that the latter birds were unable to respond properly to mycoplasmal infection challenges when 10 days after challenge showed higher antibody level against a recombinant coccidial antigen (3-1E) in A-def birds than in CON birds, consistent with lower serum interferon-gamma (IFN-γ) in the A-def group. A higher number of EA oocysts was recovered from A-def birds than from CON birds (9.2 × 10^8 vs. 5.4 × 10^8, respectively). The proliferative response of spleen lymphocytes to concanavalin A was depressed in A-def birds. These data show that Vit A deficiency compromised local immune defenses of challenged birds leading to systemic infection, as reflected in lymphocyte profiles, IFN-γ, and serum IgGs in A-def birds.

Key Words: Immunity, Vitamin A deficiency, Broilers, Intestinal intraepithelial lymphocytes, Coccidiosis

564 Delay in Fatty Liver Hemorrhagic Syndrome Observed in Commercial Layers Infected With Mycoplasma gallinarum. S. L. Branton1, B. D. Lott1, S. M. D. Sease1, S. D. Collier1, and W. R. Madlin2, 1USDA, Agricultural Research Service, South Central Poultry Research Laboratory, 2College of Veterinary Medicine, Mississippi State University.

In three trials in which commercial layers were utilized to determine the effect of Mycoplasma gallinarum on egg production, fatty liver hemorrhagic syndrome (FLHS) was initially observed in the control hens. In the three trials, FLHS was observed to occur 26 to 42 days earlier in control hens as compared with the hens infected with Mycoplasma gallinarum. In Trials 1 and 2, no therapeutic intervention was initiated and total mortality at the end of those trials was not significantly different between the controls and the hens infected with Mycoplasma gallinarum. In Trial 3, therapeutic intervention consisted of one pound of choline per feed of feed was implemented; however, as in Trials 1 and 2, there was no significant difference in total mortality attributable to FLHS between the two treatments. In each of the three trials, the controls experienced a numerically higher total incidence of FLHS.

Key Words: Chicken, Disease, Egg Production

565 Physiological Comparison Between Ascites Resistant and Ascites Susceptible Broilers. B.D. Kidd1, J.M. Balog2, N.B. Anthony1, G.R. Huff2, W.E. Huff2, and N.C. Rath2, 1University of Arkansas Fayetteville, AR, 2USDA/ARS/PPSSR.

ABSTRACT Ascites is a metabolic disease of fast growing meat-type birds. Ascites syndrome is currently being controlled by a variety of management tools including feed restriction, lighting, environmental control, and nutrient manipulation. Proper management can reduce ascites; however, no permanent solution is genetic selection for ascites resistant lines. The objective of this research was to determine the difference between ascites resistant and ascites susceptible broiler lines. The control was a relaxed line of the same strain, which had no particular selection pressure applied. Data collected were used to select for future generations of broiler breeders. Broilers were reared in floor pens with feed and water for ad libitum consumption. Birds were cold-stressed at 4h after hatch and again on day 21(10C for 5h) to initiate an ascitic response. At six weeks of age, birds were bled and euthanized. Whole body, liver, spleen, split heart and lung weights were recorded. Lung cavity was measured and birds were scored for ascites. Results showed body weights were not significantly different among all groups. Susceptible birds showed more right ventricular hypertrophy (P=0.0001) than controls and resistant birds. Total heart to body weight ratio was significantly higher (P>0.002) in the susceptible and resistant birds. Ascites mortality was not significantly different between the lines. Lung weights in the resistant birds were significantly heavier (P>0.05) when compared to control and susceptible birds. Lung cavity width was significantly smaller (P>0.06) in the resistant birds than the control birds.

Key Words: Ascites, Genetic selection, Body weight, Mortality, Broilers

566 Biochemical Identification of Essential Pulmonary Hypertension Syndrome in Broilers Following a Bacterial Challenge. J. D. Tankson1, J. P. Thaxton1, Y. V. Thaxton1, and J. D. Willbourn1, 1Mississippi State University.

Essential Pulmonary Hypertension Syndrome (EPHS) has been identified histopathologically, as well as by a visible depression in the wall of the right ventricle. Additionally, incidences of flipovers and ascites are elevated in birds experiencing EPHS. The present study was conducted to determine if EPHS could be detected biochemically. Parameters of the study included systolic and diastolic blood pressure, total serum protein, cholesterol, and hemoglobin levels. At several times post-challenge with causative bacteria, aspartate aminotransferase and creatine kinase-MB enzyme levels in plasma as well as antibodies raised against these bacteria, were quantitated. Biochemical and immunological profiles of broilers experiencing EPHS were described.

Key Words: Heart, Lungs, Biochemistry, Immunity

567 Heat stress-induced hypothyroidism mediates changes in reproductive hormones in laying hens. S.A. Elnagar1 and M.M. Beck, 1University of Nebraska Lincoln.

Two studies were conducted to determine whether heat stress (HS) effects on reproduction in the hen are mediated via hypothyroidism (Hy) and whether HS-induced Hy can be mimicked by chemically induced Hy. In Exp. 1, blood was obtained from 12 32-wk-old hens at 25C (day 0) and on days 1-5 of HS (35C, 50% RH) and analyzed for T3, T4, estriol (E2), progesterone (P4), prolactin (PRL), and vasoactive intestinal peptide (VIP). T3, E2, and P4 were depressed (P=0.0001) immediately by HS and did not recover; T4 was elevated (P=0.0013) by d3; T3/T4 decreased (P=0.008) immediately, suggesting an effect of HS on liver conversion of T4 to T3. The conversion enzyme, cd1-1, was reduced in amount in liver samples analyzed by northern blot; and rT3 was not detectable in plasma, strengthening this observation. Plasma T3 and E2 were correlated (r=0.4; P=0.004). HS-induced changes in PRL and VIP were not detected. In the second study, designed to address Hy mechanism(s), 20 hens each (32-wk-old) were randomly assigned to one of 4 treatments: HS (35C; 50% RH); Hy (2 wk. 1% dietary thiouracil); Hy with 0.5ppm dietary T4 replacement (Hy+T4); control (Co; 25C, 50% RH); blood samples were obtained for tcl and assayed for T4, E2, P4, VIP, PRL. In almost all cases (T3: P=0.0001; T4: P=0.0001; E2: P=0.0001; PRL, P=0.0045) HS and Hy produced very similar results and restoring T4 to Hy birds produced results that were similar to Co. P4 responded to HS only relative to Co (P=0.0001) and VIP was increased for all concentrations of HS irrespective of the PMA concentration. NO was increased in the LPS stimulated cells in a dose dependent manner, and decreased thymocyte response to ConA while exposed to various concentrations of FB1. The immune response is comprised of cellular and humoral activities. In order to determine if FB1 is immunotoxic to the ave, the major immune organs, i.e., spleen, thymus and peripheral blood lymphocytes (PBLs) were investigated for any alteration in their cellular response following exposure to FB1. Cells obtained from New Hampshire chickens were stimulated in culture with lipopolysaccharide (LPS) or concanavalin A (ConA) while exposed to various concentrations of FB1. Reduction of MITT and the production of nitric oxide (NO) were assessed as immune endpoints. FB1 decreased thymic cell viability in a dose dependent manner, and decreased thymocyte response to ConA. Nitric oxide production was measured for cells stimulated with phorbol myristate acetate (PMA) or lipopolysaccharide. Nitric oxide production was increased for all concentrations of FB1 irrespective of the PMA concentration. NO production increased in the LPS stimulated cells at the two higher doses of FB1. A decrease in T cell activity and an increase in NO production indicates that fumonisin B1 may alter the cellular immune response in aves.

Key Words: Fumonisin B1, Immunotoxicity, Mycotoxin

Bacterial Challenge.

Y. V. Thaxton1, J. D. Willbourn1.
The existence of the bursa of Fabricius as a distinct anatomical entity in birds provided the initial opportunity for the discovery of humoral immunity as a distinct arm of the immune system and continues to provide unique opportunities for understanding and exploitation of B-lymphocyte development. Apoptosis, or programmed cell death, is believed to be the mechanism for deletion of lymphocytes recognizing self antigens following clonal expansion. Further, some evidence suggesting that recognition of foreign antigens, presented by the bursal follicular epithelial cells, may promote retention of selected clones by protection from apoptosis. While bursal apoptosis has previously been shown to increase following in vivo exposure to glucocorticoids, the microanatomical site of induced or normal apoptosis has not been unequivocally established. Presently, we adapted the existing TUNEL (Terminal Deoxynucleotidyl Transferase Mediated dUTP Nick End Labeling) assay for use with neonatal bursae. Similar to previous reports, TUNEL revealed that normal apoptosis is preferentially, but not completely, ongoing in bursal follicular cortical cells. Administration of either a synthetic glucocorticoid (dexamethasone) or androgen (19-nortestosterone) caused follicular lymphocyte depletion and increased apoptosis per unit of area and significantly (p < 0.05) increased the interfollicular epithelial thickness, a pathological change usually associated with edema, within 6 hr following treatment. These data confirm existing data suggesting that steroid hormones may cause cell depletion and increased bursal lymphocyte apoptosis and extend existing data suggesting that normal bursal apoptosis occurs to a greater degree in the bursal follicular cortex. Continued investigations may improve our understanding of events leading to B-lymphocyte clonal expansion and maturation within the chicken bursa of Fabricius.

Key Words: Bursa of Fabricius, Chickens, Lymphocytes, Apoptosis, TUNEL

S70 Effects of Taurine or Beta Alanine Supplementation on Growth and Ascites Predictors of Broilers Exposed to Cool temperatures. C.A. Ruiz-Feria1 and R.F. Wideman, Department of Poultry Science, University of Arkansas, Fayetteville, AR 72701.

It has been suggested that cardiomyopathy (CM) might play a role in the pathophysiology of pulmonary hypertension syndrome (PHS, ascites). Taurine deficiency causes CM in cats and heart myofibril looses in rats, whereas taurine supplementation improves these cardiac conditions. Beta alanine (BAL) depletes taurine from chicken and rat hearts. This experiment was conducted to evaluate the effects of taurine and BAL supplementation on growth, ascites mortality, saturation of hemoglobin with O2 (oximetry), and electrocardiogram lead-II R-S wave amplitude (ECG) as an index of right ventricular hypertrophy. Forty one hundred-day-old male by-product chickens of the Hubbard Pullet line were used. They were fed a standard commercial diet collected, 16 days prior to inoculation, in wire cages. Environmental chambers set at 15 C in order to induce ascites. Control birds consumed tap water, and taurine (Low, 0.75, and High, 1.5%) and BAL (Low, 1.5, and High, 3%) were administered in the drinking water. At Day 37, ECG, and oximetry were recorded, and at Day 43 body weights were recorded. Mortality was recorded daily, and right:total ventricular weight ratio (RV:TV) were recorded. Data were analyzed with the PROC GLM of SAS. Birds fed High taurine had a depressed (P < 0.05) final weight (1839 g) as compared with control (2557 g), BAL birds (2123 and 2163 g for Low and High BAL, respectively), and Low taurine birds (2107 g). No differences were found in ascites mortality. The RV:TV ratio did not differ (0.26 for control, 0.23 for both taurine levels and Low BAL groups, and 0.31 for the high BAL group) among the treatment groups. ECG and oximetry were not affected by treatment. Although hearts of birds fed BAL were very flaccid, indicating the effects of BAL on heart structure, no effects on parameters predictive of PHS were found. These results suggest that, under these circumstances, taurine depletion and CM might not have an important role in the pathophysiology of PHS.

Key Words: Ascites, Cardiomyopathy, Taurine, Beta Alanine, Broilers

S71 Duration of fertility following a single insemination in two broiler lines. Hai Tao Li1, Pingbo Liu1, and Wallace Berry2, 1 Auburn University Department of Poultry Science.

Fertility in breeder hens requires production of fertilizable ova and delivery of sperm to those ova at the appropriate time and place. Sub fertile hens may produce ova that are poorly fertilizable. This would result in an overall low fertility rate for that hen. Hens may also be sub fertile in that they produce fertilizable ova, but do not store or transport sperm adequately. This would result in short duration of fertility following insemination. Differences in duration of fertility, due to genetic or other factors, have not been adequately explored. Two trails were conducted to analyze duration of fertility following artificial insemination of two genetically distinct lines of broil chickens. Tibial Dyschondroplasia (TD) lines have been selected for high (H) and low incidence (L) of TD for 12 generations. In trial 1, semen was collected from H and L line males, pooled, and sperm numbers determined by spectrophotometer. 20 H line males and 18 L line females were inseminated with 100 million sperm per hen, which is reported to be the optimal number for fertility. Eggs collected from days 2 to 20 following insemination were incubated for 10 days then broken out to determine fertility. There was no significant difference in duration of fertility between H line and L line hens in this trial. Trial 2 was conducted to determine the length of fertility following insemination with suboptimal levels of sperm. Semen collected from 10 H line and 9 L line 27 week old males was pooled and the hens were inseminated once with 25 million. The fertility data collected will allow for the identification of hens which are sub fertile due to problems with sperm storage or transport.

Key Words: Breeder, insemination, fertility

S72 Chronic heat stress induces an adaptive increase of SGLT-1 expression in broiler chickens. R. R. Hunter1, M. A. Mitchell1, C. Garriga2, M. Mitjans2, A. Camat2, J. M. Planas2, and M. Moret2, 1 Roslin Institute, Roslin, Midlothian, UK, 2 Universitat de Barcelona, Barcelona, Spain.

Exposure of broiler chickens to chronic heat stress results in numerous physiological adaptations aimed at maintaining homeothermy. Consequent reductions in feed intake and growth rate are associated with reduced intestinal weight and absorptive area. Previous studies, however, have shown an increased capacity for luminal hexose absorption in perfused jejunum in vivo during heat stress and an elevated galactose uptake into isolated jejunal enterocytes in vitro. The current study characterises the mechanisms of this apparent adaptive response. Groups of eight 4 week old, female broiler chickens were exposed to either thermoneutral (TN) or heat stress (HS) conditions for 14 days. Body weights, deep body temperatures and blood samples were taken at the start and end of the experimental period, after which the birds were killed and jejunal segments removed for tissue morphometry and assessment for the abundance of the glucose transporters SGLT-1 (brush border membrane - phosphorizid binding) and GLUT-2 (basolateral membrane - cytochalasin B binding). Hexose absorption kinetics were assessed in brush border membrane vesicles. HS reduced body weight by 12.5% (p < 0.01) and induced a marked hyperthermia of +1.5◦C (p < 0.01). Jejunal wet weight was reduced by 48% (p < 0.01) in the HS birds but jejunal length was unaffected. Villus height in the distal jejunum was also reduced. Phloridzin binding was increased in HS birds by 48% (p < 0.05) and Cytochalasin B binding was unaffected. Vmax for α-methyl D-glucoside transport was elevated by 54%. These findings suggest increased expression of SGLT-1 at the brush-border membrane in response to HS. This increase is dependent upon characterising the physiological responses to heat stress.

Key Words: Intestinal Absorption, Heat Stress, Adaptation

S73 Radio-telemetric monitoring of physiological variables in broilers during commercial transportation. M. A. Mitchell1, P. J. Kettlewell2, J. Lowe3, and R. R. Hunter1, 1 Roslin Institute, Roslin, Midlothian, UK, 2 Silsoe Research Institute, Silsoe, Beds., UK.

Exposure of broiler chickens to thermal stress during commercial transportation from farm to slaughter can result in increased mortality and reduced product quality. Precise definition of the optimum thermal conditions and the acceptable ranges and limits for temperature and humidity in transit are dependent upon characterising the physiological responses.
of the birds to quantified thermal loads. Whilst measures of physiological variables made immediately before and after a journey yield much information it may be suggested that continuous monitoring and correlation (8 parallel restraint) of on-board conditions would provide greater insight into the physiological demands of transportation procedures and conditions. A multi-channel, surgically implantable, radio-telemetry system (Tx) has been developed for use in poultry for the continuous remote monitoring of deep body temperature (DBT) and heart rate (HR). The system is bi-directional allowing full control of the Tx even after implantation. All data collected is transferred to a personal computer for further processing, storage and analysis. The transmission range is up to 30m and thus the package is suitable for use in commercial production and transport environments. Trials have been undertaken on 2 commercial journeys of approximately 3 hours duration on successive days. A total of 6 transported and 6 control birds were studied on 2 ‘journeys’. Container temperatures and humidities were recorded throughout. Variations in HR and DBT and their temporal patterns were correlated with journey events and conditions. Overall mean heart rate was higher in transported birds than in controls (320 ± 46 vs 284 ± 32 beats per minute) and DBT was also elevated (42 ± 0.6 °C vs 41.1 ± 0.5 °C). It is proposed that continuous, radio-telemetric, remote monitoring of physiological signals in poultry is a major advance in characterising the effects of potential stressors in production environments and procedures.

Key Words: Radio-telemetry, Heart Rate, Broilers

S74 Genetic characterization of commercial chicken lines for EST-based single nucleotide variants. Edward J. Smith1, Shi Li1, G. E. Pimentel Smith2, Kenneth Pierce1, Kevin Sanders1, Krystal Southern1, and Luanna Prevost1. 1Comparative Genomics Laboratory, Tuskegee University, Tuskegee, AL

Though significant progress has been made in the development of a chicken genetic map, a question that remains is the utility of this map, especially of the polymorphisms detected in the reference population, to the poultry industry. In the present work, we conducted a survey of six commercial lines for nucleotide variants used to map 10 expressed sequence tag sites in the East Lansing reference population. The ESTs were developed from a normalized cDNA library established using a three-day-old white Leghorn embryo. For each EST, a total of 268 birds were included in the screening for nucleotide variants using a combination of PCR and UNIX-based sequence analysis programs. For SNP validation, Mendelian inheritance in the East Lansing reference panel and TA-vector cloning of a heterozygous genotype at each locus were used. A total of 25 SNPs were observed and validated. About 80% of these SNPs were not detected in the East Lansing reference population. Additionally, only one of the SNPs used to map the ESTs in the East Lansing reference population was detected in the commercial populations. The ESTs described as well as the SNPs provide tools that may be useful to the poultry industry for genetic analysis.

Key Words: Expressed sequence tags, Chickens, SNPs, Genetics analysis

S75 Patterns of behavioral and adrenocortical reactions to repeated restraint in Japanese quail genetically selected for contrasting plasma corticosterone responses. G. G. Cadd1, D. G. Satterlee1, D. Waddington1, and R. B. Jones1. 1Louisiana State University, Baton Rouge, LA. 2Roslin Institute (Edinburgh), Scotland.

Behavioral and adrenocortical reactions to repeated mechanical restraint were compared in 28-day to 31-day-old male Japanese quail from two genetic lines divergently selected for reduced (low stress, LS) or exaggerated (high stress, HS) plasma corticosterone (C) responses to brief immobilization. Restraint in a metal crush cage for 5 min elicited immobility and silence in all the birds. Circulating C levels were considerably higher in quail of both lines following restraint than in the undisturbed controls of either line. As expected, both the behavioral and physiological effects were more pronounced in HS than in LS birds. Struggling increased with repeated restraint in HS and LS quail, thus suggesting behavioral habituation to the stressor in both lines. On the other hand, a line effect on the pattern of adrenocortical responses was revealed upon subtracting the change in plasma C concentrations from Day 1 to Day 4 in the undisturbed controls from the corresponding change in restrained birds. Thus, unlike LS quail in which there were no detectable effects of repeated restraint, the adrenocortical responses of HS birds showed evidence of experience-dependent sensitization. Our results demonstrate the importance of the background genome in determining the patterns of the behavioral and adrenocortical responses elicited by repeated exposure to stressful stimulation. The present results and those of previous studies can be explained in two ways, either that underlying fearfulness is lower in LS than HS quail and/or that they adopt active or passive coping strategies, respectively. Our findings may also have important implications for poultry welfare and productivity.

Key Words: Repeated Restraint, Struggling, Corticosterone, Japanese Quail, Habituation/Sensitization

S76 Administration of Anti-Adipocyte Monoclonal Antibodies In Ovo Reduces Abdominal Fat Pad Mass in Chickens. A. L. Cartwright1, Y. J. Wu1, and J. T. Wright1. 1Texas A&M University, College Station, TX. 2Pennington Biomedical Research Center, Baton Rouge, LA. 3Georgia Southwestern State University, Americus, GA.

The effect of in ovo administration of anti-adipocyte monoclonal antibodies (MAb) on growth and adipose tissue development in chickens was examined. MAb were selected for specificity against lipid-containing cells in chickens. These MAb also reduced adipocyte cluster number in vitro and reduced adipose fat pad mass in vivo. Sixty eggs from layer-type chickens were injected with MAb on day 15 of embryogenesis. Either 0.0, 0.05, 0.1, 0.2 or 0.4 mg MAb were administered into allantoic circulation and subsequently incubated. Chicks were hatched and grown until 42 d post hatch when they were killed. Body weights and feed intake were monitored throughout and tissues examined at 42 d. High doses (0.2 and 0.4 mg) significantly reduced (P<0.05) abdominal fat pad weight without affecting total body weight at 42 days of age. A dose-response curve (R2=0.406) was defined as Y=(0.7780/0.005)−(0.0850/0.018)X where X is MAb dose and Y is adipose mass. Females were more sensitive to 0.1 mg MAb than were males. Hatch success rate was not significantly affected at 0.0, 0.05, 0.1 and 0.2 mg levels. However, the highest dose (0.4 mg) severely reduced hatch rate. Total body weight or feed intake was not affected among treatments. Our experiments demonstrated for the first time that in ovo administration of anti-adipocyte MAb on day 15 of embryogenesis significantly reduced the chicken abdominal fat pad mass at 42 days of age without decreasing other growth or body weight measurements.

Key Words: Monoclonal Antibody, Adipocyte, Fat, Chicken

S77 The effect of broiler breast meat color on pH, water holding capacity, and emulsification capacity. M. Qiao2, D. L. Fletcher, D. P. Smith, and J. K. Northcutt, University of Georgia.

The relationship between broiler breast meat color and pH, water-holding capacity (WHC), and emulsification capacity (EC) were investigated. Breast fillets were collected from three commercial processing plants categorized as light, normal, and dark according to lightness (L*) values. Color (L*, a*, b*) of each intact fillet was measured at 0 h and 24 h after collection. Fillets were then ground and color, pH, moisture, WHC, and EC of ground meat determined. There was a significant difference among color groups in L*, pH, WHC and EC, respectively. The L* value of ground meat had a significant negative correlation with EC (p<0.05), pH (p<0.0001) and a* (p<0.0032). EC had a significant positive correlation with pH (p<0.0243) and a negative correlation with moisture (p<0.037). WHC had a significant correlation with a* (p<0.0125), and pH (p<0.0203). These results indicated that the light meat was associated with low pH, high moisture, low EC and low WHC. Between the normal and dark groups, there was no significant difference for WHC and moisture, but different for pH and EC. These results indicate that color can be used to identify fillets with altered functional properties.

Key Words: Broiler breast meat, Meat quality, Meat color, Water holding capacity, Emulsification capacity

S78 Comparison of Direct Plating Versus Filtering of Egg Shells Inoculated with Salmonella Typhimurium. P. L. Reynolds1, K. D. Knape1, J. B. Carey1, E. K. Eskew2, and W. D. Warren2. 1Texas A&M University, 2Biomedical Development Corp.

Microbial contamination of egg shells is of great importance in the commercial production of table eggs. Commonly used methods of enumerating egg shell microbes can not detect fewer than 50 CFU/egg. A rapid
and simple test for enumeration of low level egg shell bacterial populations is needed. The objective of this project was to compare direct plating of S. typhimurium samples recovered from inoculated eggs to a novel filtering procedure. Approximately, $10^3$ S. typhimurium organisms were inoculated on intact egg shells. The eggs were then held at 37°C for 30 minutes to dry the inoculum on the egg shell surface. Eggs were subsequently immersed in a phosphate buffered solution to remove bacteria adhering to the egg shell surface. After rinsing, samples of the rinse solution were either directly plated or filtered. Very few or no organisms could be recovered from the samples treated by the filtering procedure. To determine survival of S. typhimurium and C. jejuni water has been suggested as a possible vector. To determine survival of S. typhimurium populations is needed. The objective of this project was to compare direct plating and simple test for enumeration of low level egg shell bacterial populations. With the dip applications, greatest reductions in populations of pathogens were achieved with 2.0 - 2.5 and 1.0 - 2.0 log$_{10}$ cfu/ml, respectively with hot dip application. With ambient dip application, population reductions were 2.0 - 2.5 and 1.0 - 2.0 log$_{10}$ cfu/ml, respectively for loosely and firmly attached cells. The results of this study indicate that sodium bisulfate has potential as a pathogen reduction treatment for processed poultry. 

**Key Words:** Sodium Bisulfate, poultry pathogens, antimicrobial

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**S84** Influence of oleic acid on populations of campylobacter on poultry skin and in vitro. A. Hinton, Jr. and K. Ingram. 1 Russell Research Center, Athens, GA. 

The ability of oleic acid to reduce the number of campylobacter on poultry skin and in vitro was examined. Skin samples were taken from commercially processed broiler carcasses. Skin was washed in solutions of 0, 2, 4, 6, 8, or 10% oleic acid by blending the skin and oleic acid in a stomacher for 1 min. Oleic acid was decanted, and skin was rinsed by stomaching for 1 min in peptone water. The number of campylobacter in the peptone water rinsates was determined by plating the rinsates on Campylobacter agar (Blaser) and counting the number of colonies present after incubating the plates under microaerophilic conditions for 48 h at 42°C. Significantly fewer campylobacter were recovered from rinsates of skin washed in 10% oleic acid than from control samples. Additionally, fewer campylobacter were recovered from rinsates of skin washed in 4% oleic acid than from skin washed in lower concentrations of the fatty acid. No campylobacter were recovered from rinsates of skin washed once in 10% oleic acid or twice in 4, 6, 8, or 10% oleic acid. There was no significant difference in the number of campylobacter recovered from rinsates of skin samples subjected to 1 wash or to 2 consecutive washes in the same concentration of oleic acid, however. Poultry carcasses recovered from carcasses where oleic acid was applied to the skin that had been subjected to 2 consecutive washes in 10% oleic acid, then blended with peptone water in a Waring blender. Cultures of campylobacter were also suspended in solutions of 0, 2, 4, 6, 8, or 10% oleic acid and mixed for 5 min. Campylobacter was recovered from the culture suspended in the control tube that contained no oleic acid; however, no campylobacter were recovered from cultures suspended in tubes containing 2 to 10% oleic acid. Findings indicate that oleic acid reduces

**Key Words:** Poultry litter, Poultry litter amendment, Ammonia control, Acidified Clay

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**S79** Survival of Campylobacter jejuni in water. M.A. Davis* and D.E. Conner, Auburn University, Auburn, AL. 

Campylobacter jejuni can spread rapidly throughout a broiler flock, and water has been suggested as a possible vector. To determine survival of C. jejuni in water, three experiments (exp) were conducted. In exp I, sterile, distilled water (50ml) was added to each of 60 sterile containers. A sterile nipple watering device was also added as a potential bacterial attachment medium, and containers were inoculated with C. jejuni to provide an initial population of 10$^6$ - 10$^7$ cfu/ml in each container. Containers were sealed and stored at room temperature (23°C). At one week intervals of storage, ten containers were sampled to determine if C. jejuni could be recovered. The watering device and 10 ml of the water from each container were enriched in 50 ml of Bolton’s broth for 48 hrs, then plated onto Campy-Cefex agar. Suspect colonies were confirmed by latex agglutination and cell morphology. After one wk, C. jejuni was recovered from 9 of 10 containers, while ≥2 wk, no C. jejuni were recovered. To determine if presence of feed in water affected survival of C. jejuni, exp II was conducted using the same protocol as in exp I with the exception that 1.0g of sterile, unmedicated feed was added to each container. As in exp I, C. jejuni were recovered from 9 of 10 containers at one wk, while ≥2 wk, no C. jejuni were recovered. From exp I and II, it was concluded that C. jejuni survived in water for at least 7 d, but less than 14 d, indicating that this enteropathogen has some ability to survive in poultry water systems if contamination were to occur. Therefore, water could serve as a vector of C. jejuni in broiler houses, unless control measures are employed. 

**Key Words:** Campylobacter, Water, Survival, Poultry

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**S80** Laboratory Evaluation of Sodium Bisulfate as a Potential Antimicrobial Treatment for Poultry. Le Zhang. 1 Department of Poultry Science, Auburn University. 

The skin attachment model (SAM) was used to evaluate the efficacy of sodium bisulfate against three pathogens, Salmonella serotypes, Listeria monocytogenes, and Campylobacter jejuni. Broiler breast skin pieces (78 cm$^2$) inoculated with these bacteria were treated by immersion in 0, 1, 2, 3, 4, or 5% sodium bisulfate solutions for 60 min at 0°C (simulated chiller), 2 min at 50°C (hot dip), or 15 s at room temperature (ambient dip). Sodium bisulfate with in all application methods reduced populations of all three bacteria as compared to populations recovered from skin treated with water only. No campylobacter were recovered from skin wall that was affected by method of application, concentration of sodium bisulfate, and to some extent, bacterial type. In general, greatest reductions in bacterial populations were achieved by simulated chiller application, followed by the hot dip and ambient dip applications. In the chiller application, all tested concentrations (1-5%) of sodium bisulfate substantially reduced populations of both loosely and firmly attached cells. The populations of all the three pathogens (both loosely and firmly attached cells) were reduced by at least approximately 3.0 log$_{10}$ cfu/skin sample, which represents a 99.9% reduction beyond that due to water treatment. In the hot dip and ambient dip applications, there was a general linear trend in which increasing sodium bisulfate concentrations resulted in decreasing bacterial populations. With the dip applications, greatest reductions in populations of pathogens were achieved with 4-5% sodium bisulfate. Populations of loosely attached cells were reduced to a greater extent than were populations of firmly attached cells. Populations of loosely and firmly attached cells of all the three pathogens were reduced by approximately 3.5 - 4.0 and 1.5 - 3.0 log$_{10}$ cfu/ml, respectively with hot dip application. With ambient dip application, population reductions were 2.0 - 2.5 and 1.0 - 2.0 log$_{10}$ cfu/ml, respectively for loosely and firmly attached cells. In general, L. monocytogenes was more resistant to sodium bisulfate than were Salmonella and C. jejuni. Results of these laboratory screening studies indicate that sodium bisulfate has potential as a pathogen reduction treatment for processed poultry. 

**Key Words:** Sodium Bisulfate, poultry pathogens, antimicrobial
of log breasts which were skinned had 2.2. Thighs with skin had an average Campylobacter defeathering the same trends were observed. E. the post pick levels. Likewise, neither treatment had any affect on spray second scald treatments lowered the controls for both feathered and defeathered carcasses were sampled by whole were performed for each treatment, 8 carcasses per treatment and 8 con-

populations of Campylobacter on broiler carcasses in the process-

ing plant tend to decrease when the carcasses are scalded, but rebound after defathering. A study was undertaken to examine the effect of a post-pick scald to see if microbial loads could be lowered to pre-pick lev-

Key Words: Oleic acid, Campylobacter, Broilers


This study was undertaken to determine if the presence of skin on cut up broilers is related to the incidence or level of Campylobacter on the product. Breasts, thighs and legs with and without skin were purchased at a retail outlet for comparison. Products were paired by brand, plant and sell by date. Ten replications were done using two samples of each product with skin and two without skin in each replication (n=20). Five replications of a second experiment were conducted in which breasts, thighs and legs were purchased with skin on, and skin was removed aseptically in the laboratory. In each replication, of this second experiment, two samples of each part were skinned (n=10) and counts were compared with those found on paired parts with the skin intact. In both experiments, parts were rinsed in 50 ml of PBS and Campylobacter were detected by enrichment and enumerated by plating. Presence of skin on product at a retail outlet had no effect on the incidence or level of Campylobacter on breasts or thighs. Skin-on breast yielded log$_{10}$ 1.9 cfu/100 g serving while skin-off breast had 1.8. Skin-on thigh product had log$_{10}$ 2.2 cfu/100 g serving and skin-off had 2.1. With legs the level of Campylobacter per positive sample was log$_{10}$ 2.1 cfu/100 g serving regardless of the presence of skin. However, the incidence of Campylobacter detec-
tion did vary (P<0.01) on legs, 17+/-20 for skin-on product and only 9+/-20 for skin-off. Skinning the product aseptically in the laboratory had no effect on the presence or level of Campylobacter on broiler parts. Breasts with skin had an average of log$_{10}$ 2.3 cfu/100 g serving while breasts which were skinned had 2.2. Thighs with skin had an average of log$_{10}$ 2.4 cfu/100 g serving while thighs which were skinned had 2.2. Legs with skin had an average of log$_{10}$ 2.0 cfu/100 g serving while legs which were skinned had 2.1. This data demonstrates that removal of skin from fully processed broiler parts does not significantly change the level of Campylobacter present.

Key Words: Campylobacter, Broiler parts, skin

S84 The Effect of Hot Water Treatments After De-


Populations of Campylobacter found on broiler carcasses in the processing plant tend to decrease when the carcasses are scalded, but rebound after defathering. A study was undertaken to examine the effect of a post-pick scald to see if microbial loads could be lowered to pre-pick lev-

er, R. J. Buhr*, J. A. Cason1, J. A. Dickens1, and D. E. Marshall1, 1USDA, ARS, Russell Research Center.

Two experiments were conducted to determine if pre-evisceration car-
cass trimming (removal of the head or neck) or the direction of crop extraction (pulling through the thoracic inlet or toward the head) would influence the force required for manual crop removal and the incidence of crops removed intact from male broilers (6 wk old). Pre-evisceration trimming consisted of either removing the head between the first and second cervical vertebrae (head-off), or shearing the spinal column parallel with the shoulders (neck-off) without damaging the crop. The esopha-
gus was grasped above the proventriculus for crops pulled through the head. The peak force required to pull the crop from the carcass was recorded. In the first experiment, the head-off and neck-off techniques resulted in significantly higher rates of crops extracted intact (88.3 and 96.7%, respectively) compared to 15% for the untrimmed head-on carcasses (n=60). The pull force required to remove crops intact from carcasses with the neck off was 16% lower (3.64 kg) than that required for carcasses with the head off (4.34 kg). In the sec-

Key Words: Campylobacter, Processing, Scald

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S88 Influence of feed withdrawal and stunning voltage on crop extraction force and efficiency of crop removal during manual evisceration of broilers. R. J. Buhr1, J. A. Dickens1, and D. R. Pizzino, Jr.1, 1 USDA, ARS, Russell Research Center.

A series of experiments was conducted to evaluate the influence of pre-slaughter feed withdrawal, stunning, and bleeding procedures on the incidence of crops removed intact and the peak pull force recorded during manual evisceration. Male broilers (6 wk old) were subjected to feed withdrawal for 6, 12, 18, or 24 h and stunned and bled using an in-line commercial brine stunning system set at 12 V. Subsequently (after a 12 h feed withdrawal period), in-line stunning at 12 V or 12 V + ES (electrical stimulation) was compared to static stunning at 50 or 200 V. In addition, the degree of “neck-crop stretching” during post-stunning automated head positioning prior to bleeding, or head removal prior to or during picking were also evaluated after a 12 h feed withdrawal period. The duration of feed withdrawal had no effect on the incidence of intact crop removal (55% for both 6 and 24 h) or the peak pull force required to remove the crop (3.05 to 3.36 kg; n=20). After stunning at 12, 50 or 200 V, peak pull force was not affected (3.47 to 3.50 kg at 6 wk and 4.14 to 4.64 kg 7 wk). However, the incidence of crops removed intact at 7 wk (n=16) was greater for 12 V and 12 V + ES (94 to 81%) than at 50 and 200 V (56 to 69%). In contrast, at 6 wk (n=16) there was no difference detected in the incidence of crops removed intact between stunning voltages of 12 and 50 V (75 to 81%). Following in-line stunning at 12 V, automated head positioning prior to bleeding or head removal prior to or during picking had no effect on the incidence of crops removed intact or peak pull force (n=32). Intact crops required less force to extract than crops that ruptured during extraction. These results suggest that crops rupture during evisceration due to stronger adhesion and not due to inherent crop weakness.

Key Words: Broiler, Crop removal, Evisceration, Pull force, Extraction direction


The quality of poultry meat stored at two temperatures for varying times was assessed by digital aroma technology(an electronic nose). Four types of meat (breast with skin, breast without skin, wings, and thighs) were collected aseptically from a processing line and stored at 4C for 1 to 5 d or at 13C for 1 or 2 d to represent cold storage and processing conditions. Meat samples were rinsed with sterile saline, and the rinses and their serial dilutions (in trypticase soy broth) were assayed using an electronic nose. Four types of meat were compared: breast with skin, breast without skin, wings, and thighs. The electronic nose distinguished odors of all 4 meat types stored at 13C from each respective meat type stored at 4C. The length of storage (1 or 2 d) of any type of meat could be differentiated at 13C. Analysis of rinse dilutions from meat samples demonstrated the sensitivity of the assay; differences in odors were detected after dilution of a rinse by 1 to 6 logs. Comparison of samples stored 1 or 2 at 4C with diluent showed that few volatiles were produced. The sensitivity increased for each meat type as the number of days in storage increased. Collectively, our data indicate the usefulness of the electronic nose in monitoring the quality of chicken meat maintained under varying storage times and temperatures common in poultry processing areas.

Key Words: Chicken, Bacteria, Electronic nose

S90 Salmonella enteritidis and Clostridium perfringens shedding in broilers as influenced by flavophospholipol (Flavomycin1). N. M. Bolder1, J. A. Wagenaar2, F. F. Putrulan3, K. T. Veldman1, and M. Sommer2, 1ID-Lelystad, Lelystad, The Netherlands, 2Hoechst Roussel Vet, Wiesbaden, Germany.

Due to increasing concern for the microbiological safety of food, the effect of feeding antibiotics on intestinal pathogen loads at the completion of live production must be considered. The effect of the feed additive antibiotic flavophospholipol (FPL, Flavomycin1) on the colonization and shedding of potentially pathogenic bacteria was investigated in this challenge study. This study was conducted as a requirement of the European Union Feed Additive Directive 70/524/EEC, for the re-registration of feed additives in the EU. In individual battery cages, groups of 24 Ross broiler chicks were fed FPL (9 ppm), or a control feed. The chicks were challenged with one of the following bacteria: Clostridium perfringens, Salmonella enteritidis, or Campylobacter jejuni. Fecal samples were collected weekly to six weeks of age, and cultured for the presence of the target organisms. Bacterial shedding rates were determined by decimal dilution. Feeding FPL resulted in reduced degree of shedding and incidence of Salmonella and Clostridium at six weeks (p < 0.05), but did not significantly affect the incidence or degree of Campylobacter shedding. These results indicate that the feed additive antibiotic FPL may reduce the shedding rates of certain potential human and animal pathogens in processed foods but the reductions would not be anticipated based on the spectrum of activity of FPL, as both Salmonella and Clostridium perfringens are intrinsically resistant to FPL. Therefore, a mechanism of indirect inhibition through interaction with the intestinal microflora is suggested.

Key Words: Flavomycin, Clostridium, Salmonella

S91 Stress and meat quality in broilers. J. D. Tankson1, J. P. Thaxton*,1, Y. Vizzier-Thaxton1, and J. D. May2, 1Mississippi State University, Mississippi State, MS, 2USDA/ARS South Central Poultry Research Laboratory, Mississippi State, MS.

Broiler chicks were reared from Days 1 to 14 (T=30.6°C and RH = 35%) then in environmental chambers from Days 36 to 55. Half of the chicks were maintained as non-heated controls (NH; T=24C and RH=35%) and the other half as heat-treated (H; environmental conditions approximated hot August day in central MS). Osmotic pumps which delivered either 2 IU ACTH/kg BW/d for 7d(ACTH treatment=A) or saline (NA) were implanted surgically into both NH and H birds. The A, H and A+H treatments caused losses in BW and carcass weight gain, as well as muscle protein, moisture and caloric content when compared to NA+NH controls. These changes were not reversed within 7d after termination of A, H and A+H treatments.

Key Words: Stress, Environment, Meat Quality, Broilers, ACTH

S92 Automation of the broiler shackling process: Discovery at the bird-machine interface. A.B. Webster*,1 K-M. Lee2, J. Joni3, X. Yin2, M.P. Lacy1, and R. Carey3, 1Department of Poultry Science, University of Georgia, Athens, GA, 2School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA, 3Georgia Tech Research Institute, Atlanta, GA.

A successful automated shackling process would require that birds be presented uniformly to the shackle, i.e., in single file with common orientation and standard presentation of legs. A test bed, consisting of a conveyor, a compliant grasper (two counter-rotating drums fitted with rubber fingers), and a shackle apparatus, was developed to investigate singulation and shackling. In several trials the compliant grasper was found to be an effective singulator, and, due to its ability to completely restrain a bird, could deliver a broiler into a shackle. Broilers however often turned away from the grasper and entered it backward. They also tended to sit down on the conveyor. Since it is difficult to capture the legs of a backward, sitting broiler, and attempts to get broilers to stand were not successful, it was decided to try to design a system which would take forward-oriented birds. A study tested the effects of conveyor inclination (0°, 7.5°, 15°), vision of the birds (unhooded, hooded), and angle between compliant grasper and conveyor (75°, 90°) on bird presentation to the grasper and on shackling success. Ten forward-oriented broilers were tested in each of the 12 treatments. Eighty to 100% of the hooded broilers sat down (breast in contact with the conveyor) regardless of conveyor inclination; only 5% of the birds stood. Unhooded broilers tended to take forward-oriented birds. A study tested the effects of conveyor inclination (0°, 7.5°, 15°), vision of the birds (unhooded, hooded), and angle between compliant grasper and conveyor (75°, 90°) on bird presentation to the grasper and on shackling success. Ten forward-oriented broilers were tested in each of the 12 treatments. Eighty to 100% of the hooded broilers sat down (breast in contact with the conveyor) regardless of conveyor inclination; only 5% of the birds stood. Unhooded broilers tended to take forward-oriented birds.
to sit up (breast not in contact with the conveyor). No more than 75% of these birds adopted the same posture at any conveyor inclination, and 22% of them stood overall, some of which turned away from the grasper. Some of the treatments had high rates of shacking success (up to 100%), but it is not possible to clearly interpret the effects of the different factors tested because the speed of the grasper inadvertently varied relative to that of the conveyor, confounding the experimental design. Grasper speed always was faster than conveyor speed but catching success was best in the low to mid range of relative speed differences. It can be concluded that the posture orientation of broilers and shacking success can be managed by controlling bird vision, conveyor inclination, and the relative angle and speed of the grasper.

Key Words: Automation, Shacking

S93 Effect of Termin-8® compound on the microbiological and physical quality of shell eggs from commercial egg laying chickens. K. E. Anderson*1 and K. Richardson2, 1 North Carolina State University, 2 Anitox Corporation.

The feed industry is being pushed to supply feed to the layer industry which is free of microbial contaminants. Microbial feed contaminants have the potential to be passed to the hen resulting in the hen being a carrier of the contaminant to her egg. Termination of feed with Termin-8® to eliminate the microbial contamination could benefit laying hens in two ways: (1) reduction of competition in digestive tract between indigenous and feed borne microorganisms competing to colonize the small intestine; (2) the potential decrease of microbial contamination of egg shell surfaces. The study utilized 1512 hens housed in a laying facility with tri-deck cages divided into the 72 replicates which held 21 birds each at 413 cm² per hen. This study utilized a 2 x 2 factorial arrangement of treatments with two dietary treatments of TSAA (650 mg and 750 mg/bird) and two levels of Termin-8® (0 and 6 lb./ton) Each load of feed was sampled upon delivery so that microbial contamination rates could be determined. A 0.9 egg sample was collected from each treatment combination on a tri-weekly basis through 30 weeks of age and every 4 weeks thereafter until 66 wks of age. Production parameters were collected on a period basis. Additionally, the egg measures were shell surface microbial contamination, and quality measures were egg weights, Haugh Units, USDA grades, and egg size distribution. Treatment of the feed with Termin-8® resulted in a 2 log reduction in feed contamination. This resulted in virtually no contamination in the treated feed. Inclusion of Termin-8® feed treatment had no significant effect on the egg wt, Haugh units, shell strength, or shell elasticity, or production parameters. The microbiological loads on the shell surface were reduced (P<0.001) from 33,113 CFU/egg with 0 Termin-8® to 26,915 CFU/egg with the Termin-8® treatment. The use of Termin-8® feed treatment significantly lowered the microbial load on shell surface which would be beneficial to processors while providing high quality products to consumers.

Key Words: Layers, Shell eggs, Microorganisms, Termin-8®

S94 Bacterial counts on right and left sides of pre-chill broiler carcasses. J. A. Cason* and M. E. Berarg, USDA, ARS, Russell Research Center.

Bacterial counts from paired broiler carcass halves were examined for relationships between numbers and kinds of bacteria that might indicate fecal contamination. Broiler carcasses removed from a commercial processing plant just before chilling were split aseptically and each half was rinsed in 400 ml of phosphate buffered saline for one minute with either mechanical or hand shaking. Six carcasses were rinsed on four different days for each shaking method. Aerobic bacteria, coliforms, E. coli, and Campylobacter were enumerated in rinses from left and right halves, which were summed to obtain whole carcass counts. There were no significant (P>0.05) differences in numbers of bacteria between rinse methods or between left and right sides. For APC, coliforms, E. coli, and Campylobacter, correlations between paired left and right side counts were between 0.78 and 0.86. The correlation between whole carcass counts and absolute left-right differences was significant for APC (0.43), not significant for coliforms, E. coli, and Campylobacter. Carcasses with higher-than-average E. coli counts were not more likely to have a large difference in counts between the two halves. Correlations between different bacteria on whole carcasses were significant for E. coli-APC (0.39), E. coli-coliforms (0.67), and APC-coliforms (0.71), but other combinations had non-significant correlations. The correlation was 0.18 between E. coli and Campylobacter, a relatively fragile organism whose presence can be interpreted to indicate fairly recent fecal contamination. There were no indications that high E. coli counts on inspection-passed, pre-chill carcasses indicate recent fecal contamination.

Key Words: E. coli, Campylobacter, Aerobic plate count, Carcass rinses, Broiler

S95 Assessment of One Poultry Company’s Efforts in Complying with FSIS Salmonella Performance Standards. R. H. Bailey* and T. P. Doler, Mississippi State University, Mississippi State, MS.

With the issuance the Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems rule, on July 25, 1996, the Food Safety Inspection Service (FSIS) greatly changed the inspection paradigm for U.S. red meat and poultry. Focus shifted towards the prevention and reduction of microbial pathogens on raw meat products and placed the burden of responsibility for producing safe food on industry. FSIS became responsible for setting food safety standards, maintaining inspection oversight, and enforcement of regulations dealing with plants that failed to meet new regulatory standards. Yet industry was not provided specific technical guidance to meet the new regulations. Given the novelty of the inspection system, companies had no previous experience or documentation available to follow when there was a failure to meet FSIS standards. This paper will discuss the efforts and decisions of one poultry company to meet the new FSIS mandates, both initially, and after failure of two Salmonella performance standard testing sets. The company brought in both academic and governmental food safety scientists and a pre- and post- harvest analysis of the potential areas of pathogen entry was conducted. Some of the in-plant actions taken were review and alterations of HACCP plans, modifications of processing equipment, changes in production scheduling, increased microbial monitoring, and addition of anti-microbial carcass rinses. Among field measures undertaken were increased microbial monitoring, alteration of production schedules, increased time between flocks, involvement of the growers, and different treatment programs for birds and litter. While results of the effectiveness of specific intervention methods varied, and were difficult to ascertain in specific cases, the company was able to return to compliance with FSIS standards. Through the sharing of this information, it is desired that other organizations will be able to use the results of our experiences to circumvent similar problems.

Key Words: Food safety, Salmonella standards, Compliance

S96 The Effects of the Major Histocompatibility Complex from Two Divergent Chicken Lines on Reducing the Incidence of Avian Cellulitis. K. S. Mackin*, R. A. Norton, and S. J. Ewald, Auburn University, Auburn AL.

Previous work has indicated that there is a Major Histocompatibility Complex (MHC) effect on minimizing the severity of avian cellulitis lesions in a commercial broiler line. The objective of this study was to determine if the MHC effects observed in a broiler chicken line could also be observed in a leghorn chicken line. The two MHC haplotypes (B types) selected for study in these experiments are similar to two haplotypes found in broilers. The broiler MHC haplotypes appear to be either resistant (B13) or susceptible (B21) to a avian cellulitis. To determine if this difference could be observed in leghorn chickens, four experiments were performed (approximately 50 birds per experiment). For each experiment MHC typing was performed (week 3) serologically using alloantisera specific to B13 and B21. Avian cellulitis was induced by subcutaneous injection (week 4) with an avian cellulitis origin Escherichia coli. One week post challenge the birds were necropsied and the lesions scored. The results observed with the leghorn line appear to be closely correlated to those results observed with the broiler line.

Key Words: MHC, avian cellulitis, Escherichia coli


Key statistical principles in the design and conduct of any study are blocking, randomization, and replication. In an on-farm research study, careful planning of these and adhering to the plan can be more difficult than on an experimental farm or in a laboratory. However, failing to
carefully plan and execute regarding blocking, randomization, and replication can lead to less than desirable data. Two examples of pitfalls in on-farm studies are given.

In example one, lack of randomization led to lack of interpretability in the results. Treatments were sequentially applied making it impossible to separate time effects and treatment effects. For example, some differences between consecutive observations on different treatments were as large as differences between consecutive observations on the same treatment. Randomization of treatments is crucial in averaging out the time effect sampled in this first example.

In example two, analysis of a study was complicated by not planning for control of a variable (via blocking) that has impact on the response of interest. The effect of a treatment versus no treatment on livability of broiler breeders was of interest. At multiple farms, the treatment was assigned to one of two paired houses, while no treatment was given to the other or other of the two paired houses. But, on some farms the two paired houses had flocks with different grandparents, confounding the treatment effect with a grandparent flock effect. Careful planning would allow studying the treatment effect without the impact of a grandparent flock effect.

**Key Words**: Statistics, Field Trials, Trial Design, Statistical Analysis, Confounding Variables

**S98 Effects of nitarsone as an aid in the prevention of blackhead in turkeys challenged with H. meleagridis carried by nematodes.** James L. McNaughton* and James T. Skinner. PARC Institute, Inc., Alpharma Inc.

This study evaluated whether nitarsone (Histostat) fed continuously at a level of 0.01875% aids in the prevention of blackhead in turkeys challenged with nematodes carrying Histomonas meleagridis. Normal, healthy, newly-hatched female turkey pouls were obtained from a commercial source and randomly placed into floor pens containing used litter. Treatments included: controls (non-medicated and non-infected), infected controls (non-medicated and non-infected), and nitarsone (0.01875%) treated birds (infected). Experimental feeds were offered at time of placement. Beginning on day 5 and continuing through day 19 of the trial, pens of birds assigned to the infected control and nitarsone treatments were challenged with eggs of Heterakis sp. carrying H. meleagridis. There were 8 replicates of 50 female turkeys (50 female turkeys) of each treatment, providing 400 hens per treatment. Birds and feed were weighed on days 35 and 70 (end of trial). No birds medicated with nitarsone died as a result of histomoniasis. Control and nitarsone-treated birds had significantly (P<0.05) lower mortalities (total and from histomoniasis) than the infected control birds. At 35 days, average weights were significantly (P<0.05) greater for the birds fed nitarsone compared to both control treatments. There were no significant differences in average weight of surviving birds at 70 days. Feed conversion ratios were significantly (P<0.05) lower for the control and nitarsone-treated birds from 0 to 35 and 0 to 70 days compared to the infected controls. Feed consumption was also lower for the control and nitarsone-treated birds. Under the conditions of this trial, nitarsone prevented blackhead in turkeys challenged with cecal worms carrying Histomonas. *

**Key Words**: Nitarsone, Blackhead, Turkeys, Histomonas, Nematodes

**S99 Blackhead disease (Histomonas meleagridis) aggravated in broiler chickens by concurrent infection with coccidiosis (Eimeria tenella).** L. R. McDougald* and J. Hu, University of Georgia, Athens, GA USA.

Concurrent infections with Eimeria tenella were investigated for influence on the pathogenicity and frequency of Histomonas meleagridis in broiler chickens. We inoculated 10 and 14 day old birds with E. tenella at 1000 or 10,000 oocysts/bird. At 14 days old, we challenged with cultured H. meleagridis at 100,000 cells/bird (per cloaca). The study was terminated on day 24, and Histomonas lesions of liver and ceca were scored. Body weights were recorded on days 10, 14, and 24. The body weight gains were significantly affected by H. meleagridis, but not by E. tenella. Cecal lesion scores among H. meleagridis infected groups were similar whether or not E. tenella oocysts were inoculated. The number and severity of liver lesions (from Histomonas) were higher in birds inoculated with both E. tenella and H. meleagridis than in birds receiving only H. meleagridis, regardless of whether E. tenella were given before or at the same time as H. meleagridis. These results suggest that concurrent coccidial infections could account for the substantial increase in blackhead disease in broiler breeder pullets under field conditions, probably by providing entry for H. meleagridis through disrupted cecal mucosa.

**Key Words**: Coccidiosis, Blackhead disease, Histomonas meleagridis

**S100 Laboratory and Field Observations on the Effectiveness of Selected Ionophores With Reference to Continuous Usage Practices.** K.W. Bafundo and B.A. Hopkins*, Pfizer Animal Health, Exton, PA 19341.

Previous work has demonstrated that under conditions of continuous extended usage, the efficacy of ionophoric anticoccidials tends to erode. In recent years, the US industry has relied heavily on salinomycin for coccidiosis control, with many companies using this product as the sole anticoccidial for extended periods. To better understand the effect of these practices on field coccidia and their effect on broiler production, a series of field observations were collected from several major broiler production areas in the US over a three-year period. The primary parameters recorded were the infective coccidial species, severity of infection and percentage of birds affected. The response patterns recorded in these observations support the notion that with extended usage increased levels of coccidial exposure develop. These results were then compared to results of replicated laboratory sensitivity tests, where various ionophores were evaluated for their ability to control lesions produced by field coccidia. The results of these tests confirmed that the ability of salinomycin to control lesions of some isolates of Eimeria acervulina and E. tenella has eroded by 30% and 18%, respectively. Other ionophores, in particular semduramicin, which have not been exposed to extended field usage, did not demonstrate this pattern. The results of these comparisons clearly support the idea that anticoccidial rotation is well-founded and can provide meaningful improvements in coccidiosis control and bird performance.

**Key Words**: Anticoccidials, Ionophores, Broiler, Resistance, Coccidiosis

**S101 Tylan Soluble (tylosin tartrate) experience in broiler breeders.** P. A. Stayer*, J. B. Emmons¹, and A. G. Zimmermann¹, Elanco Animal Health, Indianapolis, IN.

The purpose of the experiment was to monitor the effect of Tylan Soluble (tylosin tartrate) on immature broiler breeder livability by controlling chronic respiratory disease caused by Mycoplasma gallisepticum (MG). Four replicates on different farms had paired medicated houses and nonmedicated houses on each farm. In medicated houses, two grams tylosin tartrate per gallon final drinking water was administered at three intervals during periods of stress to both male and female broiler breeder chicks. Medication periods were at day of placement for three days, the day of beak trimming at 7 days, and another two days immediately following water vaccination at 21 days. No consistent differences in livability were noted between unmedicated male and female treatments. Livability was improved for treated female broiler breeder chicks compared to untreated females from the same grandparent flocks.

**Key Words**: Tylosin Tartrate, Broiler Breeder, Pullet, Livability, Paired trial

**S102 Effect of feed restriction during high ambient temperatures on anticoccidial efficacy of Salinomycin and Semduramicin.** Greg Mathis*, Southern Poultry Research, Inc., Athens, GA, USA.

In some areas where high ambient temperatures are common, particularly the Maracaibo district of Venezuela, poultry growers will feed birds only in the cool hours (late afternoon, night, and early morning). The birds do not have access to anticoccidials during this 6 to 8 hour feed restricted period. Researchers have shown that ionophoric anticoccidials such as salinomycin and semduramicin are active against the free stages of coccidial development, including sporozoites and merozoites. These stages are periodically released in the birds during the feed restricted period. The objective of this study was to determine if the efficacy of these anticoccidials is diminished due to this feed restriction. An anticoccidial sensitivity battery study was conducted. The treatments were full fed and restricted (16 hours on and 8 hours off), nonmedicated noninfected and infected, salinomycin 66 ppm and semduramicin 25 ppm. Each treatment was replicated four times. The birds were placed at 12 days of age, infected on Day 2, and weighed and lesion scored on Day 8 (6 days post inoculation). Feed consumption was measured. The birds were inoculated with a mixture of E. acervulina, E. maxima, and E. tenella. The

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infection caused a moderate infection in both full and restricted nonmedicated birds with an average percent weight reduction of 31.2 and average lesion score of 2.68. This level of coccidiosis was adequate to show potential differences among treatments and did not overwhelm the birds. Salinomycin and semduramicin significantly (P<0.05) controlled the coccidiosis with percent weight reduction of 17.9 and 14.3 and average total lesion score of 1.52 and 1.45, respectively. No significant difference in efficacy was observed between like treatments which were full or restricted fed. The equal efficacy for salinomycin and semduramicin between full and restricted fed birds show that limiting feed access during hot times of the day will not effect anticoccidial efficacy of these two ionophorous anticoccidials.

Key Words: Anticoccidial, Chicken, Coccidia

S103 Effects of Marek’s vaccination in ovo on response of broiler chicks to coccidiosis vaccination, J. Hu* and L. R. McDougald, University of Georgia, Athens, GA USA.

Broiler chicks were vaccinated in ovo against Marek’s disease to study the subsequent performance of coccidiosis vaccination at one day of age. Compared to unvaccinated controls, Marek’s vaccination had no effect on 3-week weight gains. Administration of live coccidial oocysts of E. tenella and E. maxima as a vaccine on day one resulted in significant immunity to a challenge inoculum given on day 14, as shown by reduced lesion scores in the midgut and ceca, protection of weight gain, reduction of deaths from coccidiosis, and reduction in subsequent oocyst shedding. Birds receiving both Marek’s and coccidiosis vaccinations had significantly lower midgut and cecal lesion scores than those receiving only coccidiosis vaccination. Weight gain and mortality were also improved, although not significantly. These results showed an unexpected improvement in response to coccidiosis vaccine in birds receiving in ovo vaccination against Marek’s disease.

Key Words: Coccidiosis vaccination, Marek’s vaccination in ovo, interaction


Intestinal sections of the duodenum, jejunum, and ceca were collected from clinically normal broilers during routine necropsy sessions at commercial broiler integrators in the United States over a 3-year period. Hematoxylin and Eosin stained sections of the formalized tissue were evaluated using light microscopy. The objective was to survey a clinically normal population of broilers to determine the degree of sub-clinical anomalies within the intestines that could potentially be adversely effecting broiler performance factors as weight gain, feed and calorie conversion. The anomalies routinely identified were lymphocytic enteritis, villus atrophy and/or fusion, bacterial overgrowth in the jejunum and/or ceca, and infestation with Eimeria acervulina, Eimeria maxima, Eimeria tenella and tape and/or roundworms. Photomicrographs and a discussion of the findings will be presented.

Key Words: Histology, Broiler, Intestines, Eimeria, Enteritis

S105 Mortality reduction by a caprine factor in specified-pathogen-free layers after infection with Pasteurella multocida. M. S. Jones*, E. D. Peebles1, K. O. Willeford1, T. A. Parker1, and C. Wang1, 1Mississippi State University, Mississippi State, MS 39762 USA.

Three trials were conducted at completely randomized designs to study the effects of a caprine factor (CF; a proteinaceous material 8 kDa in molecular weight) in reducing mortality in specified pathogen free (SPF) layers challenged with Pasteurella multocida. One group of chickens was not inoculated and served as a negative control in Trials 1 and 2. All other birds were challenged i.m. with either 28 (Trial 1), 30 (Trial 2), or 18 cfu (Trial 3) of P. multocida strain X-73 (serotype 1) at 5 wk of age. Total average mortality of inoculated birds, which received no CF, was approximately 91.6% for all trials. In each trial, a group of birds was injected i.m. with 0.5 mL of CF solution. In Trial 1, CF solution concentration was 10 mg/mL and was given on the day before (D-1) and the day of challenge (D-0). In Trial 2, CF solution concentration was 20 mg/mL and was given on D-1, D-0, and Day 1 (D+1). In Trial 3, CF solution concentration was 20 mg/mL and was given on D-1 and D-0. Birds receiving CF in any of the three regimens showed a significant reduction in mortality for the entire 1 wk period examined. However, mortality was most notably reduced on D+1 in all three trials (P<0.0001). When viewed across trials, 20 mg/mL CF regimens appeared to prevent mortality more effectively than the 10 mg/mL regimen. These data suggest that the CF reduced mortality in SPF chickens when challenged with P. multocida.

Key Words: Caprine Factors, Infection, Layers, Mortality, Pasteurella multocida

S106 Multiple game farm bobwhite quail diseases associated with postbrooding and flight pen management. A case report, Douglas H. Erbeck1, 1Murray State University Breatheath Veterinary Center.

Parasitic (capillariosis, Heterakis and coccidiosis), bacterial (chlamydiosis, pasteurellosis, colibacillosis, staphylococciosis and Pseudomononas infection) and viral (quail poxivirus) diseases were diagnosed in bobwhite quail submitted from a game farm owner. The presentation will briefly discuss the history of the flock and diagnoses of multiple diseases. Treatment efforts and effects of treatment by the owner will be presented. A discussion on continuing disease problems (salmonellosis and uclerative enteritis) due to management constraints will attempt to shed light on successful management of game farm bobwhite quail.

Key Words: bobwhite quail, capillariosis, quail pox

S107 Molecular serotyping of Salmonella by PCR, Yang Hong*, Charlene R Hudson, and John J Maurer, University of Georgia, Athens, GA.

A two-step molecular serotyping scheme was evaluated for its ability to differentiate Salmonella strains from various sources. The first step involves identifying the Salmonella’s O-serogroup with multiplex PCR. The O-antigen biosynthesis genes themselves in the fli operon and their juxtaposition to one another were analyzed to identify multiplex PCR primers for the following serogroups of Salmonella: A/1D, B, C1, C2, and E1. Combination of these primers were examined and the discrimination was achieved based upon the unique sizes of the PCR products. The second part of the scheme examines restriction fragment length polymorphisms present in the H1 and H2 antigen genes, fliC and fliB. This PCR technique uses a single set of primers for either fliC or fliB. Sau 3A was used to produce different restriction profiles based on the variability in gene sequences. Fifty-one serovars represented by 136 strains of Salmonella were included in this project. Among them, 37 were diphasic serovars and 14 were monophasic. RFLP with Sau 3A yielded 19 different restriction profiles for fliC and 8 for fliB gene, from which 33 combined restriction profiles were derived. With the knowledge of the O antigen, eighty-four percent of the diphasic serovars and seventy-one percent of the monophasic serovars were identified using this method. These observations demonstrate the potential of rapid molecular typing for Salmonella strains using the combined RFLP and multiplex PCR techniques.

Key Words: PCR, RFLP, serotype, serogroup, restriction

S108 Molecular typing of Salmonella enteriditis, Charlene R Hudson* and John J Maurer, University of Georgia, Athens, GA.

Salmonella enteriditis is the most common cause of Salmonellosis in humans and is presently the predominant Salmonella serogroup in the United States. Attempts to distinguish isolates of S. enteriditis have been hampered by the close genetic relatedness and clonal nature of the serogroup. In order to identify a method to distinguish S. enteriditis isolates, forty-six isolates from various sources were analyzed using three different molecular typing methods: random-amplification of polymorphic DNA (RAPD), restriction-fragment length polymorphisms (RFLP) and pulsed-field gel electrophoresis (PFGE). Nine primers (1247, 1281, 1301, 1211, 1283, 1286, 1287, and Qm2) were used in RAPD analysis of S. enteriditis. All of the patterns produced with a given primer were indistinguishable from each other suggesting that none of the primers were useful for differentiating these isolates. RFLP analysis of spaMN or msi PCR products was also not successful in distinguishing the isolates. Although various restriction enzymes were used in order to generate different size fragments, the overall patterns were identical. Slightly more success in typing the isolates was attained using PFGE.
The isolates were digested in separate reactions using six restriction en-
zymes (ApaI, BlnI, NolI, SspI, XbaI, and XhoI). Restriction fragment
patterns for the isolates produced by five of the six restriction enzymes
were identical. One enzyme, XbaI, proved to be of limited use in discrim-
inating the isolates. Of the forty-six isolates tested, five to six different
patterns were observed using XbaI. The patterns varied by only one to
two fragments which indicated that the isolates were very closely related
with only one genetic difference distinguishing them.

Key Words: RAPD, RFLP, PFGE, S. enteriditis

S109 Aspergillus Abetted by Management and Design Error Indicated by Egg Air Cell Growth Following Ovo-
Injection. R. Keirs* and C. Wang, College of Veterinary Medicine,
Mississippi State University.

Increase Aspergillus sp. spore production and potential chick infection
depicted by fungus growth in air cell of hatching eggs at hatch following
ovo-injection and transfer. Sealed sabouraud dextrose agar plates with
antibiotics to prevent bacterial growth had six holes aseptically punched
into their lids in a radial pattern 1 1/4" from center to emulate the ovo-
injection holes of 0.065 inches.

These plates were placed in the hatchers simultaneously with hatching
eggs and remained until the respective chicks were pulled. Subsequently
matched hatcheries were evaluated in the respective hatcheries for the same
parameters.

Two modern hatcheries were involved with each having its own peculiar
set of conditions. One because of electrical connector problems failed to
disable hatcher fan assemblies properly for cleaning resulting in con-
siderable organic material build up. Airconditioning and heating units
recycled the air resulting in organic matter build up below intake filters.
The other hatchery had several exhaust ducts, lined with unprotected in-
sulation which repeatedly became wet then dry causing great quantities
of organic matter (chick down) to collect. These same exhaust systems
discharged near fresh air intakes creating filter clogging with organic mat-
ter. Chick down was removed nearly dry from hatchers creating excessive
aerosol contamination.

Adjusting the hatchers cleaning procedures, wetting the down prior to
removal from the hatchers, removing the exposed insulation from all ex-
haust systems, installing clean out patches and controlling chick down in
general reduced egg and plate contamination by Aspergillus markedly.
The six (6) hole punched sabouraud plates makes an excellent monitoring
device for measuring Aspergillus sp contamination over extended time
in setters and hatchers.

Key Words: Aspergillus, Hatchery, Monitoring

S110 Studies on the Cold Attenuation and Protective
Effects of a Thermostable Newcastle Disease Virus Iso-
lated from Korean Pheasants. K. H. Kwak1, M. H. Jun2, K. S.
Ryu3,4, and H. J. Song5, 1College of Veterinary Medicine, Chonbuk Na-
tional University, 2College of Veterinary Medicine, Chungnam National
University, 3Department of Animal Science, Chonbuk National University
561-756 Republic of Korea.

Newcastle disease virus, CBP-1 strain isolated from Korean pheasant
was passaged for 173 times by 9 day old SPF embryonated eggs at 37°C (par-
tent strain) and subsequently passaged for 15 (CA-15) and 30 (CA-30)
times by 10 day old commercial broiler chicks embryonated eggs at 29°C,
respectively. The physical and chemical properties, pathogenicity, safety,
booster or protective effect and characterization of temperature sensitiv-
ity were measured in cold attenuated CA-15 or 30 strain and compared
to those of parent CBP-1 strain. CA-30 strain acquired cold attenua-
tion and decreased infectivity at 41°C compared to those of parent strain
grown at 37°C. It lost hemagglutinin activity (HA) at 56°C for 30, 60 and
120 Min. CA-30 treated with ether also lost its HA and cell infectivity.

The isolate was digested in separate reactions using six restriction en-
zymes (ApaI, BlnI, NolI, SspI, XbaI, and XhoI). Restriction fragment
patterns for the isolates produced by five of the six restriction enzymes
were identical. One enzyme, XbaI, proved to be of limited use in discrim-
inating the isolates. Of the forty-six isolates tested, five to six different
patterns were observed using XbaI. The patterns varied by only one to
two fragments which indicated that the isolates were very closely related
with only one genetic difference distinguishing them.

Key Words: NDV, CBP-1, Thermostability, Cold attenuation, Patho-
genecity

S111 The Influence of Supplemental Vitamin E and Sinc-Amino Acid Complex on Avian Cellulitis. K. M. Down-
s*, R. A. Norton, K. S. Macklin, and J. B. Hess, Poultry Science De-
partment, Auburn University, AL 36849-5416.

A 35-d broiler growout (800 straight-run birds; 32 floor pens; 25
birds/pen) was conducted to determine the effect of dietary supplementa-
tion of vitamin E and amino acid complexed Zn on the level and severity
of avian cellulitis. Dietary trts included: control (C), control + vita-
min E (48 IU/kg diet) (E), control + complexed Zn (40 ppm added)
(Zn), and control + vitamin E + complexed Zn (EZN). Each trt in-
cluded a two-phase feeding program (starter d 0 to 21; 22% CP, 3202
kcal ME/kg), grower (d 22 to 35; 20% CP, 3223 kcal ME/kg). A mixed
population of avian cellulitis strain C. coli had accumulated from litter
inoculation in previous studies. To elicit a cellulitis incidence, dermal
scratches were made on the breast of all birds on d 29. On d 36, blood
samples for serum titers level determination were collected (2 birds/pen).
All birds were euthanized and necropsied to evaluate cellulitis incidence
on d 37. Lesions were scored using a 0 (no lesion) to 4 (highly severe le-
sion) scale. Data were analyzed as a completely randomized design with 8
replicates per trt. Dietary trts did not influence average body wt, overall
mortality, or overall feed conversion. Infectious bronchitis and infectious
bursal disease titer levels were similar between trts (P>0.10). However,
Newcastle titer levels were greater for EZN supplemented birds (P<0.10;
C=361, E=255, Zn=132, EZN=721). In this experiment, cellulitis was
induced in 21.9% of birds. In three previous studies, cellulitis induction
levels using the same experimental model ranged from 40 to 43%. The
lower cellulitis incidence produced in the current trial may explain the
lack of some trt differences. Although not statistically significant, the
percentage of birds without lesions was highest for EZN (81.2%). Mild
lesions were reduced versus C (P<0.10) when Zn and EZN were supplied
(C=6.8%, E=3.2%, Zn=2.8%, EZN=2.1%). Vitamin E and Zn were effec-
tive in reducing low severity cellulitis lesions and producing a shift from
mild to no lesions. Moderate, severe, and highly severe cellulitis lesion
incidences did not differ between trts (P>0.10). A lower overall cellulitis
induction level may explain the lack of trt effects for more severe lesions.
However, supplemental vitamin E and Zn may reduce cellulitis level and
severity through immunity enhancement.

Key Words: Cellulitis, Broilers, Vitamin E, Zinc, Complexed Minerals

S112 Antibiotic resistant salmonella in rendered an-
imal by-products. Cesar Morales*, Charles Hofacre, and John Mau-
ner, 1University of Georgia.

The 1998 National Antimicrobial Resistance Monitoring System of hu-
man enteric bacteria found that of 147 salmonella isolates, 27% were
resistant to one or more antimicrobial agents. At the Poultry Diagnostic
and Research Center in Athens, Georgia, we have isolated bacteria with
resistances to drugs that are not currently being used in poultry, ie. flor-
fenicol. One of the possible sources for the introduction of these antibiotic
resistant organisms to poultry is by way of salmonella in rendered prod-
ucts used as a feed ingredient. One hundred sixty-five rendered animal
products (meat and bone meal, poultry meal, feather meal, blend prod-
uct) were cultured. One gram of sample was inoculated into tetrathionate
enrichment (41°C, 24 hours) with subsequent inoculation onto XLT-4 and
Brilliant Green (BG) agar. Direct plate count of coliforms for each ingredi-
ent was also obtained by inoculating 1 gram of ingredient into EC broth
and then direct plating onto MacConkey agar. The suspected salmonella
isolates from the XLT-4 and BG were confirmed using poly-o-agglutina-
tion and the serogroup by plate agglutination. Susceptibility to 12 antimicrobial
agents was assessed by the Kirby-Bauer disc diffusion method.
The highest coliform counts were obtained from poultry meal samples (range 10^5-10^6 CFU/g), then meat and bone (10^2-10^5 CFU/g),
blended meal (10^1-10^3 CFU/g), and feather meal (<10^3 CFU/g). The
level of salmonella isolation from each ingredient was 19% for meat and
bone meal, 3% for poultry meal, 3% blended meal, and 0% feather meal.
All of the salmonella isolates (11/11) were resistant to sulfasaxazole, erythromycin, penicillin, and nalidixic acid. Sixty-four percent (7/11) were resistant to tetracycline, one was resistant to ampicillin and cefiduron; while all were sensitive to gentamicin, chloramphenicol, enrofloxacin, and sarafloxacin. In conclusion, antibiotic resistant zoonotic bacteria, such as salmonella, are a major concern in human medicine. This work has shown that feed ingredients can not only be a source of salmonella for poultry flocks but also a source of antibiotic resistant salmonella.

**Key Words:** Salmonella, Antibiotic, Resistant, Rendered, By-products

### S113 Standardization of Quantitative Dot Enzyme Immunoassay to Assess Post Vaccinal Immune Response in Pullets Vaccinated with Inactivated Newcastle Disease Vaccines. J. Kirubaharan* and A. Albert, Madras Veterinary College, Chennai - 600 007, India.

A quantitative enzyme dot immunoassay (QDIA) was developed and standardized on Nitrocellulose (NC) membrane to assess the post vaccinal immune response in pullets vaccinated with inactivated Newcastle disease virus (NDV) vaccines. Four groups of twenty birds each were vaccinated with four different types of inactivated vaccines prepared and standardized as per the standards of FAO (1991) using F, LaSota, Komorov and a local isolate of NDV respectively. A group of twenty birds were also kept as unvaccinated controls. The serum samples from vaccinated and control birds were collected on 7, 14, 21, 28 and 35 days post vaccination. Vaccinated and control birds were challenged with virulent NDV on 21 days post vaccination. The post vaccinal humoral immune response was assessed by HI, ELISA and SNT and cell mediated immune response was assessed by Leukocyte migration inhibition assay (LMIT) and delayed hypersensitivity. Besides these, an enzyme immunoassay on NC membrane was also developed. On a NC membrane (3”x9”) 0.5cm squares were drawn with pencil. On each square 1 µl of 1:200 NDV was dotted. The dilution of antigen for dotting was arrived by checkerboard titration after purification of antigen. Over these dots serially diluted serum samples collected from vaccinated and control birds were dotted and the membrane was incubated at moist chamber for 45min. After washing in wash buffer, the unbound sites were blocked with skim milk powder for 30 minutes and then washed again. The NC membrane was then soaked in anti chicken IgG-HRP conjugate for 30 minutes. Followed by washing in wash buffer, the NC membrane was soaked in diaminobenzidine (DAB) substrate for 15 minutes. Washing the membrane in distilled water stopped the reaction. The post vaccinal titre is calculated by appearance of brown color dot in the highest serum dilution. This test eliminated the need for an ELISA reader and simplified the ELISA procedure with possible on-field applications. Since same type of serial dilution was followed in HI and QDIA, it made a direct correlation of LMIT (+0.98).

**Key Words:** Newcastle disease, Immune response, ELISA

### S114 Safety and immunogenicity of HVT vaccine against Marek's disease applied in hatchery by nebulization. H. Mazija*, S. Cajavec, D. Nemarnik, E. Erukaradovic, and W. Ragland, 1 Veterinary Faculty, University of Zagreb, Croatia, 2PLIVA d.d., Zagreb, Croatia.

Marek’s disease (MD) is controlled by vaccines containing specific lentogenic strains or related herpesvirus of turkey (HTV). All vaccines nowadays are applied parenterally. The in ovo inoculation techniques offers another possibility. The purpose of the study was to evaluate safety and immunogenicity of HTV vaccine applied by ultrasound nebulization to newly hatched chickens. Aerosol device SONOVAC 95 creates aerosol of HTV water-suspension, 95% of particles range 2 to 5 in m in diameter. One hundred chickens at once are exposed to aerosol for 30 seconds. Vaccine Used had a titer of 2000 pfu per dose and was diluted in a distilled water. Safety Groups of hens, A (25) and B (49) were exposed to aerosol of HTV 1 or 15 minutes, and K (23) was given distilled water. Immunogenicity One day old layers were used. The vaccine was given to 4,400 chickens by nebulization and to 3,800 birds subcutaneously. Vaccinated chickens remained in the hatchery for 24 hours and, during 20 weeks, were placed in two separate parts in the same poultry house. Viremia Test was performed at day 10. Immuno-diffusion test was performed at day 28. There was no clinical reaction to the given HVT in chickens exposed to aerosol for 1 or 15 minutes. Vaccinated layers didn’t show any negative vaccinal reaction. Viremia was proved positive at day 10, and precipitins where present in 100% of blood sera. In layers vaccinated by nebulization mortality rate during 20 weeks was 3.70%, and in comparative parenterally vaccinated group 6.06 % respectively. The mortality rate in first three weeks that can indicate the reaction to the given vaccine, was 2.70% in chickens vaccinated by aerosol, and 3.45% in subcutaneously vaccinated group respectively.

The used THV vaccine was safe and immunogenic in both experiments. The small particle of aerosol did not cause any negative vaccinal reaction. Compared to parenteral vaccination, mortality rate was much lower, probably because there was no stress reaction caused by injection.

**Key Words:** Marek’s disease, Herpesvirus of turkey, Nebulization, Safety test, Immunogenicity

### S115 Preparation of a heterogeneous conjugate to detect *Mycoplasma iowae* by immunofluorescence. V.A. Leiting* and S.H. Kleven1, 1University of Georgia, Athens, GA.

Fluorescent antibody technique has been used as a diagnostic tool for the identification of pathogenic avian Mycoplasma species. Conjugate for *M. iowae* (MI) prepared from rabbit hyperimmune serum against one serotype (I) has not always been reliable, giving false negative results. A conjugate was prepared employing antibody against the six identified serotypes (J, K, N, Q and R) that comprise the species *M. iowae*. This heterogeneous conjugate was used to positively identify MI in field isolates and lab strains, while maintaining specificity. Polymerase chain reaction (PCR) specific for *M. iowae* was used to determine agreement.

**Key Words:** Mycoplasma iowae, Conjugate, Immunofluorescence


*Mycoplasma gallisepticum* (MG) is an important pathogen of poultry, accounting for substantial economical losses due to decreased egg production and hatchability, downgrading and condemnations of carcasses, and decreased feed efficiency. Live MG vaccine strains (F, TS-11 and 6/85) have been extensively used to reduce or eliminate the impact of this infection in commercial poultry. However, the lack of a methodology to differentiate vaccinal and field strains directly from field samples has hindered an efficient evaluation of the success of vaccination programs. The purposes of this work were (1) to develop a specific and sensitive PCR-RFLP methodology to identify MG strains directly from tracheal swabs and (2) to apply this procedure for the analysis of commercial flocks. Regions from genes coding for an adesine and a surface lipoprotein were amplified and sequenced for three vaccinal strains (F, TS-11 and 6/85). Sequence analysis demonstrated the presence of polymorphisms, that could be recognized by restriction enzymes (RFLP). Based on these data, PCR assays for the two genes were developed and tested with vaccinal and field strains. PCR products were digested with restriction enzymes, separated by electrophoresis on polyacrylamide gels and visualized after rapid silver staining. Both PCR assays allowed the differentiation of vaccine and field strain isolates as well as the direct detection of strains from tracheal swabs. In the RFLP analysis of the adesine gene, F strain could be differentiated of TS-11 and 6/85 using Aul I, Rsa I and Ssp I restriction enzymes, while the RFLP analysis of the lipoprotein allowed the differentiation of all strains using Taq I, Ssp I and Acc II. The majority of the field strains showed restriction patterns different from that obtained for vaccine strains. These PCR-RFLP methodology have been applied for the evaluation of vaccine programs in commercial flocks. More than 1000 tracheal swabs samples were analyzed from vaccinated breeder flocks with live strains. The method showed to be efficient and fast for the detection and identification of the MG strain, and allowed to evaluate the efficiency of vaccination program on these flocks.

**Key Words:** Mycoplasma gallisepticum, vaccine strain identification, PCR-RFLP
Identification and Molecular Characterization of very virulent Infectious Bursal Disease Virus (vvIBDV) in Brazil. A.S.K. FONSECA1, V.R. LUNGE1,2, E.K. MARQUES2, M. GARCIA3, and N. IKUTA1,2, 1Simbios Biotecnologia, 2Universidade Luterana do Brasil, 3Poultry Disease Research Center, University of Georgia.

Infectious bursal disease virus (IBDV) is the causative agent of a highly contagious immune-suppressive disease of young chickens. In the last years, very virulent IBDVs (vvIBDV) were reported to cause high mortality rates in many European and Asian countries. Reverse transcriptase-polymerase chain reaction (RT-PCR) assays coupled to restriction enzymes (RE) digestion were already described for the identification of vvIBDVs (Avian Dis. 37: 315-323; Avian Dis. 42: 470-479). Since 1997, clinical diseases of IBD with mortality rates between 10 and 70% have been described in commercial layers and broilers in Brazil. The purpose of this work was to identify and characterize IBDVs from these flocks by RT-PCR-RFLP assay that allows the analysis of the VP2 gene variable region. Five to ten bursas were collected from forty-five commercial flocks (layers and broilers) located in six different states of Brazil. Briefly, total RNA was extracted and amplified by RT-PCR. Products of amplification were digested with restriction enzymes St I, Mva I, Taq I and Ssp I, separated by electrophoresis on a 12.5% polyacrylamide gel and visualized after rapid silver staining. Among the 45 flocks, restriction patterns compatible with vvIBDVs, for the 4 enzymes, were found in 15 of the flocks (broilers and layers). Thirteen out of the 15 flocks were from Sao Paulo State, and 2 were from Minas Gerais State. Four of the VP2 amplified products were submitted for sequencing. Comparison with sequences available in gene databases showed that three of the sequences share 100% identity in the VP2, while one of the sequences has 98% identity with European and Asian vvIBDV sequences. Phylogenetic analysis demonstrated that all Brazilian vvIBDVs are closely related with vvIBDV VP2 sequences previously described for European and Asian isolates grouping in a cluster distinct of classical and variant IBDV strains.

Key Words: very virulent Infectious Bursal Disease Virus, RT-PCR, IBDV typing.

Comparison of nitric oxide synthase activity in macrophages from different genotypes upon stimulation with various bacterial lipopolysaccharides. N. Dil1 and M. A. Qureshi1, North Carolina State University, Raleigh, NC.

Our previous studies have shown that macrophages from Cornell K-strain (B11-B15) and a broiler derived macrophage cell line (MQ-NCSU) were hyper responsive to E. coli lipopolysaccharide (LPS) whereas macrophages from GB1 (B11-B13) and GB2 (B15-B16) were hyporesponsive to inducible nitric oxide synthase (iNOS) activity. In the current study, these genetic differences were further examined by using LPS from E. coli as well as other bacterial sources. Sephadex-elicited (pooled sample from 10, five-wk-old chickens/genotype) and MQ-NCSU macrophages (1 x 106) were seeded in 24-well culture plates and stimulated with LSP (5µg/µL) from E. coli (EC), Salmonella typhimurium (ST), Serratia marcensces (SM) and Shigella flexneri (SF) for 24h. Nitrate levels were quantitated in the culture supernatant fractions by Griess method using triplicate samples from each macrophage and LPS source. Non-LPS stimulated and medium alone control groups were also included. The results showed that macrophages from K-strain (range from two separate trials: 31-89 µM) and MQ-NCSU (22-81 µM) were high responders whereas both GB1 (15-38 µM) and GB2 (7-15 µM) were low responders against all LPSs used (<25 µM). However, LPS from EC and ST were more stimulatory for K-strain whereas LPS from EC and SF were more stimulatory for MQ-NCSU macrophages. On the contrary, differential LPS source sensitivity of GB1 and GB2 chicken macrophages was very minimal. Data analysis comparing various LPS irrespective of macrophage source showed EC LPS' to be most effective (P<0.05) whereas comparison of genotypes irrespective of the source of LPS showed K-strain and MQ-NCSU macrophages as the highest responders for iNOS activity. These data further confirm the genetic-based differences in iNOS activity in chickens. Furthermore, the hypo-and hyper responsiveness for iNOS activity seems to be an intrinsic difference in respective genetic sources and not related to a specific source of LPS.

Key Words: iNOS activity, LPS source, macrophage, genetics, chicken.

Optimization and application of PCR for the detection of Mycoplasma gallisepticum and Mycoplasma synoviae. H Moscoso, S Thayer, and S Kleven, University of Georgia, Athens, GA/USA.

Mycoplasma infections are of great concern in avian medicine because they cause economic losses in poultry production. Control of mycoplasmal infections are of great interest following the eradication. The purpose of this work was to optimize a previously published MS/MG PCR method in terms of simplicity and rapidity without affecting the sensitivity and specificity. DNA was isolated from tracheal swabs or cultures by a boiling/freezing method yielding 15-300ng/µL. DNA was equally amplified in the range of 50-2000ng, indicating a highly sensitive system. The intensity of the MG/MS PCR product was enhanced by decreasing the GC content of the primers without affecting the specificity. Varying the quantities of taq polymerase from 0.25 to 5U resulted in a gradual increase in the signal with no affect on the background, suggesting a saturated condition for the enzyme. Increasing the amount of MgCl2 (25mM) from 1 to 10µl produced a significant increase in the signal but also a substantial increase in the noise above 6µl. We identified 100% of MS/MG cultures among 34 reference isolates of different species. Simultaneous testing of 15 swabs with IDEXX PCR agreed 100% in detecting MS/MG. The modified MS/MG PCR has proven to be sensitive and specific suitable for rapid detection of infection in field samples.

Key Words: Avian, Mycoplasma, PCR.

Short-latency stressor effects on sociality in broiler chicks known to show contrasting T-maze behavior. R. H. Marin1, R. B. Jones2, and P. Freytes1, 1CRILAR (CONICET), Anilacca, La Rioja, Argentina, 2Roslin Institute, Roslin, Midlothian, Scotland.

Ninety six newly hatched broiler (Cobb) chicks were socially housed in 8 mixed-sex groups, each comprising 12 birds. The times taken by individually-tested chicks to traverse a T-maze and thereby reinstate visual contact with their companions were measured at 2 days of age. Chicks were assigned to high (HP) or low (LP) performance categories according to whether they completed this task quickly (<25s) or more slowly (>75s), respectively. These chicks were then marked to facilitate later identification before their return to the home cage. Sociality was measured at 9 or 10 days of age by placing chicks individually in a start box at one end of a 2-m long runway; a goal box at the opposite end contained two other chicks. Forty four chicks were tested following one of two treatments. Control chicks (11 HP, 11 LP) remained undisturbed in the brooder until testing whereas stressed birds (11HP, 11 LP) were subjected to mechanical restraint for 5 min one hour before test. At test, we measured the latencies to leave the start box and to enter a close zone (20 cm section nearest the goal box) as well as the accumulated time spent in the close zone during the 10 min test. A two-way analysis of variance (treatment, chick category) revealed no detectable effects on either of the latency measures, probably because running times were very low. However, HP chicks spent longer (F1,40 = 4.11, P<0.049) in the close zone than LP ones and this social reinstatement behavior was markedly greater (F1,40 = 10.79, P<0.002) in the stressed birds than in controls. There were no significant interactions. The present results support our previous suggestion that underlying sociality (motivation to be near conspecifics) is greater in HP than in LP chicks. They also clearly demonstrate that the imposition of a known stressor increased sociality in both categories of chicks.

Key Words: Broiler chicks, Sociality, Stress, T-maze behavior.


Darkling and hide beetles are significant insect pests of poultry houses that destroy insulation, compromise the wood structural members of the building and create a nuisance when manure is placed in fields. Previous attempts to limit these pest populations has relied on the use of pesticides or total clean out of the building. Field research trials evaluated the use of a fungal biopesticide, Beauveria bassiana (Bb) to control these insects in brooder houses. Studies using beetle tube traps. The middle house of a 7-house layer complex was treated monthly. Treated turkey brooder

Key Words: Biopesticide, Beauveria bassiana.
houses had no darkling beetles at the completion of the brooder cycle. Grow-out houses did show an increasing population of beetles during the flocks, with the treated houses having numerically fewer beetles than the standard treated houses. Treated broiler houses reduced beetle 93-98% compared to controls. Hide and darkling beetle populations disappeared in the treated layer house from October through June. Beneficial insect populations (carcinops, earwigs and parasitic wasp) were unaffected by the fungal treatments. Adulid darkling beetles were found in the house in late June and remained present in the house through October, however at greatly reduced populations compared to untreated houses. Hide beetles did not re-establish. These trials demonstrated efficacy equal to currently used insecticides for beetle control in turkey and broiler production. Efficacy in a layer house was 99+%, which is significantly greater than can be obtained with current products.

Key Words: Hide and Darkling Beetles, IPM, Biopesticide


Commercial breeder departments commonly practice ‘spiking’, the introduction of supplemental or replacement males into breeder flocks to maintain the desired male:female ratio. This is presumed to increase fertility, however, there have been few controlled studies of this practice. It is unknown whether the practice of spiking males improves fertility through matings by the introduced males (restoring or increasing male:female ratio), through stimulation of mating activity of the original males, or both. To examine these possibilities, 60-week old broiler breeders housed in 16 pens in a slab//litter breeder house were assigned to 4 treatments with 4 replicate pens/treatment. Each pen initially contained 5 males and 70 females. Treatment 1 served as control with no replacement of males. Treatment 2 had 50% of the males replaced with unfamiliar males from another pen. Treatment 3 had all the males replaced with unfamiliar males. Supplementary males were added to Treatment 4 to bring the ratio to 7 males:70 females. Opaque black plastic sheeting was used to prevent birds from observing activity in adjacent pens. Eggs are collected daily and incubated weekly for a period of four weeks. Eggs are incubated for a minimum of 10 days then candled to determine viability. Eggs without embryos are then broken out to determine fertility or early embryonic death. Initial egg production averaged 60% for all hens. Initial fertility was the same for all groups and averaged 86%. It is expected that each treatment will increase fertility, suggesting that spiking can increase fertility both by increasing the number of breeding males and by stimulating breeding behavior in the original males.

Key Words: breeder, fertility, spiking

S123 Using the Hunter Labs Labscan II Spectrophotometer to evaluate eggshell color in broiler breeders. D.R. Ingram*, L.F. Hatten, III, and B.A. Conner, Louisiana Agriculture Experiment Station, Louisiana State University Agricultural Center.

One hundred and twenty brown shelled eggs obtained from a commercial broiler breeder flock were used to determine if there was a difference in the location on the eggshell or the number of measurements made when evaluating color with the Hunter Labs Labscan II Spectrophotometer. Each egg was measured on the equator, the small end and the large end. One measurement was compared to the average of three measurements at the same location. Also, one measurement on the equator was compared to the average of three different measurements on the equator. L, the shade of white to black; a, the shade of red to green; and b, the shade of yellow to blue were measured. Then E, the color, was calculated. All data were analyzed by ANOVA. It was found that either end was significantly different, either lighter or darker, than the equator. One measurement was not different from the average of three in the same location and one measurement on the equator was not different from the average of three different locations on the equator. It was concluded that one measurement on the equator was sufficient to evaluate eggshell color.

Key Words: Eggshell Color, Broiler Breeder Eggs, Spectrophotometer


It is a common practice to wash and disinfect poultry grow-out barns after used bedding material has been removed. Since the floor of poultry barns usually has the presence of soil and organic matter, a study was conducted to determine if disinfectants are effective in reducing the aerobic bacteria, Campylobacter, and yeast levels. A commercial poultry house was chosen as the test site. After the litter was removed from the facility, the floor was swept clean in the middle of the barn and away from feed and water lines. One foot by one foot plots were randomly assigned to one of four disinfectant treatments so that each disinfectant was applied to ten plots with ten untreated plots serving as the control. The disinfectants evaluated were a phenolic compound, a quaternary ammonium compound, a nascent oxygen compound and a compound which contains potassium peroxynitosulfate and sodium chloride as the active ingredients. Each disinfectant was prepared according to the manufacturers’ recommendations. Each disinfectant was then applied in a coarse spray at a rate of 10ml/plot. One half of the plots was sampled fifteen minutes and the other half was sampled six hours after the disinfectants were applied. Plots were sampled using a sterile drag swab. Swabs were cultured to determine aerobic bacteria, mold, yeast and incidence of Campylobacter. Results were analyzed using the GLM procedure of SAS. All data were converted to log10 values prior to analysis. Incidence of Campylobacter was analyzed using the Fisher’s exact test. Disinfectants did not significantly affect the aerobic plate count as compared to the untreated control plots. Significantly (P<0.05) impacted aerobic bacteria counts with a reduction in counts occurring at six hours. Mold and yeast levels (P<0.05) were significantly impacted disinfectants but not by time. Incidence of Campylobacter was not impacted by disinfectants as compared to the untreated plots. Additional research will be conducted to determine if higher application rates or additional time after application and before sampling will increase the effectiveness of the disinfectants.

Key Words: Disinfectants, Poultry house sanitation, Campylobacter

S125 Effects of Body Weight Uniformity on Early Egg Production by Broiler Breeders. B.P. Hudson*, J.B. Hess, and R.J. Lien, Poultry Science Department and Alabama Agricultural Experiment Station, Auburn University, AL 36849.

Research was conducted to assess the effects of BW uniformity on breeder hen performance through peak egg production. At 20 wk of age, 400 Cobb-500 breeder hens were selected on the basis of BW and housed in eight floor pens in a manner that resulted in different BW uniformities. The high uniformity treatment (H) consisted of birds each weighing between 1.86 and 2.04 kg at 20 wk. The low uniformity treatment (L) consisted of equal numbers of light birds (weighing between 1.54 and 1.72 kg) and heavy birds (weighing between 2.18 and 2.32 kg) in each pen. Both treatments had similar mean BW at 20 wk (approximately 1.95 kg). Equal feed allotments were provided to both treatments throughout the trial. Allotments were increased from 93 g/bird/day at 20 wk to 154 g/bird/day at 28 wk, then decreased to 148 g/bird/day at 35 wk. Individual BW and pen uniformity was measured weekly. Weights of all single-yolked, intact eggs produced were determined daily. Results indicated that uniformity in the H treatment remained above 90% throughout the trial, but decreased slightly with age. Uniformity increased in the L treatment from 52.3% at 20 wk to 84.8% at 29 wk, but decreased slightly from 29 to 35 wk. Body weight means of both treatments remained similar throughout the trial. Light birds in the L treatment gained significantly (p<0.0001) more weight than heavy birds from 25 to 30 wk, possibly due to decreased egg production and a higher availability of nutrients for growth. This phenomenon led to rapid increases in uniformity for treatment L immediately following the onset of lay. Although BW uniformity was significantly different (p<0.10) throughout the trial, the egg weight distributions of both treatments were generally normal and similar. Ten-day production was numerically higher for treatment H from 26 to 35 wk, but not significantly. There were no significant differences in BW uniformity for treatment H. It appears that relatively large differences in BW uniformity may not necessarily have a marked negative effect on early production by breeders.

Key Words: Body Weight Uniformity, Broiler Breeder, Egg Weight Distribution

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S126 Recovery of Campylobacter jejuni from segments of the reproductive tract of broiler breeder hens. R. J. Buhr1, N. A. Cox1, N. J. Stern1, and J. L. Wilson2, 1 USDA, ARS, Russell Research Center, 2 Department of Poultry Science, University of Georgia.

Two trials were conducted to determine the presence of Campylobacter jejuni within segments of the reproductive tract of 60 wk old broiler breeder hens. In the first trial, after stunning, bleeding, scalding, and defeathering, the reproductive tracts were aseptically excised from fifteen hens, five from each of three adjacent floor pens that were feces-positive for Campylobacter. The reproductive tract segments (infundibulum, magnum, isthmus and shell gland, vagina, and cloaca) were pooled by pen, or second trial, one week later, a total of ten individually hens were sampled from the three pens; the reproductive tract was divided into the following segments: magnum, isthmus, shell gland, vagina, and cloaca. Samples were placed into sterile plastic bags and suspended 1:3 (w/v) in Bolton’s enrichment broth. Samples were stomached for 1 min and serial dilutions were plated (0.1 mL) on to Campy-Cefex plates. The plates were incubated at 42°C for 24 h in a microaerobic environment. In Trial 1, the pooled reproductive tract segments for hens from Pen A were Campylobacter-positive for the shell gland, vagina, and cloaca; hens from Pen B were positive for the cloaca only; and hens from Pen C were positive for the magnum and cloaca. In the second trial, nine of ten cloaca samples were Campylobacter-positive and only Hen 3 was negative. Hen 6 was Campylobacter-positive in both the shell gland and vagina. Hen 6 was the only hen lacking an egg within the reproductive tract at the time of sample collection. Campylobacter colonization of the hens’ reproductive tract may enable vertical transmission of Campylobacter from the hen to the chick.

Key Words: Campylobacter, Breeder hen, Reproductive tract, Vertical transmission, Colonization

S127 Effect of Air Velocity and Body Weight on Water Usage by Broilers. J. D. May1 and B. D. Lott, USDA, Agricultural Research Service, South Central Poultry Research Laboratory.

Poultry practitioners often treat broilers with medications in water. It is important to know the rate of water usage. The objective of this research was to determine the effect of air velocity and body weight on rate of water usage. Male broilers were grown in environmental chambers from 21 to 49 days of age and weighed weekly. The chambers were maintained at 27°C and broilers were exposed to still air (< 15 m/min) or air velocity of 120 m/min. Water was supplied by nipple drinkers and water usage was recorded by computer at 30 min intervals. Water usage was calculated as percent of body weight per day. Daily water usage for still air ranged from 23 percent of body weight at 22 d to 12 percent of body weight at 48 d, and was 17 percent of body weight at 34 d. Air velocities tested had no effect before 30 d and at 34 d usage was 15.7 percent at 120 m/min. The average usage from 35 to 49 d was 14.3 percent in still air and 12.4 percent at 120 m/min. These results show the effect one may expect from air and tunnel ventilation.

Key Words: Water Use, Air Velocity, Feed gain, Growth

S128 Social reinstatement behavior of broiler chicks tested in a T-maze is not affected by test order, right-left preferences, or type of day. R. R. Jones1, C. R. M. Almeida1, and R. H. Marín2, 1 CRILAR (CONICET), Anílaco, La Ríoa, Argentina, 2 Roslin Institute, Roslin, Midlothian, Scotland.

Broiler chicks show pronounced individual differences in the latency to traverse a T-maze and thereby reestablish visual contact with their companions. Chicks that completed this task quickly then grew faster both in the laboratory and on farm, they were more sociable, and they showed lower adrenocortical responses to a selected stressor than did their slower counterparts. Before we can recommend this simple, rapid, non-invasive test as a selection criterion for future commercial breeding programmes we must ensure that T-maze behaviour is not sensitive to potentially confounding variables such as order of testing, existing preferences to turn right or left at the junction of the maze, or the time-of-day. Here, 240 newly hatched, mixed-sex broiler chicks (Cobb) were randomly allocated to 12 groups of 20. At 2 days of age a group of 20 chicks was placed in the brood area of each of two T-mazes at 08.30 h; the brood areas were positioned on either the right or the left sides of the mazes. After 30 min acclimatisation one chick from each of group was placed in the isolation chamber of the T-maze and the time it took to traverse the maze was recorded. This procedure was repeated until all 20 chicks and all 12 groups had been tested. Testing was completed in one day and the locations of the brood areas were rotated after each block of 20 tests. Analyses of variance revealed no detectable effects of: test order, right or left location of the brood area, or time-of-day and no significant interactions. These findings strongly suggest that the above variables would not confound the classification and possible genetic selection of broiler chickens based on their social reinstatement responses in a T-maze.

Key Words: Broiler chickens, T-maze behavior, Social reinstatement


PURPOSE OF EXPERIMENT: The aim was to demonstrate the effects of shell and shell membrane thickness and egg weight loss on embryonic development of three local Egyptian strains of chicken. EXPERIMENTAL DESIGN: Fertile eggs were used from three local Egyptian strains of chickens (Alexandria, Norfa, and Naked neck). The eggs were incubated and weighed at 0, 6, 12 and 18 days of incubation. Percentage egg weight loss was calculated. At 21-day of incubation, egg types were classified as early dead, late dead, and pipping embryos and hatching eggs. Shell was prepared and Pores were counted. Egg shell with or without membrane thickness was measured for each of the shell regions (large end, equator, and small end). RESULTS: Differences in egg shell thickness among egg types and their interaction with strains were highly significant at all egg shell regions. The ascending order of shell thickness values within egg types was pipped, early dead, hatching, then late dead eggs; within strains was Naked neck, Alexandria, then Norfa eggs, and within shell regions was equator, large end, then small end. The thin shell of hatching eggs may be due to the more consumption of calcium by embryos than deads for the unhatching eggs. The chicken eggs used the equator calcium more than from large or small end regions. The highly significant difference of shell membrane thickness among egg types and strains may suggest that it has important role in embryonic development, because it acts as a barrier to gaseous diffusion and in regulating water flux. The hatching eggs exhibited the lowest weight loss during incubation period, and some early and late deads may be due to excessive egg weight loss. Hatchability depends on a proper relationship between pore concentration and shell thickness (pore length) which provides proper weight loss for optimum embryo growth. In addition, membrane thickness had strong relationship with egg weight loss and number of pores. CONCLUSION: To improve hatchability of chicken eggs, shell and shell membrane and egg weight loss of the hatching eggs should be taken into consideration for each strain to make better combination between the environmental factors and embryonic development.

Key Words: Chicken, Embryonic development, Shell thickness, Egg weight loss, Pores


The crop is a known source of Salmonella and Campylobacter contamination. Previously, we evaluated selected organic acids in the drinking water during simulated pre-transport feed withdrawal (FW) and reported that 0.5% acetic, lactic, or formic acid significantly (P < 0.05) reduced the number of Salmonella recovered from crops. However, total contamination of the drinking water acid was reduced. Presently, we evaluated the effect of lactic acid (0.5-1.5%), acetic acid (0.5-1.5%), buffered lactic acid (1.5%), or buffered acetic acid (1.5%) on consumption by broilers during 8 h pre-transport FW. Broilers provided selected acids were found to consume less acid water than broilers provided distilled water. In an additional on-farm commercial study, broilers provided 0.5% lactic acid during a 4.5 h transport period (on the farm and 6 h transport), and pre-FW crop, post-FW crop, and pre-chill carcass wash samples were collected for Campylobacter and Salmonella detection. Crop contamination with Salmonella was significantly reduced by lactic acid treatment (6/175; 3.4%) as compared to controls (29/175; 16.6%). Importantly, Salmonella isolation incidence in pre-chill carcass rinses was significantly reduced by 50% (26/175 VS. 55/176) Campylobacter contamination with Campylobacter was significantly reduced by lactic acid.

Key Words: Salmonella, Lactic acid treatment, Drinking water, Prolacta Trim Feed Withdrawal.
acid treatment (109/175; 62.3%) as compared to the controls (149/175; 85.1%). Lactic acid also reduced the incidence of Campylobacter found on pre-chill carcass rines by 14.7% compared to the controls. These studies suggest that incorporation of lactic acid in the drinking water pre-transport feed withdrawal may reduce Salmonella and Campylobacter contamination of crops and broiler carcasses at processing.

Key Words: Salmonella, Campylobacter, Crops, Chickens, Lactic Acid

S131 Defining Minimal Growth Velocity Data Needed for Artificial Neural Network Detection of pulmonary Hypertension Syndrome in Broilers. W.B. Roush1, 2 R.F. Wideman2, A. Cahanes1, and T.L. Cravener3. 1The Pennsylvania State University, University Park, PA 16802, 2University of Arkansas, Fayetteville AR 72701, 3The Hebrew University, Rehovot, Israel.

A previous study has shown that an artificial neural network (ANN) evaluation of two-weeks of daily growth velocity is a non-invasive approach to predict birds with pulmonary hypertension syndrome (PHS). This study was conducted to define the minimum number of days of growth data and to determine the type of ANN that would give the best determination. The birds were weighed daily, in both trials, at approximately 0800. In Trial 1, the birds (Hubbard male chicks) consisted of 33 Normal(N) and 13 diagnosed with PHS. Birds that died after 28 d were necropsied for PHS. Birds surviving to day 50 were euthanized and a PHS diagnosis was made. In Trial 2, the birds (ANAK male birds) consisted of 46 N and 16 diagnosed with PHS. Birds dying after 25 were necropsied for PHS. On d 42, the birds were euthanized and necropsied for PHS. Four ANNs (Back Propagation (BP3), Ward Back Propagation (Ward BP), Probabilistic (PNN) and General Regression (GRNN)) were evaluated for their ability to predict PHS in the shortest number of days based on daily growth rate. A 100% prediction of PHS and N birds was considered the criterion of success. Only birds with two weeks of body weights were evaluated. Growth velocities (BW(d+1)-BW(d)) were calculated. Starting at 14 d, each of the four ANN was trained on daily growth velocity. With each run, the number of predictive d was decreased. The best ANN was a GRNN. The GRNN correctly diagnosed birds with or without PHS on four- and six-d of growth velocity data for trials 1 and 2, respectively. The results were poorer with the BP3, Ward BP, and PNN. The results suggest that, within the Hubbard and ANAK strains, GRNN based on the first six consecutive days of growth velocity would be sufficient to identify male chicks with a propensity for developing PHS.

Key Words: Pulmonary Hypertension Syndrome, Ascites, Artificial Neural Networks, Broilers


The purpose of this study was to determine the influence of dietary phosphorus (P) and supplemental phytase on total and water soluble P in the excreta of broilers. Male broiler chicks were given either control rations or one of three treatment rations containing phytae (Alzyme Phytase, Alltech, Inc., Nicholasville, KY, 11,500 PTU/kg). The control (no phytase) and Treatment 1 rations contained 1.0% calcium (Ca)-0.45% available P (aP2) in the Starter, 0.9% Ca-0.35% in the Grower. Treatment 2 rations contained 0.9% Ca-0.35% aP2 in the starter, 0.9% Ca-0.25% aP2 in the Grower. Male Treatment 3 rations contained 0.8% Ca-0.25% aP2 in the Starter, 0.7% Ca-0.15% aP2 in the Grower. Feed intake and body weights were measured weekly. At 3 and 6 weeks of age, 12 birds from each dietary treatment were sacrificed for carcass composition determinations by dual energy X-ray absorptiometry. Excreta samples were collected every other day from 1 to 6 weeks of age, and analyzed for total and water soluble P in fresh manure. At 6 weeks of age, body weight and feed efficiency did not differ among treatments. Bone density, carcass fat and protein did not differ. Treatment 1 with the higher Ca and aP plus phytase had the highest (55 ppm) water soluble P in the manure; while Treatment 3 with the lowest Ca and aP plus phytase had the lowest (28 ppm) water soluble P in the manure. Thus manure water soluble P levels can be reduced by reducing aP in the diet and adding phytase, without impairing performance or bone strength. Further, these results show no potential impact on reducing P in manure is derived by the addition of phytase to standard rations without reducing dietary P.

Key Words: phytase, environment, bone strength, manure

S133 Effects of 25-hydroxycholecalciferol and vitamin D3 on phosphorus utilization by turkey pouls fed a typical corn-soybean meal diet. G. M. Owens1 and D. R. Ledoux, University of Missouri, Columbia, MO.

A study was conducted to determine the effects of 25-hydroxycholecalciferol (25-OH-D3) on performance and bone mineralization in pouls. Two hundred and forty day-old male pouls were randomly allotted to 8 treatments (6 reps of 5 pouls each) for 21 days using a completely randomized design. Turkeys were fed a positive control diet containing 0.60% available phosphorus (aP), 1.2% calcium (Ca), supplemented with 1100 IU of vitamin D3/kg (diet 1); a basal diet containing 0.30% aP and 1.0% Ca, supplemented with 1100 IU of vitamin D3/kg (diet 2); basal diet supplemented with 3650 IU of vitamin D3/kg (diet 3); basal diet supplemented with 20 mg/mg, 40 mg/mg, 60 mg/mg, 80 mg/mg, or 100 mg/mg 25-OH-D3 (diets 4-8). With the exception of Ca and P, the diets met or exceeded the nutrient requirements of starting turkeys. In comparison to the positive control diet, the experimental diets caused lower (P < 0.05) feed intake, body weight gain, tibia ash, and bone breaking strength. Feed conversion was not affected (P > 0.05) by dietary treatments. There was no difference (P > 0.05) between the two vitamin D3 diets for feed intake, body weight gain, tibia ash weight or bone breaking strength. Compared with pouls fed 1100 IU vitamin D3, pouls fed 3650 IU vitamin D3 had an increase (P < 0.05) in percent tibia ash. Compared with pouls fed 20 mg/mg 25-OH-D3, pouls fed 40 to 100 mg/mg 25-OH-D3 gained more weight and had stronger bones (P < 0.05). Results of this study suggest that 25-OH-D3 may be more effective than vitamin D3 in promoting phosphorus utilization.

Key Words: 25-hydroxycholecalciferol, Pouls, Vitamin D3, Phosphorus

S134 Simultaneous application of phytase and non-starch polysaccharide degrading enzymes in wheat-barley based diets fed to turkey pouls . Y. C. Li1, 2 R. D. Ledoux1, and K. Zyla1. 1University of Missouri, Columbia, Missouri, U.S.A., 2University of Agriculture, Krakow, Poland.

A 21 day battery study using 390 day-old pouls was conducted to evaluate the effects of feeding phytase and non-starch polysaccharides (NSP) degrading enzymes (xylanase and b-glucanase) individually and in combination to turkeys fed a wheat-barley (40%, 10%) based diet. A completely randomized design was used with five pen replicates of five pouls assigned to each of 13 dietary treatments. Dietary treatments consisted of a low available P (aP2) and low Ca basal diet (0.45% aP; 1.0% Ca) supplemented with three levels of phytase (Natupro 8600a, 0, 600, 1000 FTU/kg of diet) and four levels of NSP degrading enzymes (Natugraina Blend; 0, 25, 50, 100 mg/kg diet) in a 3 x 4 factorial arrangement, plus a positive control diet (0.6% aP; 1.2% Ca). There were no treatment effects on weight gain and feed intake (P > 0.05). Feed conversion was improved (P < 0.05) in pouls fed diets supplemented with NSP degrading enzymes, but was not affected (P > 0.05) by phytase. Intestinal viscosity was reduced (P < 0.05) in pouls fed NSP degrading enzymes, but was not affected (P > 0.05) by phytase. Percent toe and tibia ash were increased (P < 0.05) by phytase supplementation. Percent toe and tibia ash were not affected by NSP degrading enzymes (P > 0.05). No phytase x NSP degrading enzymes interactions were observed for any of the response variables measured. Results indicated that a combination of phytase and NSP degrading enzymes fed to pouls did not cause any negative interactions, suggesting that these two feed enzymes could be simultaneously added to turkey diets based on wheat and barley.

Key Words: Phytase, NSP degrading enzyme, Viscosity, Wheat, Pouls

S135 Managing tunnel ventilated poultry houses: An educational video. G.W. Malone1, G.W. Quinn1, and J.O. Donald2. 1University of Delaware, Newark, DE/USA, 2Auburn University, Auburn, AL/USA.

Many broiler houses in locations that experience hot weather for at least part of the year are now being equipped with tunnel ventilation. As more poultry growers utilize tunnel-ventilated houses in order to maximum
production efficiency during moderate and hot weather, there is a growing need to provide educational materials on how to operate and maintain these systems. A 25-minute instructional video entitled: “Managing Tunnel Ventilated Poultry Houses” was prepared as a joint project by the University of Delaware and Auburn University. This video provides essential information growers need to manage tunnel-ventilated houses effectively under various weather conditions. The video explains setups for minimum ventilation, transitional ventilation and tunnel ventilation. It also provides information on when to be in each ventilation mode, and places emphasis on understanding wind chill and the resulting “effective temperature.” Guidelines for operating the various types of evaporative cooling systems used in tunnel houses are presented. Backup system requirements and maintenance needed for this equipment are also reviewed. The final ten-minute segment of this tape gives answers to questions that are commonly asked by tunnel house owners. Response during the first two months of the introduction of this video has been overwhelming.

Key Words: Broiler, Tunnel ventilation, Video

S136 Fluctuating asymmetry in Japanese quail genetically selected for contrasting adrenocortical responses. D. G. Satterlee1,1, G. G. Cadd1,1, and R. B. Jones2,1 Louisiana State University, Baton Rouge, LA, 1 Roslin Institute (Edinburgh), Scotland.

Differences in the amount of developmental instability were assessed in Japanese quail of two lines that had been genetically selected over several generations for either reduced (LS, low stress) or exaggerated (HS, high stress) plasma corticosterone response to brief mechanical restraint. At 32 wk of age, three bilateral traits were selected for study in each quail line. The characters chosen were: length of the metatarsus (shank length, SHKLEN), diameter of the shank (SHKDIA) perpendicular to the spur, and distance between the auditory canal and the nares (face length, FACELEN). Significantly greater bilateral trait size variances were associated with the measurement of SHKLEN (P < 0.0088) and FACELEN (P < 0.0016) in the HS line than in the LS line. Quail of the HS line also showed a tendency towards greater (P = 0.22) SHKDNA variance when compared to quail of the LS line. These findings suggest that developmental instability (i.e., fluctuating asymmetry, FA) is more pronounced in HS quail than in LS quail. Previous studies have shown that not only do quail of the HS line show greater adrenocortical responsiveness to a wide range of stressors, but that they are also more easily frightened than LS birds. Therefore, the line differences in FA found here may reflect the birds’ differential responsiveness to chronic social and physical environmental stressors. The present findings also support previous suggestions that measuring asymmetries in bilateral traits could be an additional and valid method of assessing stress and of comparing phenotypic stability in selected populations.

Key Words: Fluctuating Asymmetry, Corticosterone, Japanese Quail


Poultry house sanitation plays a crucial role in the control and prevention of pathogenic diseases. The Bio-burner originated in an attempt to control viral and bacterial infections in the floor of turkey grow-out barns since typical sanitation procedures did not appear to aid in the control of these pathogens. The Bio-burner is an insulated, stainless steel cabinet with six liquid propane torches that supply a direct flame to the floor at a temperature of greater than 1900°F. Floor temperatures immediately post burning have been recorded greater than 700°F but the temperature drops to 120°F within 60 seconds. The following evaluations were conducted to determine if the Bio-burner was effective in eliminating a known level of Salmonella from concrete and dirt surfaces. Ten milliliters of naflidixic acid resistant Salmonella typhimurium was added to one foot by one foot areas at a rate of 10^8 CFU/ml. Four plots were swabbed with sterile drag swabs immediately post application of the culture and four each of the concrete and dirt plots were drag swabbed after exposure to the Bio-burner. All plots tested pre-burning were positive Salmonella and all plots tested post burning were negative for Salmonella.

Key Words: Disinfectants, Poultry house sanitation, Salmonella

S138 The use of an indicator amino acid to determine the phenylalanine requirement of male broiler chicks. K. G. Sterling1, J. M. Harter-Dennis1, and J. Timmons1, 1 University of Maryland Eastern Shore.

The indicator amino acid oxidation technique was adapted for use with broiler chickens. A direct oxidation experiment was used to rapidly determine the requirement of phenylalanine for male broiler chicks. It was necessary to establish the phenylalanine requirement in order to accurately formulate diets for future indirect oxidation studies where L-\([1-\text{\textsuperscript{14}}\text{C}]\text{phenylalanine}\) will be used to evaluate amino acid requirements. Chickens (n = 168) with an average weight of 269.43 grams (207 to 367 g) and age range of 14 to 16 days were given a phenylalanine deficient pretest diet 12 hours prior to an overnight fast. Then, the oxidation of L-\([1-\text{\textsuperscript{14}}\text{C}]\text{phenylalanine}\) was measured by feeding graded levels of dietary phenylalanine (0.3, 0.4, 0.5, 0.6, 0.7 and, 0.8%) and 0.45% tyrosine in a corn starch/crystalline amino acid diet (RCB, 6 trts, 7 reps/trt, 4 male chicks/rep). Amino acid levels in the experimental diets were formulated to meet the Illinois Ideal Amino Acid Profile with all other nutrients provided to meet or exceed the NRC (1994) recommendations. The isotope was added to the diet to give 0.2 µCi/g of DM. Release of \(\text{\textsuperscript{14}}\text{CO}_2\) was measured for 4 hours following two meals of the respective diets fed two hours apart. Meals were based on body weight (BW) and dry matter (DM) content of feed (1% of BW as DM per meal). Increasing the level of dietary phenylalanine to approximately 0.7% linearly increased the oxidation of L-\([1-\text{\textsuperscript{14}}\text{C}]\text{phenylalanine}\). Increasing the dietary level of phenylalanine from 0.7% to 0.8% had no significant influence on the recovery of radioactivity in the \(\text{\textsuperscript{14}}\text{CO}_2\) from L-\([1-\text{\textsuperscript{14}}\text{C}]\text{phenylalanine}\). Data were analyzed using a two-phase linear regression with breakpoint analysis that revealed a dietary phenylalanine level of 0.6888% (95% confidence limits; 0.5778 to 0.7998%) in a diet containing 0.45% tyrosine was sufficient in minimizing the oxidation of L-\([1-\text{\textsuperscript{14}}\text{C}]\text{phenylalanine}\).

Key Words: Broiler, Indicator amino acid, Phenylalanine requirement

S139 Performance and egg quality parameters of commercial laying hens fed graded levels of acetic acid treated vetch seeds. M.T. Farran*, S.W. Kadi, and V.M. Ashkarian, American University of Beirut, Beirut, Lebanon.

An experiment was conducted using graded levels of 1% acetic acid treated ground vetch seeds (Vicia sativa) to determine the optimum level in layer rations, and its effect on the performance and egg quality parameters. Isocaloric (2900 Kcal/Kg) and isonitrogenous (18.4% CP) diets containing 0, 15, 30, 45, and 60% treated vetch seeds (TV) were fed to 140 individually caged SCWL layers of similar age, body weight, and production rate for a period of 14 weeks. Body weight change, feed intake, egg production, and feed conversion of hens fed 60% TV were significantly depressed as compared to all other treatments. Egg weight of 60% TV was significantly lower than those of the 15 and 30% only. Haugh Unit (HU) scores of all TV diets were significantly higher than that of the control. Yolk color score was not affected by the different dietary TV levels. The shell thickness (ST) of the 60% TV eggs was the lowest (0.288mm) among all treatments (P<0.05). The 15, 30, and 45% TV resulted in an average ST of 0.323mm which was significantly lower than that of the control (0.339mm). The results indicated that 1% acetic acid TV may be used up to 45% in layer rations without considerably affecting the performance and egg quality, except ST. Moreover, the inclusion of acetic acid TV at all levels in laying hen diets improve the HU score.

Key Words: Vetch, Acetic acid, Laying hen

Soybean meal has replaced a large portion of the fishmeal in Peruvian broiler diets owing to the impact of the El Niño weather phenomenon. Because supplementation with exogenous enzymes can potentially improve feed nutritive value, the objective of this experiment was to evaluate the effects of Alzyme Vegpro, a commercial enzyme preparation targeted to soy protein and energy, on broiler performance and production economics. 800 mixed sex-day-old Ross broiler chicks were allotted to four diet treatments at 14 days of age. Starter (days 14-28) and finisher (days 29-49) diets were formulated to be isocaloric and isonitrogenous. The standard starter diet served as a positive control (PC) and contained 62.3% corn, 14.2% soy and 11.9% fishmeal. The negative control (NC) was based on increasing energy and amino acid digestibilities by 5% which resulted in a formula containing 61.7% corn, 26% soy and 5% fishmeal. Enzyme treatments consisted of 1 and 1.5 kg/T of Vegpro added to the NC formula. Similar adjustments were made to the finisher formulas. There were three replicate pens of 60 birds per treatment. Vegpro decreased intake relative (P < 0.05) to the PC and NC diets (PC, 5475; NC, 5470; 1 kg/T VP, 5389; 1.5 kg/T VP; 5357). This reduction in feed consumption could be explained due to improved energy, protein and amino acids available. Body weight at 49 days increased by 3.2 and 3.5% in comparison with the PC (P > 0.05) for the 1 and 1.5 kg/T Vegpro treatments, respectively. Vegpro improved efficiency of utilization of the NC diet by 4.83% and 5.34%, respectively, for the 1.0 and 1.5 kg/T Vegpro treatments (P < 0.05). In terms of production costs, the 1 kg/T Vegpro treatment was 3.12% more economical that the PC and 3.08% more economical than the NC diet. Calculation of the European Efficiency Factor revealed a 19 point difference between the enzyme-supplemented treatments and the controls (PC, 210.95; NC, 231.6; VP 1 kg/T, 249.62; VP 1.5 kg/T, 252.88).

Key Words: Enzyme, Soybean meal, Broiler

S141 Effect of low protein, amino acid fortified, grower and finisher diets on broiler growth performance. A. H. Cantor1, A. J. Pescatore1, R. S. Gates1, D. B. Burnham2, M. J. Ford1, A. S. Hussein3, and N. D. Patton1, 1University of Kentucky, Lexington, KY, 2Heartland Lysine, Inc., Chicago, IL, 3United Arab Emirates University, Al-Ain, UAE.

A trial using 1152 day-old male broiler chicks was conducted to evaluate the effect of low CP, amino acid fortified, corn-soybean meal grower and finisher diets on growth performance. Twelve replicate groups of 24 chicks were assigned to each of four treatments. Chicks were housed in floor pens (102 X 152 cm), equipped with tube feeders and nipple drinkers. All chicks were fed the same broiler starter diet during Days 1 through 14. The experimental grower and finisher diets were fed during Days 18 through 35 and Days 35 through 42, respectively. Respectively CP levels used in the grower and finisher diets were as follows: Treatment A - 23.0 and 22.5%; Treatment B - 20.8 and 20.0%; Treatment C - 18.5 and 17.5%; and Treatment D - 16.3 and 15.0%. The lowest CP diets were supplemented with lysine, arginine, methionine, threonine, tryptophan, isoleucine, and valine to meet NRC (1994) requirements. The diets with the intermediate levels of CP were prepared by mixing the highest and lowest CP diets in a ratio of 1:2 or 2:1. Decreasing dietary CP resulted in linear and quadratic effects on feed intake for both periods. There were no differences in these variables for broilers in Treatments A and B. Reducing dietary CP from Treatment A to Treatment D decreased gain to feed ratio during the grower and finisher periods by 7.2% (0.528 vs. 0.490) and decreased final body weight by 9.8% (2.15 vs. 1.94 kg). However, reducing dietary CP from Treatment A to Treatment C lowered the gain to feed ratio and final body weight by only 2.1 and 4.7%, respectively.

Key Words: Low protein diets, Amino acids, Growth performance

S142 The Tryptophan Requirements of Male Versus Female Siblings of a Commercial Broiler Strain. A. P. Rosa1,2, G. M. Pettit1, H. M. Edwards, Jr., and R. I. Bakalli, 1Department of Poultry Science, The University of Georgia, Athens, GA 30602-277, 2Universidade Federal de Santa Maria and CAPES Foundation, Brazil.

An experiment was conducted to evaluate the influence of supplemental tryptophan (TRP) on the performance of broilers and to determine the tryptophan requirements for males and females. A factorial design experiment was conducted from 1 to 18 days of age in battery brooders to evaluate the effects of six levels of TRP (0.09, 0.12, 0.15, 0.18, 0.21 and 0.24% of the diet) and two sexes. Ross x Ross 308 feather sexable male and female broilers were used. The 6 x 2 factorial design had four replicate pens of eight birds each. The basal diet was composed of corn (70.79%), corn gluten meal (17.41%), gelatin by product, poultry fat, DL-methionine, L-lysine, L-arginine and L-threonine. Nutrient requirement limits were the same in all diets except varying levels of tryptophan (23% of crude protein and 3.34 kcal/g of metabolizable energy). At 18 days of age three birds per replicate were killed and livers and fat pads were taken. Body weight gain and feed conversion ratio (FCR) of broilers (0.9-1.8 days) were significantly affected by the TRP levels. The diets with levels of 0.09 and 0.12% of tryptophan resulted in the poorest performing birds (P < 0.0001). The females had greater % liver than males but other parameters were similar. Fat pad as a percentage of body weight was decreased in birds fed 0.09% of TRP in the diets. The broken-line model was used to estimate the chicks TRP requirement [response=max+inc*(req-req*)], where max=plateau, req=rate constant, req= requirement, x=level, and l=1 when x less than req, otherwise l=0]. The TRP requirement of the males was 0.138 plus or minus 0.003% for gain and 0.130 plus or minus 0.003% for feed conversion. The TRP requirement of the females was 0.140 plus or minus 0.003% for gain and 0.137 plus or minus 0.004% for feed conversion. There is no apparent difference in the tryptophan requirement of young broilers due to gender (P > 0.05).

Key Words: Tryptophan, Corn Gluten Meal, Gender, Females, Broiler

S143 Effects of dietary vitamin E and selenium on incidence of ascites, growth performance and blood glutathione peroxidase in cold-stressed broilers. G. Roch* and M. Boulianne, University of Montreal, St.Hyacinthe, Quebec, Canada.

The objective of this study was to examine the effects of dietary vitamin E, organic and inorganic selenium (Se) on the incidence of ascites, growth performance and blood glutathione peroxidase in cold-stressed broilers. A total of 1,368 day-old commercial broiler chicks were divided in six treatment groups of four replicates each. The experimental design was a 2x3x4 factorial with two levels of vitamin E (75 and 250 IU/kg), 0.3 ppm organic Se (Sel-Plex selenium yeast, Alltech Inc.), 0.3 ppm and 0.6 ppm inorganic Se (Na selenite). Broilers were fed ad libitum and subjected to cold stress starting at 21 days of age. Temperatures were decreased to 70, 60 and 55°F over a 2 week period. Weekly body weights, daily feed consumption, mortality, right ventricular/total ventricular weight ratios (RV/T) and blood glutathione peroxidase (GPX) at 47 days of age were measured. Feed conversion, ascites incidence, RV/T and blood GPX were lower (P < 0.05) with the 250 IU/kg vitamin E - 0.3 ppm organic Se diet. There was no difference in final body weights among the various treatments.

Key Words: Selenium, Vitamin E, ascites

S144 Digestible Sulfur Amino Acid Requirements for Maintenance in the Turkey During the Starter Period. J.M. Brown*1 and J.D. Firman1, 1University of Missouri-Columbia.

In order to develop an effective model for the precise feeding of turkeys, maintenance requirements for amino acids must be determined. These experiments were designed to determine the maintenance requirement for sulfur amino acids in turkeys age 0-3 weeks. Stainless steel batteries housed the 192 birds used in each of the two trials to provide for six replications of eight treatments. Treatment diets were formulated to contain the following percentages of digestible sulfur amino acids: .11, .16, .21, .26, .31, .36, .41, .46. All other amino acids were provided at 15% excess relative to sulfur amino acid level based on the Missouri Ideal Turkey Ratio. Birds were maintained on experimental diets for seven days. In the first experiment, body weight gain responded linearly (p < .0001) to sulfur amino acid intake (r2= .95). The sulfur amino acid requirement for
maintenance in the starting turkey was determined to be 26.13 mg/day, based on body weight gain. Samples are currently being analyzed to determine the requirements for maintenance of sulfur amino acids and whole body protein. This data and the accompanying results from a second experiment will be presented.

Key Words: Turkey, Sulfur Amino Acids, Maintenance, Requirement, Amino Acids

S145 Organic chromium, mannan oligosaccharides and zinc bacitracin: effects on broiler performance and carcass characteristics. C. D. Mateo1, K. A. Jacques2*, and J. Harvey2, 1University of the Philippines Los Baos, Laguna, Philippines, 2Alltech Inc. Nicholasville, KY, USA.

Male Arbor Acre broiler chicks (500) in battery cages with slatted bamboo floors were distributed to five dietary treatments in a completely randomized design with 10 replicates of 10 birds per treatment. Treatments included a negative control (NC, basal diet); 50 ppm zinc bacitracin (ZnB); ZnB + chromium (Cr) yeast (BioChrome, Alltech Inc., 200 ppb Cr); mannan oligosaccharides (MOS) (Bio-Mos, Alltech Inc., 1 kg/ton in starter, 0.5 kg/ton in grower); and ZnB + MOS. Live weights, feed intake, weight gain and FCR were measured. At 42 days, one bird from each replicate pen (10 birds per treatment) was sacrificed to evaluate carcass characteristics. ZnB/Cr or ZnB/MOS or MOS alone increased (p<0.05) weight gains days 1-21. Relative to ZnB, ZnB/MOS and MOS had higher weight gains (p<0.05). Addition of Cr to ZnB tended to increase weight gain (+2.12% relative to ZnB). Weight gain was unaffected in the grower period. Over the entire trial, broilers given ZnB/Cr or ZnB/MOS or MOS alone tended to have higher weight gains compared to those given ZnB only. No significant differences were noted in feed intake; however NC birds tended to consume less feed. FCR days 1-21 was better in birds given ZnB/Cr or ZnB/MOS or MOS alone compared to NC or ZnB (p<0.05). Improvements of 4.23 and 4.17% (p<0.05) were shown by MOS and ZnB/MOS relative to ZnB. Cr addition to ZnB improved FCR by 2.14% compared to ZnB alone. FCR during the grower period was unaffected. Overall, the Cr and MOS-supplemented birds tended to have better FCR than ZnB and NC groups. MOS and ZnB/Cr brought about a slightly higher breast yield than the ZnB and NC (p>0.05). Moreover, both Cr and MOS tended to reduce abdominal fat yields compared to ZnB. It was concluded that ZnB/Cr or ZnB/MOS or MOS alone increased weight gain and efficiency days 1-21. As the trial was conducted during the hot summer months, Bio-Mos and Cr appeared to assist in overcoming the stress of heat and humidity experienced by young birds.

Key Words: Mannan oligosaccharides, Chromium, Zn bacitracin

S148 Effects of Dietary Vitamin E Supplementation in Young Male Turkey Poults: I. Growth Performance and Lymphoid Organ Characteristics. J. Kalbfleisch1, G. F. Erf2, J. Brannon1, and S. Noll*, 1Dept. of Animal Science, University of Minnesota, St. Paul, MN 55108, USA, 2Dept. of Poultry Science, University of Arkansas, Fayetteville, AR 72701, USA.

To examine the effects of dietary vitamin E (VE, alpha-tocopherol acetate) supplementation on performance of young turkey poults, 675 poults (male, Nicholas strain) were raised in floor pens (35 birds/pen) on previously used litter and vaccinated for Newcastle disease and hemorhagic enteritis (HE) at 2 and 4 wks of age, respectively. Treatments consisted of corn-soybean meal-meat bone meal based diets supplemented with either 12 IU VE/kg (control), 50 IU VE/kg (MVE) or 150 IU VE/kg (HVE) (6 pens/treatment). Turkeys were individually weighed at 0, 3, and 6 wks of age. Pen feed intake was determined for each 3-wk period. Blood samples (5/pen) were taken preceding each vaccination and weekly thereafter to determine vaccine response. At 6 wks of age, 2 birds per pen were sacrificed and lymphoid tissues removed, weighed, and the number of leukocytes determined (total and per g of tissue). Body weights were unaffected by treatment at 3 and 6 wks of age. Feed intake was significantly (P<0.05) greater for HVE birds for the 6 wk period. However, feed efficiency was not different among the treatments. Weights (g/100g BW) of spleen, bursa, and thymus were unaffected by VE, as were the number of leukocytes per lymphoid organ and per g of lymphoid tissue. Poults receiving MVE and HVE had a greater numeric incidence of HE-positive antiseras.

Key Words: Turkey, Growth rate, Feed intake, Vitamin E, Lymphoid organs.

Table 1. Effect of storage on eggshell breaking strength (kg) and Haugh units.

<table>
<thead>
<tr>
<th>Day of trial</th>
<th>No storage</th>
<th>7 d storage</th>
<th>21 d storage</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2.974a</td>
<td>3.217b</td>
<td>3.149b</td>
<td>0.060</td>
</tr>
<tr>
<td>21</td>
<td>3.019b</td>
<td>3.026b</td>
<td>2.820b</td>
<td>0.058</td>
</tr>
<tr>
<td>42</td>
<td>2.967b</td>
<td>3.090b</td>
<td>2.812b</td>
<td>0.056</td>
</tr>
<tr>
<td>Haugh units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>87a</td>
<td>54a</td>
<td>60b</td>
<td>0.8</td>
</tr>
<tr>
<td>21</td>
<td>84a</td>
<td>57b</td>
<td>61b</td>
<td>1.0</td>
</tr>
<tr>
<td>42</td>
<td>86a</td>
<td>60b</td>
<td>62b</td>
<td>0.9</td>
</tr>
</tbody>
</table>

These results indicate that both eggshell breaking strength and internal egg quality were affected by storage and that breaking strength was influenced by dietary selenium.

Key Words: Selenium, Eggshell breaking strength, Haugh unit, Egg storage, Selenized yeast
S149  Effects of Dietary Vitamin E Supplementation in Young Male Turkey Poults: II. Tissue Levels of Vitamin E, Proportions and Concentrations of Immune Cells. G. F. Erf1, S. Nolf2, T. K. Bersi1, X. Wang3, J. Kalbfleisch4, and W. G. Bottje5. 1Dept. of Poultry Science, University of Arkansas, Fayetteville, AR 72701, USA, 2Dept. of Animal Science, University of Minnesota, St. Paul, MN 55108, USA.

To examine the effects of dietary vitamin E (VE, alpha-tocopherol acetate) supplementation on immune system development in young turkey poults, poults were raised in floor pens (35 birds/pen, 18 pens) on previously used litter and vaccinated for Newcastle disease and hemorrhagic enteritis. Treatments consisted of turkey starter feed supplemented with either 12 IU VE/kg (control), 50 IU VE/kg (MVE) or 150 IU VE/kg (HVE) (6 pens/treatment). When the birds were 6 weeks of age, blood, lymphoid organs, and liver were collected from two birds per pen. Portions of thymus, spleen, bursa, and liver were snap frozen for analysis of VE content. Peripheral blood mononuclear cell (PMNC) suspensions and suspensions from thymus and spleen were prepared for analysis of lymphocyte subsets. Cells were immunofluorescently labeled using a panel of antibodies specific for lymphocyte subsets in turkeys (lymphocytes, T helper cells, cytotoxic T cells, and B cells) and analyzed by flow cytometry. VE levels were highest in thymus, bursa, spleen, and liver in poults receiving the HVE diet, whereas tissue VE levels in birds fed the MVE diet were either intermediate (thymus) or not different from those in controls (bursa, spleen, liver). Poults receiving the HVE diet had increased proportions of lymphocytes and decreased proportions of helper cells, cytotoxic T cells, and B cells in comparison to those receiving the control diet. B cells and helper cells were not significantly affected by treatment.

Key Words: Turkey, Leukocytes, Lymphocytes, Vitamin E, Lymphoid organs

S150  Evaluation of feeding phytase daily or every-other-day to broilers from 0-21 days of age. J. M. Harter-Dennis1, J. Timmons1, D. Ferara1, and A. E. Selton2, 1Dept. of Agriculture, University of Maryland Eastern Shore, 2Alltech Inc., Guelph, Ontario, Canada.

One of the potential problems with post-pellet spray application of phytase is the potential for uneven coverage of the pellets which may reduce its beneficial effects of increasing phosphorus availability in cereal grains. This experiment was designed to mimic this problem by feeding phytase-containing feed daily and comparing the performance to birds fed a 2X dose of phytase every second day. Two hundred and twenty-four one-day old male broilers were fed commercial-type mash starter diets formulated to meet or exceed NRC standards for all nutrients except available phosphorus (AP). All diets contained 1.0% Ca. The experiment consisted of 4 treatments with 8 reps/trt and 7 male broilers/rep. Diet 1 was formulated to contain .45%AP and diets 2, 3 and 4 to contain .25%AP. All treatments consisted of wheat/soy diets containing either 0.10 or 0.25 ppm Se supplied either in selenite or organic form (Sel-Plex, Alltech Inc.) fed with 50 ppm vitamin E and 0.10 ppm inorganic or organic Se plus 100 ppm vitamin E. Measurements included weekly weights, intake at 21 and 38 days and feather scores at day 37. Whole, eviscerated weight and meat yield were measured at 21 and 38 days and feather scores at day 37. The 24-h drip loss was determined and the breast fillets and marylands weighed. A 2 x 2 factorial ANOVA was performed based on Se level and source followed by another 2 x 2 factorial ANOVA based on 2 levels of vitamin E and 2 sources of Se. Growth was unaffected by treatment, however increasing dietary Se improved FCE (P=0.018) from 0.559 to 0.577 owing to lower feed intake while sustaining the same growth rate. Feathers scores improved as dietary Se increased (P=0.084). Feather scores increased as dietary Se increased (P<0.05); and birds fed diets containing organic Se had better feather coverage. Organic Se increased weight of the marylands (P<0.05); however, Se source and level interacted on breast weight with increasing organic Se level improving breast weight whereas inorganic Se had the opposite effect. Increasing dietary Se reduced (P<0.001) drip loss from 1.19 to 0.78%, whilst birds receiving sodium selenite had a higher drip loss (1.12%) than those fed the organic source (0.85%). Inclusion of vitamin E at two levels with a 0.1 ppm background Se from both inorganic and organic sources had no effect on performance or meat quality. It may be concluded that Se is an essential micronutrient in poultry influencing not only meat yield and quality, but also performance. The organic source of Se was superior to the inorganic source.

Key Words: Selenium, Vitamin E, Carcass composition

S151  Comparative evaluation of a yeast culture, mannanoligosaccharide and an antibiotic on performance of turkeys. V.G. Stanley1, C. Brown1, and A.E. Selton2. 1Prairie View A&M University, Prairie View, Texas, USA, 2Alltech Inc., Nicholasville, Kentucky, USA.

Current restrictions on the use of antibiotics to enhance poultry performance have led producers and researchers to search for alternatives. Yeast cultures and mannan oligosaccharides have been shown to enhance turkey performance. The objective of the current study was to compare the efficacy of yeast culture (YS) (Yea-Sacc1026, Alltech Inc., Nicholasville, KY, 0.1 g/kg), mannan oligosaccharide (MOS) (Bio-Mos, Alltech Inc., Nicholasville, KY, 0.05 g/kg) and terramycin (TM) (50 mg/kg). Broad-breasted White turkeys were fed either a negative control corn-soy based diet or a diet with one of the test feed additives. Body weight and mortality were evaluated every two weeks. Mortality did not differ among treatments. Litter moisture, pH, and coliform numbers, and drinker coliform counts were evaluated at 105 days of age. Body weights of YS (7.09 kg) supplemented birds were greater (P<0.05) at 105 days of age than control (7.09 kg), TM (7.23 kg) or MOS (7.14 kg). Moisture content of litter from TM (27.1%) and MOS (27.3%) was lower (P<0.5) than litter from birds given YS (37.2%) or the control diet (37.2%). The lowest mean pH was observed in litter from turkeys fed MOS, followed in order by YS, TM and the control. Litter from turkeys given MOS had the lowest coliform count (log 6.5±n0.12 CFU/g), TM (log 5.11±0.47 CFU/g) and the control (log 6.5±0.12 CFU/g). Drinker coliform counts were significantly lower (P<0.05) for YS-fed birds (log 5.18±0.37 CFU/ml) than for TM (log 5.79±0.16 CFU/ml), MOS (log 6.02±0.07 CFU/ml), or the control (log 5.90±0.12 CFU/ml). It was concluded that both YS and MOS were viable alternatives to the antibiotic TM as growth enhancers for turkeys.

Key Words: Yeast culture, mannan oligosaccharides, terramycin


A study was conducted at Barter Pty. Ltd. in Griffith, NSW to examine effects of selenium (Se) level and source on broiler performance and meat quality as well as the interaction between vitamin E and Se source. A total of 3,600 day-old male chicks were divided into 36 floor pens in 6 treatments consisting of wheat/soy diets containing either 0.10 or 0.25 ppm Se supplied either in selenite or organic form (Sel-Plex, Alltech Inc.) fed with 50 ppm vitamin E and 0.10 ppm inorganic or organic Se plus 100 ppm vitamin E. Measurements included weekly weights, intake at 21 and 38 days and feather scores at day 37. Whole, eviscerated weight and dressed weights were measured at a subset of birds per treatment processed day 38. The 24-h drip loss was determined and the breast fillets and marylands weighed. A 2 x 2 factorial ANOVA was performed based on Se level and source followed by another 2 x 2 factorial ANOVA based on 2 levels of vitamin E and 2 sources of Se. Growth was unaffected by treatment, however increasing dietary Se improved FCE (P<0.018) from 0.559 to 0.577 owing to lower feed intake while sustaining the same growth rate, particularly where organic Se was fed (P=0.084). Feather scores improved as dietary Se increased (P<0.001); and birds fed diets containing organic Se had better feather coverage. Organic Se increased weight of the marylands (P<0.05); however, Se source and level interacted on breast weight with increasing organic Se level improving breast weight whereas inorganic Se had the opposite effect. Increasing dietary Se reduced (P<0.001) drip loss from 1.19 to 0.78%, whilst birds receiving sodium selenite had a higher drip loss (1.12%) than those fed the organic source (0.85%). Inclusion of vitamin E at two levels with a 0.1 ppm background Se from both inorganic and organic sources had no effect on performance or meat quality. It may be concluded that Se is an essential micronutrient in poultry influencing not only meat yield and quality, but also performance. The organic source of Se was superior to the inorganic source.

Key Words: Selenium, Vitamin E, Carcass composition

Key Words: phytase, available phosphorus, Allzyme, enzymes, broilers
S153 Carcass yield from broilers fed either sodium selenite or sodium yeast. F. W. Edens*1, C. R. Parkhurst1, and A. E. Sefton2. 1North Carolina State University, Raleigh, NC USA, 2Alltech Biotechnology Center, Nicholasville, KY USA.

Sodium selenite (NS) has been the traditional source of selenium in poultry diets, but selenium yeast (SelPlex®) has become widely used in several countries signaling its importance as a substitute for selenite. Selenium yeast (OR) is equivalent or even superior to NS in terms of gut absorption, performance, induction of whole body feathering, and tissue retention. Therefore, it was of interest to extend our understanding of the influence of selenium on performance characteristics and investigate the influence of OR vs NS. Sodium selenite (NS-0.1 and 0.3 PPM) and selenium yeast (OR-0.1 and 0.3 PPM) were provided in the diets of auto-tossing slow feathering male broilers given starter (3177 kcal/kg ME, 22.5% CP), grower (3168 kcal/kg, 19.5% CP), and finisher (3160 kcal/kg, 17.5% CP) formulations. Vitamin E was supplied at 33 IU/kg of diet. At 49d of age, spring- and summer-grown broilers were slaughtered, and carcass yields were determined. The percentage yield of cut-up parts was not different between spring and summer. Both NS and OR increased fat pad at 0.3 PPM. Leg and thigh yields were increased by OR at 0.1 and 0.3 PPM. Yield of feet for both OR and NS was decreased by 0.3 PPM. However, yield of pectoral major was decreased by OR, and pectoral minor yield was decreased by OR at 0.3 PPM. Breast meat yields were negatively correlated with increased feather yield in OR supplemented birds. Breast meat yields were also decreased by 0.3 PPM selenium supplementation. The data suggest that OR supplementation caused a small redistribution of body mass that may be associated with improved early feathering in broiler males.

Key Words: Organic selenium, Selenite, Carcass yield, Feathering, Broiler

S154 Histological alteration in the thymus, ileum and bursa of fabricius of turkey poult challenged with a novel small round virus. F. W. Edens*1, M. A. Qureshi2, and Y. M. Saif3. 1North Carolina State University, Raleigh, NC USA, 2FAHPR: The Ohio State University, Wooster, OH USA.

The small round virus (SRV; 103 EID50), isolated from turkey poult exhibiting signs of poult enteritis and mortality syndrome (PEMS), was given to 7-day-old poult as an oral challenge (SRV only), and 3 d later uninoculated (EC only) or SRV-challenged (SRV+EC) groups were given an oral challenge of 108 CFU of turkey E. coli isolates. These three groups were compared with a control group inoculated with 0.2 mL of turkey embryo homogenate from normal SPF embryo. Poult in the four treatment groups were maintained separately in inflatable isolation units. At 3, 5, and 7 d post bacterial inoculation (PI), sections of the thymus, bursa of Fabricius and proximal ileum were collected and fixed in neutral buffered formalin, sectioned at 5 microns and stained with Giemsa or hematoxylin and eosin. Birds given the virus only challenge exhibited moderate thymic degeneration with eosinophilic infiltration, moderate degeneration of the proximal ileum and mild degeneration of the bursal epithelium. Tissues from E. coli challenged poult showed degeneration of the bursal follicles often in association with eosinophilic infiltration, moderate thymic degeneration, and degenerated ileum villi associated with increased numbers and size of goblet cells, a sign not found with virus challenge. Degenerative changes in bursa, thymus and ileum were exacerbated with the virus plus bacterial challenge. At 7 d PI, tissues from bacteria-challenged birds continued to show pathology of the ileum, but in SRV only birds, the ileum was beginning to show signs of healing. These data suggest that the combination of SRV and E. coli induce pathological signs that resemble PEMS and supports the idea that the SRV may be the etiologic agent causing PEMS.

Key Words: Poult, Enteritis, SRV, E. coli, Eosinophilic inflammation

S155 The effect of betaine on lesion scores and tensile strength of coccidia-challenged broilers. J.C. Remus*1, M. A.Q.ureshi1, and Y. M. Saif2. 1North Carolina State University, Raleigh, NC USA, 2Colorado Quality Research, Wellington, Colorado, USA.

This experiment tested if betaine (Betafin BCR) could improve lesion score and tensile strength of coccidia-challenged (CC) chicks fed a methionine spared diet. Male Ross chicks were brooded in cages to 12 days then assigned to a treatment, which was replicated 10 times with 10 chicks per pen. A corn-soya basal starter diet (B) was formulated to contain 0.45% methionine, 0.80% TSAA, 66 ppm salinomycin and was adequate in other nutrients. The treatments consisted of B-no challenge (B+NC), B+CC, B+0.075%DL-methionine+NC (B+DLM+NC), B+DLM+CC, B+0.075%DL-methionine+CC (B+DLM+Bet+CC) and B+DLM+betaine+CC (B+750Bet+CC). Coccidia challenge was given orally at 14 days of age and consisted of 10,000 oocysts Eimeria tenella, 30,000 oocysts E. maxima and 150,000 oocysts E. acervulina per bird. Five birds per pen were lesion scored 6 days post challenge using the Johnson and Reid method (1970). At 7 days post challenge, 2 birds per pen were sampled for tensile strength tests using an Ametek Accuforce Cadet Digital force gauge. The areas tested were the upper (15.24 cm anterior to base of duodenal loop), mid (7.62 cm either side of the yolk stalk) and lower (15.24 cm starting at 7.62 cm anterior to the ileocecal junction). No differences were noted for gain or feed:gain. No detectable lesions were seen in NC treatments. The average lesion scores for CC treatments were less than 1, thus a subclinical challenge was present. The B+CC and B+DLM+CC had the highest total lesion scores while both betaine additions to the B diet improved these scores in CC birds. The best average tensile strength occurred in B+750Bet+CC and the two NC groups, these were higher than the B+CC and B+DLM+CC values. The average tensile strength of B+375Bet+CC did not match B+NC but was still better than the B+CC and B+DLM+CC. This work indicates that lesion score improvements noted in betaine supplemented birds fed a methionine spared diet may be expressed as better maintenance of NC tensile strength when birds are exposed to coccidia.

Key Words: Coccidia, Betaine, Tensile strength

S156 Immunocytochemical demonstration of a chromogranin A (CGA)-like substance in the chicken bursa of Fabricius. Kathleen E Clements*1, Nahum O. Puebla1, Amanda E. Compton1, John A. Proudmann2, Stefan Clerens3, Gert Van den Bergh3, Frank Van Den Enden1, and Luc R. Berghman1. 1Poultry Science Department, Texas A&M University, College Station TX 77843, 2Germplasm and Game Biology Laboratory, USDA-ARS Beltsville, 3Lab of Neuroendocrinology and Immunological Biotechnology, University of Leuven, Belgium.

The bursa of Fabricius is primarily known as the central immune organ responsible for the differentiation of B-lymphocytes in birds. In addition, several papers have also reported the presence of endocrine (hormones) and neuroendocrine components (neuropeptides) in the bursa. It is, however, not always clear if these substances can be linked to the bursal secretory dendritic-like cell originally reported by Glick and Olah in 1978. In an attempt to develop an alternative approach to the study of the neuroendocrine aspects of the bursa of Fabricius, we have used a recently developed monoclonal antibody against turkey chromogranin A (CGA), a member of a family of regulated secretory proteins found in the secretory granules of many neuroendocrine and nervous tissues. Bursa tissue from 26-day old broilers was fixed in Bouin Hollande Sublimate, paraffin-embedded and 7-μm sections were made. Upon dewaxing, the sections were incubated overnight with monoclonal anti-turkey CGA (as citric acid, dilutions ranging from 1/1000 to 1/9000). The next day, the primary antibody was detected with a peroxidase-conjugated secondary antibody in combination with hydrogen peroxide and diaminobenzidine as the substrate system. Preliminary results clearly showed the presence of a CGA-related molecule in a dendritic-like cell type in the bursa of Fabricius, although not all animals displayed immunoreactivity. At this moment, however, it is unclear whether the difference between individual animals is merely a matter of sensitivity of the employed detection system or whether expression of CGA is a function of the animal’s physiological state. It has, indeed, been suggested that the expression of another neuro-endocrine marker protein, S-100, may be related with disease, i.e. ongoing immune activity. Therefore, we intend to use alternative fixation and embedding methods and other available anti-CGA antibodies in order to further optimize our localization strategy and to monitor the expression of CGA as a function of the immune response against different pathogens.

Key Words: Chicken, Bursa of Fabricius, Chromogranin A.
S157 A monoclonal antibody-based sandwich ELISA for chicken luteinizing hormone (LH). Nahum O. Puebla1, John A. Proudford2, Frans Vandesande3, and Luc R. Berghman1, 1Poultry Science Department Texas A&M University, 2Germplasm and Gamete Physiology Lab ARS-USDA Beltsville, 3Lab of Neuroendocrinology and Immunological Biotechnology, University of Leuven, Belgium.

Specific immunoasays for the respective pituitary glycoprotein hormones are difficult to develop because luteinizing hormone (LH), follicle-stimulating hormone (FSH) and thyroid-stimulating hormone (TSH) share a common α-subunit. In the past, we have reported on the production of monoclonal antibodies (mAbs) against the chicken LHβ and α-subunit. Based on the LHβ-specific mAbs, a sandwich ELISA has now been developed. In a first step, polystyrene microtiter plates are coated with a cocktail of three protein A-purified mAbs against the chicken LHβ-subunit. Upon incubation of the samples, the captured LH molecules are then detected by addition of a rabbit anti-α-subunit antiserum. Finally, the sandwiched cLH is detected with a species-specific biotinylated secondary antibody and peroxidase-conjugated streptavidin. The detection limit of this assay is in the order of 80 pg LH/ml (USDA-cLH-K-3). Cross-reaction with USDA-cFSH-K-1 is 0.3%, and no cross-reactivity can be detected with affinity-purified cGH and biosynthetic cPRL. Assay of plasma samples from thyroidectomized animals does not suggest any cross-reactivity with cTSH. In spite of its apparently ample sensitivity as expressed in ng USDA-cLH-K-3/ml, final concentrations of up to 50% laying hen plasma barely produce a measurable signal in this new assay, suggesting circulating LH levels in the order of 0.1 ± 0.2 ng/ml, i.e. ten-fold lower than classicRIA values. It was verified that this is not due to so-called matrix effects of adult hen plasma by establishing a standard curve of USDA-cLH-K-3 in 50% adult hen plasma. By contrast, the assay performed excellently in plasma samples of juvenile chickens and roosters. For instance, LHRH-induced LH peaks were detected without any problem. Our data can be explained by the pronounced isoform preferences of this new assay — in line with our earlier observations — in combination with the assumption that the isof orm composition of circulating LH is different in the adult hen as compared to juvenile chickens and adult males.

Key Words: Chicken, Luteinizing Hormone, ELISA


Control of bursal lymphocyte proliferation during maturation and early immunoglobulin expression is poorly understood. Presently, we evaluated the effect of serum or IgG on 3H-Thymidine incorporation (DNA synthesis) by neonatal bursal lymphocytes. In experiment 1, serum from three rabbits was heat inactivated and evaluated for effects on proliferation at either 0.3%, 1%, or 3% final serum concentration. Serum (3%) from all three animals significantly decreased DNA synthesis as compared to phorbol 12,13 dibutyrate- (PDB) stimulated controls. Additionally, 0.3% and 1% serum from two of the rabbits significantly decreased DNA synthesis. In a second experiment, commercially-purified rabbit IgG, at a concentration of 2 mg/ml final concentration, was found to significantly decrease (45%) 3H-Thymidine uptake of neonatal bursal lymphocytes as compared to PDB-stimulated controls. Similarly, the effect of 0.002, 0.02, or 0.2 mg/ml final concentration of commercially-purified chicken IgG, rabbit IgG, or bovine serum albumin on these bursal lymphocyte proliferation was investigated in experiment 3. All concentrations of either rabbit or chicken IgG significantly (p < .05) decreased 3H-Thymidine uptake of lymphocytes as compared to PDB-stimulated controls. Although a small suppression of DNA synthesis was observed in response to the BSA protein control, 0.2 mg/ml of either chicken or rabbit IgG suppressed DNA synthesis significantly more than the appropriate BSA protein control. These data indicate that as little as 0.2 mg/ml IgG may significantly decrease day-old-chick B-lymphocytes proliferation in vitro. As circulating concentrations of maternal IgG in excess of these concentrations are found in neonatal chicks, these findings open the possibility that IgG in the microenvironment of B-lymphocyte development may influence proliferation and may be involved in development regulatory influence within the bursa of Fabricius.

Key Words: Bursa of Fabricius, IgG, Lymphocytes, Proliferation

S159 Heterogeneity in broiler breeder hens: Does leptin play a role?: C.M. Ashwell1, J.P. McMurtrey1, and C.N. Coon2, 1Growth Biology Laboratory, USDA-ARS, Beltsville, MD 20705, 2Center of Excellence for Poultry Science, University of Arkansas, Fayetteville, AR 72701.

The polypeptide hormone leptin has been shown to regulate feed intake and energy homeostasis in mammals. Leptin is also thought to play a role in the onset of puberty and reproductive cycle of mammals. Recent studies have demonstrated the presence of leptin homologs in poultry species. The possible role of leptin in broiler breeder hen physiology was investigated due to recent difficulties in managing hen body weight, feed intake, and reproductive efficiency. Thirty Cobb-500 hens (25 weeks of age), photonuculated but not actively laying, were removed from feed restriction and fed ad libitum in individual cages. After 4 days of adjustment, daily feed intake and body weight were measured for each hen. Upon calculating each bird’s daily feed intake (g)/metabolic body weight (kg 0.75), the 3 hens with the highest (0.204) and lowest (0.095) average values were analyzed for leptin mRNA expression levels. Using an RT-PCR based assay for quantification of leptin mRNA levels, significant differences (*p<0.05) were detected between the high and low groups. Hens with low feed intake had as much as 90% greater leptin mRNA levels over the high feed intake hens. This observation suggests similar effects of leptin on feed intake and energy balance in chickens as that found in mammals. The level of leptin expression in broiler breeders may be an important marker for hens that are able to maintain optimal body conditions for egg production without stringent management techniques.

Key Words: Broiler breeder, Feed Intake, Management, Reproductive efficiency


Microbial contamination of egg shells is of great importance in the commercial production of table eggs. The objective of this project was to evaluate the aerobic plate counts (APC’s) of eggshells in both an in-line and off-line egg processing facility at selected sites, throughout the processing procedure. Samples were collected through the daily processing shift. Four sites in the processing plant and five time periods were chosen for the experiments. The first site was from the conveyor system before passing through the washing machine. The second site was after detergent wash but before sanitizer application. The third site was immediately after sanitizing. The fourth site was immediately before packaging. Samples were taken from the sites at five equally spaced intervals. Three eggs were collected from each site, and removed aseptically and placed into sterile plastic bags containing 50 ml of phosphate buffered solution (PBS). The PBS was then immediately serially diluted. The dilutions were plated on aerobic plate count agar within eight hours of collection and incubated at 37 C for 48 hours. The in-line versus off-line comparisons were within time periods across sites. As the processing shift progresses off-line incoming APC counts were significantly higher than in-line eggs at site 1. After time period 1 at site 2 off-line APC counts were significantly higher. After time period 1 at site 3 off-line APC counts were significantly higher. Site 4 off-line counts were significantly higher than in-line counts at all times.

Key Words: In-line, Off-line, Aerobic plate counts


Meat processors need an accurate and reliable means of measuring fat content of deboned raw materials and final products on a production line. This quality control check is needed to verify the lean content of the final product to ensure compliance with consumer specifications. Solvent extraction methods for fat are accurate but laborious, time consuming, use toxic chemicals and produce toxic waste fluids. Near infrared transmission (NIT) spectroscopy has been used to analyze the fat composition of beef, pork and lamb. The NIT technique to analyze fat content in poultry lean meat was investigated. Deboned poultry breast muscle, trimmings, and finished products (i.e. chicken nuggets with spices and additives) were collected from a local processing plant over a 4-month period. Fat was measured by the Soxtec solvent extraction method. Fat values ranged
S162  The Susceptibility of Domestic Birds to West Nile Virus. Y. Weisman*, C. Banet, and M. Malkinson, Kimron Veterinary Institute, Bet-Dagan, Israel.

In the last two years a number of West Nile virus isolates were made from the brains of wild and domestic birds. In an attempt to characterize their virulence, we have inoculated groups of broilers, turkey poultys and young geese intraenarebralily (I/C) with several of these isolates. We observed that 3 to 6 weeks old geese were particurally susceptible to experimentia infection. In addition, some of the broilers had clinical signs of infec-
tion (nervous signs inappetance and death). Antibodies were detected by ELISA and virus neutralization in the sera of broilers and turkeys that resisted I/C challenge.

Key Words: West Nile Virus, Geese, Broilers

S163  The adult darkling beetle, Alphitobius diaper-
virus as a candidate vector for the transmission of turkey coronavirus (TCV). W. Watson1, J. Guy2, and S. M. Stringham3,4, 1N. C. State University, Raleigh, NC, 2College of Veterinary Medicine, N. C. State University, Raleigh, NC.

Turkey coronavirus (TCV) is a debilitating enzootic disease of turkeys. TCV is often, but not always, associated with Poult Enteritis Mortality Syndrome (PEMS) an enzotic disease of turkeys of an unknown etiology. Insects may be involved in the epizootiology of this disease. The objective of this study was to examine the potential of adult darkling beetles to transmit TCV virus, strain NC95, to healthy turkeys under laboratory conditions.

Virus isolate (NC95) is a highly infectious strain with low mortality. Beetles were fed virus-infected feces mixed with chicken feed. The nega-
tive control beetles were given chicken feed and water. Beetle guts were dissected and the guts removed at hour 1, 12, 24, 48, 72 and 96 follow-
ing the initial viral feeding. Guts were homogenized and injected into turkey eggs for embryo propagation. Fluorescent antibody was used to determine the presence of TCV.

Darkling beetles were found to be capable of mechanical transmission of TCV for a short period. Only turkey embryos receiving beetle guts within one hour of feeding virus were positive for TCV. The limited time during which darkling beetles are able to transmit TCV indicates that this insect is a poor candidate as a mechanical vector of TCV in the field.

Key Words: Darkling beetles, Turkey coronavirus, Transmission

S164  A novel small round virus induces alterations in performance and macrophage functions in turkey poultys. M.A. Qureshi*, F.W. Edens1, and Y.M. Saif2, 1North Carolina State University, Raleigh, NC, 2The Ohio State University, Wooster, OH.

The small round virus (SRV) is a single stranded RNA virus recently isolated from turkey poultys exhibiting poult enteritis and mortality syn-
drome (PEMS). The current study mortality turkey poultys were orally challenged with 10^3 EID50 of SRV at 7d of age followed 3 days later with an oral challenge of 1 x 10^6 turkey E. coli isolates. Control (inoculated with 0.2 mL of turkey embryo homogenate from normal SPF embryos), SRV alone and E. coli alone poultys groups were also included. The SRV (122g) and SRV+E. coli (138g) group poultys exhibited significant reduction in 7d gain as compared with the control (165g) and E. coli (167g) alone group poultys. Thymic and bursal atrophy was pronounced in SRV alone group at 3.5 & 7d PI. The interaction of SRV and turkey macrophages was also examined. Sephadex-elicted abdinal macrophages from normal poultys were cultured and incubated with 0, 1, 5, and 10 µL of SRV for 42 to 48h. SRV exposure reduced macrophage viability by 15 to 26% vs sham-exposed macrophage cultures. SRV-infected macrophages exhib-
ted 15-27% reduction in percentage of phagocytic macrophages for E. coli. Furthermore, a 17-47% reduction in E. coli killing by SRV infected macrophages occurred over uninfected macrophages. These findings im-
ply that SRV alone or in combination with E. coli affects poult growth and lymphoid organ development. Furthermore, SRV infection may re-
duces macrophage viability as well as the phagocytic and bactericidal potential of turkey macrophages.

Key Words: SRV, E. coli, PEMS, Poult performance, Macrophage func-
tion

S165  Molecular Characterization of an Avian Ast-
tovirus isolated from Poult Enteritis Mortality Syndrome Affected Turkeys. M.D. Koci1,2, V.M. Simmons1,2, D.R. Kapczynski1, B.S. Seal1, and S. Schultz-Cherry1, 1Southeast Poult-
try Research Laboratory, Agricultural Research Services, USDA, Athens, GA 30605, 2Department of Veterinary Pathology, College of Veterinary Pathology, Univ. of Georgia, Athens, GA.

Poult enteritis mortality syndrome (PEMS) is an emerging, infectious disease of young turkeys. PEMS is characterized by high mortality and gastroenteritis. Here we report the identification and molecular charac-
terization of an avian astrovirus isolated from PEMS affected turkeys. Astroviruses are known to cause disease in several animals, including turkeys, although only human astroviruses have been well characterized. The genomic organization and predicted amino acid motifs of the turkey astrovirus isolate are consistent with previously reported astroviruses. Sequence analysis was used to detect the active site for a serine pro-
teinase in the S1 gene sequence on the genome RNA. Studies are currently underway to investigate the role of astrovirus in PEMS.

Key Words: PEMS, Turkeys, Astrovirus, Serine protease, Frameshift

S166  Initial Characterization of an Avian Reovirus Isolated from Turkey Poultys with Poult Enteritis Mortality Syndrome. V.M. Simmons1,2, M.D. Koci1,2, D.R. Kapczynski1, S. Schultz-Cherry1, 1Southeast Poultry Research Laboratory, Agricultural Research Services, USDA, Athens, GA, 2Department of Veterinary Pathology, College of Veterinary Medicine, Univ. of Georgia, Athens, GA.

We isolated an avian reovirus (ARV) from turkey poultys infected with Poult Enteritis Mortality Syndrome (PEMS). Antigenic and nucleotide comparisons were performed to characterize the similarity between the PEMS ARV isolate and S1133, the chicken ARV reference strain. Virus neutralization and indirect immunofluorescence assays revealed that the antibody against S1133 does not fully neutralize or recognize the PEMS ARV isolate. To support these data we compared the S1 gene nucleotide sequence of both viruses. Sequence analysis suggests that the PEMS iso-
late is less than 50% similar to ARV S1133. Further studies will reveal if the lack of similarity is attributable to the PEMS ARV isolate being novel or to species differences.

Key Words: Reovirus, Turkey, PEMS, S1133, Sequence

S167  Phylogenetic Comparision of the S3 Segment of a Novel Turkey Reovirus Isolated from PEMS-Infected Poultys to Other Avian and Mammalian Reoviruses. D.R. Kapczynski1, V.M. Simmons1,2, M.D. Koci1,2, and S. Schultz-
Cherry1, 1Southeast Poultry Research Laboratory, Agricultural Research Services, USDA, Athens, GA, 2Department of Veterinary Pathology, Col-
lege of Veterinary Medicine, Univ. of Georgia, Athens, GA.

Avian reovirus infection in turkeys causes diarrhea, growth depression and mortality. In an attempt to characterize their virulence, we have isolated a novel turkey reovirus from PEMS-affected poultys. Phylogenetic analysis of the nucleotide sequence indicated that the PEMS isolate is approximately 68% similar to other reported reoviruses. It has a novel genome organization and is a member of the genus Astrovirus. Phylogenetic analysis of the nucleotide sequence indicated that the PEMS isolate is approximately 68% similar to other reported reoviruses. It has a novel genome organization and is a member of the genus Astrovirus.

Key Words: Reovirus, Turkey, PEMS, S1133, Sequence

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analysis of the PEMS reovirus indicates a putative zinc-finger motif and a basic amino acid region in the C terminus. This is the first work to provide molecular data for a turkey reovirus.

**Key Words:** Reovirus, Turkey, PEMS, Sequence

**S168** Interactions of Cornell Isolate PEMS Virus with Turkey Macrophages. C. L. Heggen-Peay*1, M. A. Qureshi1, and K. A. Schat2, 1 North Carolina State University, Raleigh, NC, 2 Cornell University, Ithaca, NY.

High mortality and 100% morbidity characterize poult enteritis and mortality syndrome (PEMS), an acute, infectious, intestinal disease of turkey pouls. PEMS is a multifactorial disease since viruses, bacteria, insects, young age, stress, temperature, and moisture all seem to play a role. However, it is believed that one factor may be identified as a primary causative agent of PEMS. This belief has led to the identification of several new viruses. The Cornell isolate virus has been shown to cause decreased body weight and decreased relative bursa and thymus weights when inoculated into turkey pouls at 7 d of age, as compared with non-inoculated hatchmate controls. The current study evaluated effects of in vitro treatment of abdominal macrophages from turkey pouls with Cornell isolate virus. Three trials were conducted on macrophages harvested from 3- to 5-day-old pouls. In each trial, the number of adherent macrophages was significantly lower (p<0.05) at 24 and 48 h post-infection in the virus-treated samples as compared with the controls. When MTT was added for the last 4 h of incubation, no differences were observed at 24 h post-treatment. However, at 48 h post-treatment, absorbance was significantly higher (p≤0.05) when 1 and 5 µL of virus were added, as compared to 0 and 10 µL of virus added, suggesting that the virus may be activating the macrophages, resulting in increased metabolism of MTT. In Trials 2 and 3, the number of adherent macrophages treated with virus was significantly increased (p<0.05) as compared with non-treated controls at several time points post-treatment. When MTT was added to macrophage cultures for the last 4 h of incubation, absorbance was significantly increased (p<0.05) at 24 and 96 h (Trial 2) and at 24, 48, 72, and 96 h (Trial 3) in the virus-treated samples, again suggesting that the Cornell isolate virus may be activating macrophages in vitro. In addition, using convalescent sera, viral antigen could not be detected inside the macrophages treated with virus in vitro. These results suggest that the Cornell isolate virus may be an important factor in PEMS and its associated immune alterations.

**Key Words:** Cornell Virus, PEMS, Macrophage

**S169** Molecular and antigenic classification of viruses of the DE072 serotype of IBV isolated between 1990 and 1999 in the USA. C.W. Lee*, D.A. Hilt, and M.W. Jackwood, University of Georgia, Athens, Georgia.

Initial characterization of the DE072 strain indicated this virus was serologically distinct from other IBV serotypes. For this reason, only the DE072 vaccine strain (which was made from prototype DE072 strain) has been used to prevent infection of this IBV serotype. However, using the virus neutralization test, we found that subgroups of the DE072 serotype exist and cross protection may not be afforded by the DE072 vaccine. Sequence analysis of the entire S1 gene showed that only one isolate was relatively close to the DE072 vaccine strain and the majority of the isolates formed distinct group. These results demonstrate the persistence of viruses of the DE072 serotype strain and possibly explain why this strain is difficult to control. A DE072 vaccine protection test will be performed in SPF chickens to determine the protection efficacy against different subgroups of the DE072 serotype.

**Key Words:** IBV, DE072 serotype, Virus neutralization test, S1 gene, Vaccine protection test

**S170** Characterization of a Field Isolate of Infectious Bronchitis Virus in Layers by Classical Virologic Methods. C.N. Estevez*, P. Villegas, and J. El-Attrache, Poultry Diagnostic and Research Center, University of Georgia.

A virus field isolate that has been producing respiratory disease manifestations in a vaccinated layer operation in the Midwest United States was isolated and characterized as infectious bronchitis virus. Additional characterization using hemagglutination inhibition assays, ELISA and in-vivo vaccine protection assays indicate that this isolate is closely related to the IBV strain Delaware 072. However, cross reactivity with the Massachusetts and Connecticut strains was also observed.

**Key Words:** Infectious bronchitis, Viral strain, Layers

**S171** The Mechanism of Viral Entry of the Arkansas Serotype of Infectious Bronchitis Virus. B. Miguel* and C. Wang, Mississippi State University.

Infectious bronchitis virus (IBV) is an enveloped coronavirus that causes respiratory disease. IBV has a detrimental economic impact on the poultry industry due to high morbidity and an increase in condemnation at processing. The objective of present study was to investigate the mechanism of entry of the Arkansas (Ark) serotype of IBV into host cells. Primary chicken embryonic kidney and fibroblast cells infected with the Ark serotype at different incubation times were examined using electron microscopy. The virus was detected by electron microscopy at 1-minute post-infection. The virus particles were not enclosed in vesicles. Endocytosis inhibitors, such as protein kinase A (PKA) and cytochalasin D, were used to determine their effect on viral entry. Neither cytochalasin nor PKA inhibited penetration of the virus. Iron and zinc chelators, were used to evaluate the role of ions in virus receptor binding. The chelators for ions of two type, intracellular and membrane iron chelators. Results indicated that zinc was not involved in virus binding and penetration. Penetration was also not affected in the presence of an intracellular iron chelator, but was affected by the presence of a membrane iron chelator. Metallic ions involved in the penetration of the virus may give a clue to a binding receptor. This study suggests that fusion as oppose to endocytosis is the preferred route for the penetration of Ard serotype of IBV.

**Key Words:** Infectious bronchitis virus, Viral entry, Binding

**S172** Effect of Maternal Antibody on In Ovo Administration of Infectious Bursal Disease Virus Vaccines. J. J. Giambrone*1 and M. Corley1, 1 Auburn University.

In Ovo administration of Marek’s disease (MD) vaccine is becoming the method of choice for broiler flocks. Infectious bursal disease virus (IBDV) vaccines are also being tried by this method. Although the cell associated MD vaccines are not affected by maternal derived antibody (MDA), the efficacy of IBDV vaccines can be affected by MDA. In two experiments, we studied the effects of MDA on two IBDV vaccines given by the In Ovo route. Vaccines were the BursaHens (virulent 2512) and the BursaSplex (2512 + antibody). In the first study, both vaccines were given at the same titer to 18-day-old SPF broiler embryos. In the second study, both vaccines were given as in the first, but embryos were from two commercial breeder flocks of different ages (28 and 64 weeks). This was done to have embryos with either high or low levels of MDA. The AC ELISA test was used to determine the distribution of vaccine viruses in the bursa of Fabricius, spleen and thymus. The BursaHens was virulent in SPF broilers causing morbidity and mortality and atrophy of the bursa. This vaccine spread quickly in the bursa, spleen, and thymus. In contrast, the BursaSplex did not cause clinical disease, however, it did cause bursal atrophy. In commercial embryos, MDA slowed and reduced the spread of both vaccines and the amount of clinical disease seen with Bursa bolen. This slowing of vaccine replication and vaccine virulence was more apparent in embryos from the younger breeder flock, which had the highest MDA. Therefore, MDA had a profound influence on In Ovo administration of IBDV vaccines.

**Key Words:** IBDV, In Ovo, Vaccination, Maternal Antibody

**S173** Detection of Infectious Bursal Disease Virus by Antigen Capture Chemiluminescent ELISA. M.M. Corley*1, J.J. Giambrone1, T.V. Dormitorio1, and J. Hudson1, 1 Auburn University.

We investigated the limit of detection of two Infectious bursal disease (IBDV) vaccines administered in ovo to specific pathogen free (SPF) broilers, using a newly developed antigen capture chemiluminescent ELISA technique (ACC ELISA) technique. Embryos at 18 days of age were vaccinated with 100 EID50 of either IBDV-2512 or 2512-ICX. On days 3,6,9,15, and 21 post vaccination (PV), birds were sacrificed and bursa, spleen and thymus collected. Tissue homogenates were prepared and vaccine viral particles were released by freeze treatment and

**Key Words:** IBDV
centrifugation at 12,000 X G for 30 minutes. The ACC ELISA was conducted on the aqueous phase using anti-chicken IBVD as the coating antibody, monoclonal antibody 17-82, and the peroxidase labeled anti mouse IgG. A chemiluminescent peroxidase substrate was used instead of a chromogenic ABTS substrate. Chemiluminescence was measured in a luminometer at 425 nm. This procedure allowed detection of IBVD in tissues weighing as little as 0.02g. Either vaccine was detected in 1-day-old chickens (3-days PV). The IBVD virus migration was traced from the bursa to the spleen, and subsequently to the thymus. The virus was not found at 21 days PV. This technique is highly sensitive and useful in the accurate detection of small tissue samples from very young IBVD infected chickens.

Key Words: Chemiluminescence, ELISA, IBVD

S174 Molecular Characterization of Infectious Bursal Disease Virus Associated with Respiratory Problems and Poor Performance on Broiler Farms in Georgia. A. Banda*, M. Ruano, J. El-Attrache, and P. Villegas, Department of Avian Medicine, College of Veterinary Medicine, University of Georgia, Athens, GA.

IBVD was detected by RT-PCR from bursal samples of broiler chickens that were submitted with a history of recurrent respiratory problems and poor performance. These IBVD's were further characterized by RFLP. The IBVD variant E strain was predominately detected in most of the cases. Additional strains with genomic characteristics similar to that of IBVD strains variant A, Sal, and PBG-98 were also detected.

Key Words: Infectious bursal disease virus, RT-PCR, Broilers

S175 Experimental Production of Turkeys Tolerantly Infected with Avian Leukosis Virus Subgroup J. S Gharibeh1, T Brown1, and M Pantin1, University of Georgia.

Commercial turkeys (n = 10) were inoculated intravenously and intraperitoneally with 0.1 ml of ADOL-7501 isolate of avian leukosis virus-subgroup J (ALV-J) at 3 days of age. No gross or histologic lesions were observed in infected turkeys at 1, 2, or 3 weeks post inoculation (at the end of the necessary observation period). However, 4 weeks post inoculation four out of seven plasma samples from the infected turkeys became positive for ALV p27 by antigen capture ELISA. Plasma from these turkeys was subsequently tested using reverse transcriptase polymerase chain reaction assay (RT-PCR) using previously published H5 and H7 primer sets specific for ALV-J pol and env gene nucleic acid sequences and were positive for the next 23 weeks. The RT-PCR positive turkeys never developed detectable antibody to ALV-J specific gp85 using a commercially available ELISA and were considered to be tolerant infected. Plasma (0.1 ml) from RT-PCR positive ALV-J viremic turkeys plasma was collected at 15 weeks of age and injected into the yolk sac of fertile SPF chicken eggs at 5 days of incubation. Chicks hatched from these eggs were RT-PCR positive and viremic for ALV-J. To examine for potential ALV-J nucleotide sequence variations associated with this passage in turkeys, cDNA complimentary to sequence coding for a portion of gp85 was produced by RT-PCR from the stock virus (ADOL-7501), from the turkey plasma, and from plasma from the viremic SPF chicks. These cDNA’s were compared by sequence analysis.

Key Words: ALV-J, Viremia, Turkey, Chicken

S176 Competitive polymerase chain reaction for Avian Leukosis Virus Subgroup J. G. Zavala1, M. W. Jackwood1, and D. Hitt1, Department of Avian Medicine - The University of Georgia.

A competitive polymerase chain reaction (cPCR) was used to assist quantification of provirus derived from subgroup J avian leukosis virus (ALV-J) propagated in cell culture. Proviral DNA obtained from the American prototype strain ADOL-Hc1 was used as an internal control, and the ADOL-7501 isolate was used as a source of target proviral DNA to be quantified. The virus isolates were propagated in line 0 secondary chicken embryo fibroblasts. The proviral target DNA was harvested from replicate cultures of the inoculated cells every 24 hours for a total of 10 days post-inoculation. The relative densities of PCR amplicons for the internal control and the target sequences were compared to assess the concentration of initial target proviral DNA. The data obtained served to establish a proviral DNA growth curve as a function of viral replication. This system was thus used to determine the optimal time for harvesting proviral DNA after inoculation of cells with ALV-J. The cPCR system could also be used to quantify viral replication in susceptible birds.

Key Words: avian leukemia virus, competitive PCR

S177 Reduced phosphorous excretion using phytase enzyme and a purified phosphorous product. P. L. Ruszler*, Virginia Tech, Blacksburg, VA.

In concert with efforts to control phosphorous runoff from surface application, three commercial egg farms in Virginia totaling about 1.15 million hens, and one breeder egg farm with over 100,000 birds entered a 50% cost sharing program for one year with the Virginia Board of Conservation and Natural Resources. The purpose of the trial was to determine the effect of two dietary phosphorous (DP) reduction techniques upon the amount of total phosphors (TP) excreted by Leghorn hens. Three farms used the Natuflops® 600 product at the rate of 136 phytase units per lb of feed and reduced DP about 0.1%. Calcium was adjusted to maintain the Ca:P ratio. One farm used a purified phosphorous product prepared by B&B specialties and reduced the available phosphorous (AP) stepwise by 31% while holding calcium at pre-trial levels of 3.85% to 4.00%. Feed and concomitant manure samples were taken monthly and analyzed for total phosphorous. The base TP levels for Farms B, F, and G were calculated to be 75, 74, and 68% respectively. Their TP averages for 12 months of the trial were analyzed and found to be .59, .64, and .58%. Pre-trial manure (PTM) sample analyses were 3.59, 2.04, and 3.44% TP. The 12 month excretion levels were reduced to 2.00, 1.69, and 1.94% TP respectively. This amounts to reductions from base levels in the manure at 44.3, 17.2, and 43.8% by the farms using phytase. The subsequent TP level for Farm S was 65% with an analyzed dietary TP level reduced to .52%. This was done by reducing the AP in the diet from .41% to .29% using the purified phosphorous product. PTM samples were analyzed at 2.76% TP and the 12 month excretion level dropped to 1.55% TP for a reduction in the manure of about 4.3%. Rate of production, egg size, shell quality, and mortality were not affected by these changes in TP levels. Both treatment procedures were equally successful in reducing excreted TP levels without any appreciable changes in the cost of feed. Based upon these results, we should be able to reduce dietary phosphorous by 13 to 20%.

Key Words: Phosphorous, Phytase, Purified Phosphorous, Manure, Laying Hens

S178 Effect of breeder flock age and diet density on broiler performance. Gary E. Gladys1, Paul V. Twinning, Jr.2, Taalat M. Saleh3, and R. Michael Hulet4, Pennfield Feeds, Inc., Fredricksburg, PA, 1Paul Twinning Associates, Inc., Princess Anne, MD, 2South Valley University, Sohag, Egypt, 3Penn State University, University Park, PA.

An experiment was conducted to determine the effect of breeder age and diet density on growth performance of broilers. Progeny (1628) from the CobbXcobb strain but with two different flocks (29 and 57 wk of age) were randomized into three different diets (48 pens with 34 birds/pen). A commercial broiler diet C was compared with a diet that had 5% lower protein/amino acids and was adjusted to make it isocaloric (95% C), and with a diet that had 5% lower protein/amino acids but the energy was not balanced with the other two diets (LowPE). Birds were given feed and water ad libitum with three diets feed to all broilers. Birds were weighed at 0, 21, 35, and 44 d of age. No significant difference in body weight was found for broilers on the C (2.14 kg), 95% C (2.14 kg), and LowPE diets (2.14 kg) at 44 d of age. The broilers on the C diet were found to have significantly improved cumulative feed conversion (1.84) over birds on the LowPE diet (1.89). Cumulative mortality was not significantly different by dietary treatment. No differences in body weight of birds were found for the progeny of the older (2.16 kg) and younger flocks (2.14 kg). However, cumulative feed conversion was significantly improved for broilers from the younger breeder flock (1.85) when compared to broilers from the older breeder flock (1.89). No difference in mortality (3.24 %) was found for the breeder flock treatment.

Lower density diets gave acceptable growth performance for broiler diets. An advantage in feed conversion was found for broilers from the younger breeder flock, but more information is needed to make a firm conclusion.

Key Words: Diet Density, Breeder Flock Age, Broilers
S179 Effect of embryo temperature and age of breeder flock on broiler post-hatch performance. Gary E. Gladys1, Donna Hill2, Ron Meijerhof3, Talaat M. Saleh4, and R. Michael Hulet5, 1Pennfield Feeds, Inc., Fredricksburg, PA, 2Hoechst-Roussel Vet, Somerville, NJ, 3Hybro BV, Boxmeer, Netherlands, 4South Valley University, Sohag, Egypt, 5Penn State University, University Park, PA.

An experiment was conducted to determine the effect of embryo temperature and breeder age on post-hatch progeny performance. Eggs from two flocks of a CobbXCoob strain but different ages (29 and 57 wk) were incubated at 37.2 °C (60% relative humidity, RH) in the same incubator. At 16 d of incubation, one third of the eggs from each flock were moved to different hatcher where the embryo temperature were set at the following embryo temperatures: 37.2(A),38.3(B), and 39.4°C with 60% relative humidity. After hatching, all broilers from the embryo temperature treatments by breeder flock age were randomized into 48 pens of 34 birds per pen.

Body weights at hatch, 43.14, 42.15, and 41.14 g, were significantly different for embryo temperature treatments of C, B, and A, respectively. Broilers from embryo temperature treatment A (715 g) and B (715 g) had significantly greater body weights at 21 d than birds from treatment C (670 g). At 44 d, body weights for treatments B A, and C were 2.26, 2.21, and 2.17 kg, respectively, and were significantly different from each other. No difference in cumulative mortality or feed conversion was found for embryonic temperature treatments. While body weights for the broilers from the older flock had greater initial body weight, no difference in body weight was found at 44 d for broilers from either the older (2.23 kg) or the younger flock (2.21 kg). However, broilers from the younger flock had significantly improved cumulative feed conversion (1.85) over the broilers from the older flock (1.92).

Embryo temperature during the final stages of incubation is important for growth performance to 44 days of age.

Key Words: Embryo Temperature, Breeder Flock Age, Broilers

S180 Effect of high and low incubator temperatures at different stages of incubation upon the broiler embryo. M. J. Wineland*, K. M. Mann, B. D. Fairchild, and V. L. Christensen, North Carolina State University.

The effect of temperature during incubation in the setter can alter the metabolism and growth of the developing embryo. Eggs from a 52 week old broiler breeder flock were used in a 2 x 2 factorial arrangement with 2 setter temperatures (37.5, 38.6) and 2 periods of development (1 - 9 days, and 10 - 18 days of incubation). Water vapor pressure was equal in the two temperature treatments and all hatching was performed in the same machine. Eggs were spaced in the setter trays to create an even temperature within the setter.

The 18 day % moisture loss from the eggs and 21 day % residual yolk were greatest (13.88 and 19.90) when setter temperature was high both early and late and the least (12.42 and 16.49) when setter temperature was low both early and late in the setter. The 21 day % relative chick yield, the % relative chick without residual yolk and % relative heart weight was greatest (68.66, 59.55, and .819) when the setter temperature was low both early and late in the setter. There were no significant differences in % dry matter of the chicks. These results indicate chick weight was greatest when eggs are incubated at the lower temperature.

Key Words: Incubation, Temperature, Embryo

S181 Effect of different setter and hatcher temperatures upon the broiler embryo. M.J. Wineland*, K.M. Mann, B.D. Fairchild, and V.L. Christensen, North Carolina State University.

The effect of setter and hatcher temperature during incubation can dramatically effect embryonic growth and development. Eggs from a 52 week old broiler breeder flock were used in an experiment (2 x 2 factorial) with two setter temperatures (37.5, 38.6) and two hatcher temperatures (36.9, 38.3). Water vapor pressure was equal in the two temperature treatments. Eggs were spaced in the setter trays to create a more even temperature within the setter. The higher temperature selected was to provide under experimental conditions a embryo temperature approximating that found commercially. The % moisture loss was greater from eggs with setter at the higher temperature. The % relative chick yield was greatest (68.66) in chicks hatched from eggs at the low setter and hatcher temperature when compared to the high setter and hatcher temperature (63.02) There was no difference in % dry matter of the chicks or % wet chick weight. The % relative chick without residual yolk from the lower temperature setter were significantly greater than in the higher temperature setter (59.55 vs. 55.53). There was significantly less % residual yolk from chicks in the low temperature setter and hatcher (16.49) when compared to the chicks from the high temperature setter and hatcher (20.34). The % heart weight was greatest in chicks from the lower temperature setter and hatcher (.819) and the least in chicks from the high temperature setter and hatcher (.568). These results indicate that lower setter and hatcher temperatures produce a chick with increased body weight and body weight without residual yolk which could be due to water reserves. The greater utilization of yolk material at the lower setter temperature indicate a possible increased aerobic metabolism of the embryo due to a possible lower metabolic rate. The increased heart weight at both the lower setter and hatcher temperatures indicate the ability of the embryo to direct resources to important organ systems.

Key Words: Incubation, Temperature, Embryo

S182 An examination of the incubation profiles and hatched chick weights of three broiler breeder genetic pure lines. . G. M. Fasenko* and F. E. Robinson, University of Alberta, Edmonton, Alberta/Canada.

A study was conducted to examine chick growth and the number of incubation hours required to reach internal and external pipping and hatching in three broiler breeder genetic pure lines. Fertile breeder eggs were obtained from a primary breeder in the U.S. All eggs were weighed prior to setting. At day 7 of incubation 60 eggs from each line having viable embryos were marked and at day 18 of incubation 40 eggs per line having viable embryos were placed into pedigree hatching baskets. Starting at 432 hours of incubation, the eggs in the pedigree hatch baskets were monitored every 3 hours to obtain the number of incubation hours required to reach internal and external pipping and hatching. Hatched chicks were weighed, and the hearts and livers removed and weighed. Data were analyzed for significance at the 5% level.

The incubation hours required to reach internal and external pipping and hatching did not significantly differ between the three lines. However, the time taken to go from internal to external pipping was significantly affected by the line (P=0.0223). Line 1 took significantly less time to reach external pipping from internal pipping (12.0 hours) versus Line 2 (16.6 hours) and Line 3 (16.5 hours). Chick weight did not significantly differ between the 3 lines (giving heart (P=0.344) and liver weights (P=0.0001) were significantly different. Line 1 had a significantly lower heart weight compared to both Lines 2 and 3 which did not significantly differ between one another. Liver weight was significantly lower in Line 3 compare to both Line 1 and 2 which did not significantly differ between each other. Historically, the primary broiler breeder company producing these three lines has documentation that Lines 2 and 3 have higher late embryonic mortality than Line 1. The longer time taken by the embryos of Lines 2 and 3 to go from internal to external pipping may partially explain the higher late embryonic mortality observed in these 2 lines. These results indicate chick weight was greatest when eggs are incubated at the lower temperature. Incubating the eggs at the higher temperature also indicate less utilization of the yolk as a nutrient source, possibly due to an increase in anaerobic metabolism. The differences in the % relative heart may indicate a larger tissue mass or increased glycogen store due to improved aerobic metabolism of eggs incubated at the lower temperature.

Key Words: Broiler Breeder, Genetic Lines, Pipping and Hatching Times

S183 Enhancement of chicken and turkey macrophage functions by in vitro and in vivo Aquatize administration. M. A. Qureshi1, R. A. Ait2, L. N. Thomas3, and J. Mullerat2, 1North Carolina State University, Raleigh, NC, 2Bioxy Incorporated, Raleigh, NC.

Aquatize is Bioxy Incorporated’s patented oxyhalogen compound consisting of a buffered solution of several inorganic salts including sodium chloride. A noted metabolite of an oxyhalogen chemical reduction is Tetrachlorodecaoxide (TCDO) that has been shown to have immunomodulatory effects. In the current study, Sephadex-elicted chicken abdominal macrophages were exposed in vitro to varying concentrations of Aquatize. For cell viability quantification, macrophages were seeded in 96-well plates and viability assessed by MTT-assay whereas adherent macrophages were quantified by a MTT-assay whereas adherent macrophages were quantified by a MTT-assay whereas adherent
macrophage monolayers were established on glass coverslips for phagocytosis of \textit{E. coli} in two separate experiments. A 1:500 (vol./vol.) concentration of Aquatize was toxic to 1 x 10^9 macrophages at 3 or 24 hour exposure. However, the toxicity at 0.01% (vol./vol.) was similar to sham-treated cultures. Lower concentrations of Aquatize did not affect substrate adherence potential of macrophages. While the overall percentage of Aquatize treated macrophages phagocytic for \textit{E. coli} was comparable to the sham-treated controls, 1:2000 and 1:5000 concentrations improved the number of \textit{E. coli} phagocytic macrophages (2.6 - 5.4 vs 1.9 - 3.3 in controls, P < 0.05). However, the overall phagocytic potential of macrophages against \textit{E. coli} at 3 wk was comparable between the treatment groups. Macrophages from 1:2000 Aquatize group produced 1.4 to 1.7 fold higher (P < 0.05) nitrite after LPS stimulation over macrophages from unsupplemented group. Data from these studies imply that Aquatize increases macrophage sensitivity to inflammatory stimuli thereby enhancing the first line of immunological defense in poultry.

\textbf{Key Words}: Aquatize, macrophage functions, chickens, turkeys

\textbf{S184 Egg production, eggshell quality, and bone parameters in broiler breeder hens receiving Bio-Mos and Eggshell 49.} W.D. Berry* and P. Luï, 1 Auburn University Department of Poultry Science.

The objective of this study was to determine whether the Alltech, Inc. products Bio-Mos\textsuperscript{TM} and Eggshell 49\textsuperscript{TM} would affect egg production, shell quality, and bone strength in broiler breeder hens during a second laying cycle. Four hundred sixty 5 week old broiler breeder hens were induced to molt by reduction of daylength to 8 hours light and fasting. Feeding was resumed when the birds had lost an average of 25% of their initial body weight. Half of the hens were fed a standard breeder diet (Control). The remaining birds were fed a standard breeder diet containing a combination of 1 lb/ton of the Bio-Mos product and 1 lb/ton of the Eggshell 49 product for one week (Treated). Diets were fed at a rate of 30 lbs/100 birds/day. Daylength was adjusted to 16 hours and water was provided free choice. Egg production was recorded daily for 12 weeks following return to egg production. Egg weight, egg specific gravity, shell thickness, and shell density were determined at the beginning of the experiment and weekly. Following 12 weeks of production, femurs from hens in each group were analyzed for wet and dry weight, breaking strength, and ash weight. Hens in the Treated group had significantly greater body weight. Egg production increased faster in the Treated group after feeding was resumed. Peak egg production was not different in the two groups, however, the Treated group maintained a higher level of production for the following peak. Overall, the Treated group produced an average of 6 eggs/hen (1200 total) more than the Control group. Egg weight, shell weight, shell weight per unit surface area, and overall egg specific gravity were not different between the groups. Femur dry weight and ash weights tended to reduced in the Treated group, while bone breaking strength was significantly lower in the Treated group. These results suggest that inclusion of Bio-Mos and Eggshell 49 in diets of molted breeder hens supported increased egg production and improved feed conversion without degradation of shell quality. However, increased egg production may have led to reduced bone strength through changes in bone structure and depletion of bone mineral.

\textbf{Key Words}: breeder, mannan oligosaccharide, egg production

\textbf{S185 Comparative evaluation of yeast culture, mannanoligosaccharide and antibiotic on performance of turkeys.} V.G. Stanley*, C. Brown, and A.E. Sefton, 1Prairie View A&M University, 2Alltech Inc, Guelph Ontario, Canada.

Current restrictions on the use of antibiotics to enhance poultry performance have led producers, veterinarians and researchers to search for alternative yeast cultures and mannanoligosaccharides that have been shown to enhance turkey performance. The objective of the current study was to compare the efficacy of yeast culture (YS) (Yeast Sac\textsuperscript{1026}, Alltech Inc., Nicholasville, KY, 0.1 g/kg), mannanoligosaccharide (MOS) (Bio-Mos, Alltech Inc., Nicholasville, KY, 0.05 g/kg) and terramycin (TM) (50 mg/kg). Broad Breasted White turkeys were fed either a negative control corn-soya based ration or ration with one of the test feed additives. Body weight (BW) and mortality were evaluated every two weeks. Mortality did not differ among treatments. Litter moisture, pH, and coliform numbers, and drinker coliform counts were evaluated at 105 days of age. Body weights of birds (0.09 kg) at 105 days of age or the control (7.49 kg) at 105 days of age than control (7.09 kg), TM (7.23 kg) or MOS (7.14). Moisture content of litter from TM (27.1%) and MOS (27.3%) birds was significantly lower (P < 0.05) than litter from birds given YS (37.8%) or the control (37.2%). The lowest mean pH was observed in litter from turkeys fed MOS, followed in order by YS, TM and the control. Litter from turkeys given MOS (log 3.68 + 0.19 cfu/g) had the lowest coliform count followed by YS (log 4.799 + 0.50 cfu/g), TM (log 5.11 + 0.47 cfu/g) and the control (log 6.5 + 0.12 cfu/g). Drinker coliform counts were significantly lower (P < 0.05) for YS fed birds (log 5.18 + 0.37 cfu/ml) than for TM (log 5.70 + 0.16 cfu/ml), MOS (log 6.02 + 0.07 cfu/ml), or the control (log 5.90 + 0.12 cfu/ml). Both YS and MOS have shown to be suitable alternatives to the antibiotic TM as growth enhancers of turkeys.

\textbf{Key Words}: Yeast culture, Mannanoligossaccharide, Terramycin, Turkeys

\textbf{S186 Turkey hen growth response to diets supplemented with either antibiotic or mannan oligosaccharide.} R. Michael Hulet*, Eric S. Lorenz\textsuperscript{1}, and Talaat M. Saleh\textsuperscript{2}, 1Penn State University, University Park, PA, 2South Valley University, Sohag, Egypt.

A study was conducted to determine the effect on growth of different diets supplemented with antibiotics (bacitracin methylene disalicylate, virginiamycin) or with mannan oligosaccharide (mos) compared to a control basal diet. Nine hundred sixty turkey hens were randomized into three dietary treatments (24 pens). All hens were placed into pens, given water, and fed ad libitum. They were placed at an initial density of 48 birds/m\textsuperscript{2} from 4 to 12 wk of age. Dietary treatments were separated into three different dietary periods: 0 to 4, 4 to 8, and 8 to 12 wk of age. The test diet (B) was the basal diet supplemented from 0 to 12 wk with mannan oligosaccharide at 0.5 g/kg diet. The commercial type diet (A) was the basal diet supplemented with an antibiotic (bacitracin methylene disalicylate, 55 mg/kg) for 0 to 8 wk and then a growth promotant (Vir- giniamycin, 22 mg/kg) from 8 to 12 wk. The control diet (C) contained 28% protein for 0 to 4 wk, 19% protein for 4 to 8 wk, and 16% protein for 8 to 12 wk. No significant difference in growth was found for the birds fed the test diets: A (7.26 kg) or B (7.28 kg) when compared with the Control diet (7.27 kg). A significant difference was found in feed efficiency for the birds fed the mos (1.92) when compared with hens fed either the Control (1.85) or the A diet (1.85). Two week mortality was significantly higher for the birds fed the B (2.50%) compared to the Control Diet (2.72%) when compared to birds started on an antibiotic feed (6.2%). Birds fed 0.5 g/kg mos had improved feed efficiency with no difference in body weight. The feeding of antibiotic supplemented feed to turkey hens appears to be important for the first two-week livability.

\textbf{Key Words}: Turkey Hens, Mannan Oligosaccharide, Feed Conversion


Nicarbazin was initially approved by the USA-FDA as a coccidiostat for broiler chickens in 1955. Since that time, it has been approved in 21 countries as well as the European Union as a coccidiostat. The maximum residue limits (MRLs or safe concentration of residues) in muscle in these countries range from 0 to 5 PPM. The wide disparity in MRLs resulted in trade limitations in the sale of poultry meat to countries with a zero MRL. The Joint FAO/WHO Food Standards Program Codex Alimentarius Commission (CAC) provides a process for the evaluation of data to establish an international MRL standard to facilitate world trade. The process for the initial listing by the Codex Committee on Veterinary Drug Residues in Food (CCVDRF), the preparation of toxicology and residue dossiers, the review of the dossiers by the FAO/WHO Joint Expert Committee on Food Additives (JECFA), the recommendation to the CCVDRF, and the CCVDRF recommendation for the final MRL standardization by the CAC will be outlined. Critical toxicology, residue, and assay requirements will be listed. The timing and international impact on the MRL will be discussed. The initial Nicarbazin CCVDRF Listing was in November 1966. The MRL of 0.2 PPM in all chicken tissue
was approved by the CAC in July 1999. This MRL is an international standard for world trade.

**Key Words:** Nicarbazin, MRL, Codex

### S188 National Poultry Database Demonstration Disk Development

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The National Poultry Database (NPD) Demonstration Disk was developed to show the information transfer potential for the poultry system, as has been done through the National Dairy Database. The Agricultural Databases for Decision Support (ADDs) program currently includes databases for dairy, goat, sheep, beef and swine. The NPD supports industry, county or State Extension, or teaching programs that provide poultry information, educational programs, and support for decision making to a wide variety of audiences.

The NPD committees reviewed and selected trade journals, professional journals, proceedings, meeting handouts, pamphlets, newsletters, mass-media and other sources of information for the disk. Selected materials are full-text, with no editing. The NPD demonstration disk is web-enabled, and shows the NPD structure, which is comprised of a variety of subject choices (arrays and sub-arrays). The decision array will serve as a database browser, with access to a sophisticated search and retrieval engine. "Hot buttons" will emphasize topics of current societal concerns or that require special consideration. The ADDs organization, with its ADDs Center, provided most technical support. Financial support will be required from allied industry or industry members for development and maintenance of the NPD, with additional support possible through sales of CD-ROM or Internet access to data. For more information, contact any NPD committee member.

**Key Words:** national poultry database, database, demonstration disk, ADDs, decision support

### S189 Effect of carnitine on growth and ascites susceptibility of broilers exposed to both simulated high altitude and cold stress

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Two studies were conducted to examine the effects of dietary carnitine on broiler ascites susceptibility and various physiological parameters. In the first study 216 Cobb-500 males were utilized in a 2 week experiment. During this time birds were exposed to slightly below the recommended ambient temperature (30°C) and at an atmospheric oxygen content of 17%. Carnitine treatments included 0, 50, 100 and 200 PPM. Treatments were replicated with six groups of 6 birds each. Variables monitored included feed consumption, live weight, feed/gain, heart weight, ascites heart ratio (AHR) and mortality. No effect was noted for performance variables, however, ascites heart ratio (P<.01) and hematocrit (P<.01) were lowered by dietary carnitine. We have noted in other studies that blood hematocrit is the first trigger changing during the evolution of ascites. Most of the carnitine effect was evident for the 50 PPM treatment, but there was a trend for continued improvement through 200 PPM. In the second study, conducted under similar conditions, chicks were fed 0, 12.5, 25, and 50 PPM carnitine. Body temperature was monitored as an additional variable. Carnitine supplementation improved livability to 14 d of age while carnitine only tended (P<.1) to reduce ascites incidence. However, an inverse correlation (P=.08) between body temperature and ascites incidence was recorded. When initial chick body temperature was used as a covariant the carnitine and hematocrit response was similar to the study 1. In conclusion, data presented indicate that initial chick body temperature is related to ascites susceptibility and further, that carnitine offers promise as a potential ascites therapeutic.

**Key Words:** Ascites, Broilers, Carnitine, Altitude, Growth

### S190 The impact of dietary intervention on shell quality and egg losses

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Egg losses through the cage because of shell quality can be substantial (6 to 16%) in mature flocks. Therefore the objectives of this study were to 1) document egg losses through the cage and in shell quality among first cycle hens and 2) compare the ability of dietary intervention programs to mitigate these losses. Two commercial hens (n = 384) representing egg number and egg mass strains were compared for eleven 28-day periods. When shell quality had diminished by the end of the seventh period dietary intervention treatments were initiated: control (C), oyster shell + vitamin E (Sh+Vit, 60 ppm Sh + 80 mg/kg Vit E), calcium citrate + D3 (C3D), and 200 ppm histidine (Hd 49) (ES49). Egg losses as a percentage of hen day production remained at less than 1% during the first 6 periods. At the end of periods 7 and 8 losses exceeded 1% and increased to more than 2% by periods 10 and 11. Hen strain significantly impacted hen day egg production, eggs per hen housed, feed consumption and conversion, however dietary treatments had no effect on these parameters or body weight (P > 0.05). While repeatable and significant strain differences in egg specific gravity, egg weight, shell weight and thickness were observed throughout the entire study, dietary treatments had no consistent impact on these parameters. The one exception was egg weight which was significantly greater in periods 8 - 11 among birds fed the ES49 treatment. However, the same hens laid significantly heavier eggs before the dietary treatments were even initiated. Under the conditions of this study dietary intervention strategies aimed at improving the shell quality of graded eggs showed no consistent improvement compared to a well balanced control diet.

**Key Words:** Shell quality, Egg losses, Eggshell 49

### S191 Broiler performance is affected by dietary enzyme supplementation in corn and soybean meal diets

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The efficacy of a commercial enzyme preparation containing α-galactosidase (KEMZYME® C/S for broilers, Kemin Industries, Inc.) was tested in broilers receiving corn-soybean meal diets from 1 to 49 days of age. Experiment one consisted of broilers receiving diets with or without 112g/ton of the enzyme preparation and was conducted in hot temperature conditions. Straight-run Peterson x Arbor Acre broilers (3,600) were randomized across 72 floor pens (1,800 broilers/treatment). Broilers receiving enzyme supplemented diets had improved 1 to 49 day feed conversion (2.29 vs 2.10; P < 0.001) and livability (86.88 vs 92.99; P ≤ 0.001). Experiment two involved enzyme preparations tested at 112g or 150g/ton in straight-run Cobb x Cobb broilers (50 broilers/pen; 18 pens/treatment). Feed conversion was improved (P ≤ 0.078) by the addition of the enzyme preparation. Body weights and carcass parameters were not affected by enzyme supplementation in either experiment. Broilers receiving corn and soybean meal based diets may have improved performance from enzyme supplementation, especially in hot temperature conditions.

**Key Words:** α-Galactosidase, Enzyme, Broiler

### S192 Biogenic Amines: 1. Influence of feeding various dietary concentrations of eight biogenic amines individually or in combination to broilers

*R.D. Miles* and C.W. Comer, University of Florida, Dairy & Poultry Sciences.

Studies were conducted with day-old male feather-sexed chicks raised in Petersime batteries in a temperature controlled room for a three week experimental period. Chicks were weighed individually on day one and allocated to treatment replicates by weight in order to minimize replicate body weight differences. In each experiment, chicks had ad-libitum access to the corn-soybean meal basal diet and water. A 24-hour lighting regime was used. Data collected were body weight, feed consumption, feed conversion, organ weights, toe ash, fecal moisture and intestinal score. The reagent-grade biogenic amines cadaverine, histamine, putrescine, spermidine, spermine, tyramine, tryptamine and phenethylamine were fed individually at dietary concentrations of 0, 500, 1000 and 1500 ppm, respectively. These same biogenic amines were fed in combination at 62.5 ppm, 125 ppm and 187.5 ppm to provide the total dietary biogenic amine concentrations of 500, 1000 and 1500 ppm, respectively. In another study, the same dietary combinations and concentrations of biogenic amines were used except that an additional 500 ppm histamine was added to each combination group. Performance of adding these biogenic amines alone or in combination with/without 500 ppm additional histamine to a corn-soybean meal diet.

**Key Words:** Biogenic amines, Broilers, Performance
Studies were conducted with day-old male broilers raised to either 3 or 6 weeks of age in Petersime batteries or floor pens, respectively. Individually caged commercial egg-type White Leghorns were housed under a 16 hour continuous lighting regime for two, 28-day periods. In the broiler and laying hen studies a practical corn-soybean meal basal diet was used. In the first 3-week study with broilers the biogenic amines histamine, phenethylamine, spermine, and tryptamine were fed alone at 500 ppm and in combination with 500 ppm histamine. In another 3-week study 0, 500 and 1000 ppm histamine was fed alone or in combination with 0 and 200 ppm copper. In a 6-week floor pen study the biogenic amines cadaverine, histamine, phenethylamine, putrescine, spermidine and tyramine were fed in combination, each at a dietary concentration of 500 ppm. A diet containing no supplemental biogenic amines served as the control. In the layer study, the biogenic amines cadaverine, histamine, phenethylamine, putrescine, tryptamine and tyramine were fed in combination, each at a dietary concentration of 500 ppm. A diet containing no supplemental biogenic amines served as the control.

There were 10 dietary treatments in a 2 x 5 factorial arrangement with two feed types (mash or pelleted) and five feed additive treatments [combined with new wood shavings]. There were 8 pens of 30 chicks each per dietary treatment for each feed type, body weight and mortality were increased (P < 0.04) compared to mash feed. The BMD treatment differed by 28-30%. The experiment was designed as a 2 x 2 factorial with two networks used in this research (back propagation and general regression neural networks) fit the forecast line more tightly to the previous years egg price line than regression analysis. In case of general regression neural networks, the R² was as high as 73%. Results suggest that neural networks may be a more reliable method of egg price forecasting than simple regression analysis if reliable data is collected and manipulated for such models.

Key Words: Biogenic Amines, Broilers, Layers, Performance

S194 Floor pen evaluation of two unique microbial additives in feed and a water soluble microbial in water on performance of broiler chickens. M. D. Sims¹*, C. W. Comer, University of Florida, Dairy & Poultry Sciences.

A 42-day feeding trial was conducted in September and October with 2,400 straight-run Ross x Ross 308 broiler chicks on used litter, top dressed with new wood shavings. There were 8 pens of 30 chicks each per treatment. Stacking density was moderately high (0.063 m² per bird). There were 10 dietary treatments in a 2 x 5 factorial arrangement with two feed types (mash or pelleted) and five feed additive treatments [control basal diets; bacitracin methylene disalicylate (BMD, Alpharma, Inc.), 55 mg/kg; water soluble direct-fed microbial in water (DFM¹, Alpharma, Inc.), 55 mg/kg; water soluble microbial in feed (DFM², Alpharma, Inc.), 55 mg/kg; water soluble microbial in feed (DFM³, Alpharma, Inc.), 55 mg/kg; water soluble microbial in water (DFM⁴, Alpharma, Inc.), 55 mg/kg]. All diets contained the cooked feed ingredients and all feed ingredients were added in the mixer prior to pelleting. At 21 d of age, pelleted feed increased body weight (P<0.04) compared to mash feed. The BMD² treatment improved (P<0.06) body weight compared to the control, and the microbial treatments were intermediate and did not differ statistically from either BMD³ or control treatment results. There were no significant feed type x additive interactions at either 21 or 42 d. At 42 d of age, by feed type, body weight and mortality were increased (P<0.01) by pelleted vs mash diets. The 42-d live weights of the DFM0 and DFM1 pelleted feed groups were significantly heavier (P<0.05) than all other treatments. By additive, DFM0 diets lowered (P<0.05) feed conversion ratio (1.854 vs 1.940 kg feed/kg weight) compared to controls. Feed conversion adjusted for mortality (feed consumed ÷ live weight plus mortality weights) at 42 d was lowest for the DFM0, pelleted feed group (1.823), which was significant (P=0.03) compared to the control (1.932) and held a 5 point advantage (0.01 = 1 point) over the BMD⁵ pelleted feed group (1.875). Similar trends were observed in the broilers receiving feed in mash form. In conclusion, broilers fed DFM0 had heavier 42-d broiler body weight compared to control and antibiotic treatments. Pelleted feed improved 21- and 42-d body weight but worsened 0 to 42 d mortality. Broilers receiving beneficial microbes in these DFM0 and DFM1 products were heavier and converted feed more efficiently. The dry microbial additives appeared to survive pelleting and were preferred over the water soluble form for convenience.

Key Words: Broiler, Bacitracin methylene disalicylate, Direct-fed microbial, Pelleted feed
was a slight decrease in weekly feed allocations between 3 and 24 wk resulting in a cumulative intake reduction of 1.5 lb per pullet compared with the HEAVY treatment. Within the two growing treatments, pullets were fed a standard 15% CP growing diet with and without 0.1% supplemental AVIZYME. At 25 wk, all birds were switched to a breeder diet with and without enzyme and given the same feed allocations. All the pullets within a pen were weighed at 6 and 8 wk and every 4 wk thereafter. There was a clear feed treatment effect on pullet BW beginning at 6 wk (HEAVY, 546 g; LIGHT 530 g; P < .0003) and this difference became greater with age (24 wk, HEAVY, 2727 g; LIGHT, 2546 g; P < .0001). Between 16 and 28 wk, there was a common trend but not highly significant (P < .15) effects of enzyme supplementation on BW. Hen-day egg production from 26 to 30 wk was significantly increased in hens from the HEAVY treatment (36.7 vs. 33.5%; P < .003) but there were no effects on egg weight. There were no supplemental enzyme effects on either egg production or egg size. In summary, it appears that supplemental AVIZYME did facilitate slight but consistent increases in BW beginning at 16 wk but this did not result in any measurable production related effects.

Key Words: broiler breeder, enzyme, restriction

S198 Comparison of Alzyme® and Natuphos® in Commercial Leghorn Diets. A. Bateman, D. A. Roland, Sr., and M. Bryant*, Auburn University.

An experiment was conducted to compare the efficacy of two phytase products, Natuphos® (BASF) and Alzyme® (Altech). Because BASF and Altech use different methods of obtaining activity levels, this study was designed to compare the reported activity of the two phytase products. Commercially (1600) were fed 10 diets consisting of a positive control (.4% available phosphorus (AP)), a negative control (.1% AP) or the negative control plus one of the two phytase products (Natuphos® or Alzyme®). Phytase levels used were 50, 100, 150 or 200 FTU/kg or 1900, 3800, 5700, or 7600 PTU/kg respectively. There were eight replications with 20 hens per replicate. Diets were fed for eight weeks. Performance was evaluated on the basis of feed conversion (FC), egg weights (EW), egg specific gravity (SG), feed consumption (FC), and performance. The results indicate that supplemental AVIZYME did facilitate small but consistent increases in BW beginning at 24 wk but this did not result in any measurable production related effects.

Key Words: broiler breeder, enzyme, restriction

S199 Bioavailability of phosphorus in low oligosaccharide, low-phytate soybean meal for chickens. G.L. Cromwell1, S.L. Tlatory1, M.D. Lindemann1, H.L. Stilborn, T.E. Sauber2, and D.W. Rice2, 1University of Kentucky, Lexington, 2University of Arkansas, Fayetteville, AR 72701.

The bioavailability of P in soybean meal (SBM) prepared from low-oligosaccharide, low-phytate (LP) soybeans and near-isogenic normal (N) soybeans was determined in chicks. The LP-SBM and N-SBM analyzed .77 and .70% total P, .22 and .48% phytate P, .55 and .22% non-phytate P, and 1.13 and 5.30% oligosaccharide. Broiler-type, male chicks (n = 300) were allotted at 3 d of age to 10 diets (five pens of six chicks/penn, 67 g avg BW). A basal diet (20% CP, 1.0% Ca, .47% total P, .20% non-phytate P) consisted of dextrose, starch, and non-experimental (NE) SBM with added corn oil, amino acids, vitamins, and minerals. All of the P in the basal was from the NE-SBM (.32%) and monocalcium phosphate (.15%). Diets consisted of the basal (Diet 1) or the basal with .05, .10, or .15% added P from monosodium phosphate (MSP, Diets 2-4), or the same levels of added P from N-SBM (Diets 5-7) or LP-SBM (Diets 8-10). The N- and LP-SBM were substituted for dextrose-starch. Chicks 14-d gains and feed-gains were: 266, 332, 414, 451, 292, 322, 318, 334, 357, 380 g; 1.50, 1.35, 1.30, 1.28, 1.30, 1.36, 1.36, 1.21, 1.21, respectively. At the end of the trial, all chicks were killed and tibias were removed. Tibia strength (4.09, 6.20, 10.84, 14.74, 3.97, 5.76, 5.77, 5.72, 6.79, 8.69 kg) and ash (26.6, 29.5, 35.5, 38.7, 26.0, 28.0, 28.9, 28.8, 30.0, 32.3%) increased linearly (P < .01) with increasing P from MSP, N-SBM, or LP-SBM. For growth and bone traits, MSP was superior (P < .01) to SBM and LP-SBM was superior (P < .01) to N-SBM. Bone strength and ash weight were regressed on grams of added P consumed for each P source with the basal included in the regressions, and slopes were determined for each P source. Based on slope-ratios, the relative bioavailability of P (assuming MSP= 100%) was 28% for N-SBM and 58% for LP-SBM. The results indicate that the P in LP-SBM is approximately twice as bioavailable as the P in N-SBM for growing chicks.

Key Words: Chickens, Soybean Meal, Phosphorus, Phytate

S200 Phosphorus requirements of broilers 6 to 9 weeks of age as influenced by phytase supplementation. F. Yan*, J.H. Kersey, C.A. Fritts, and P.W. Waldroop*, Poultry Science Department, University of Arkansas, Fayetteville, AR 72701.

Two studies of identical design were conducted to evaluate the nonphytate phosphorus (nPP) needs of male broilers fed soybean meal type diets from 6 to 9 wk in the presence or absence of phytase. Male broilers were grown to 6 wks on diets considered adequate in Ca and P and fed test diets from 6 to 9 wk. The test diets contained 0.10 to 0.35% nPP in increments of 0.05% and were fed with or without the addition of 1000 FTU/kg of phytase. Fifty male broilers were placed each of 48 pens with builtup litter and four pens of birds were assigned to each diet in both studies. A total of 96, 53, and 60 birds in each group were killed at 16, 24, and 30 wk, respectively. Diets were fed a standard 15% CP growing diet with and without 0.1% supplement of enzyme and given the same feed allocations. All the other three replicates per study were used to determine body weight gain and feed conversion at the same age. There were no significant effects of nPP level or phytase supplementation on body weight, feed conversion, or mortality at any age, indicating that no more than 0.10% nPP was satisfactory to support live performance. However, tibia ash was significantly influenced by level of nPP and by phytase supplementation. Without phytase supplementation, regression analysis suggested that 0.25-0.30% nPP was needed to maximize tibia ash, in agreement with the NRC recommendations. When phytase was added to the diets, tibia ash was not improved by nPP levels greater than 0.25%. Feeding phytase to diets with phytate was more effective in reducing dietary phosphorus with the addition of phytase can markedly aid in reducing fecal excretion of P in areas where this is an environmental problem.

Key Words: Broilers, Phosphorus, Phytase, Eutrophication

S201 Formulating on basis of digestible amino acids does not overcome all problems associated with use of high levels of feather meal. Qi Jiang, M.A. Motl, C.A. Fritts, and P.W. Waldroop*, Poultry Science Department, University of Arkansas, Fayetteville, AR 72701.

Although feather meal (FM) is often used in poultry diets, its inclusion level is often limited because of concerns regarding its poor amino acid digestibility. One of the arguments put forth for moving to digestible amino acid requirements is that it would allow for increased usage of feed ingredients with lower amino acid digestibility. While this is undoubt-edly true, there frequently are problems with such ingredients other than their reduced amino acid digestibility. A study was conducted to evaluate the use of FM of known amino acid digestibility in diets for growing broilers. A sample of FM was subjected to digestible amino acid (DAA) and TME assay by laboratories experienced in these assays. Using these values, diets were formulated in which FM was incorporated at 0, 5, 10, or 15% DAA values assigned to corn and soybean meal were those re-
levels of unconventional proteins in studies to determine digestible amino acid requirements.

**Key Words:** Broilers, Digestible amino acids, Feather meal, Alternate feed-stuffs

**S202 Interaction of lysine and methionine in diets for growing broilers.** C.A. Fritts*, M.A. Motl, J. Si, and P.W. Waldroup, Poultry Science Department, University of Arkansas, Fayetteville, AR 72701.

Recent research has suggested that levels of Lys or Met in excess of NRC recommendations would result in improved performance in some strains of broilers, especially in breast meat yield. In addition, some have interpreted the "Ideal Protein" concept to mean that amino acids such as Met should be kept in an "ideal" ratio to Lys, suggesting that if Lys is increased above its actual needs a commensurate increase in Met should be made. The objective of this study are twofold: 1) to evaluate the effects of levels of Lys and Met in excess of NRC recommendations in diets of male broilers grown for further processing; 2) to determine if any interaction exists between levels of Lys and Met when minimum levels are exceeded. Three studies of identical design were conducted. Corn and soybean meal of known composition were used to formulate base diets for 0-3, 3-6, and 6-9 wk which provided a minimum of 110% of amino acids other than Lys, Met, and TSAA which were at 100% of recommended levels. From these base diets, experimental diets were derived by additions of lysine HCI and DL methionine to provide a factorial arrangement with three levels of lysine (NRC, + 0.15%, + 0.30%) and four levels of methionine and TSAA 9NRC, + 0.05%, + 0.10%, + 0.15%). Each of the 12 diets was fed to 2 (trial 1) or 4 (trial 2 and 3) replicate pens of 50 male chicks (Cobb 500). Samples of birds were processed at 49, 56, 63 days for parts yield. Although significant differences in performance were noted among trials due to environmental temperature there were no trial x treatment interactions so data were combined. There were no significant interactions between levels of Lys and Met for any parameter when both were fed equal to or in excess of NRC recommendations. Increasing Lys above NRC recommendations significantly improved BW and FCR at 21 d but not at latter ages; breast meat yield was improved only at 63d. Increasing Met above NRC significantly improved FCR at 42 and 56 d; there was no significant effect of Met levels on breast yield at any age. Results of this study suggest that persons formulating diet on "Ideal Protein" basis should not elevate amino acids if lysine is in excess.

**Key Words:** Broilers, Lysine, Methionine, Interaction, Ideal Protein

**S203 Effects of different ratios of extruded full-fat soybeans and soybean meal on performance of broilers.** A. Subuh, M.A. Motl*, J.A. Kersey, C.A. Fritts, and P.W. Waldroup, Poultry Science Department, University of Arkansas, Fayetteville, AR 72701.

Full fat soybeans (FFS) provide both protein and energy and are especially useful where the infrastructure does not provide inedible oils for poultry feeds. However, they must be heat treated to denature trypsin inhibitors and cell disrupted to maximize the digestibility of the oil. A lot of soybeans (mixed species) was crushed in a roller mill and then extruded without steam. The FFS was analyzed for CP (40.5%), ether extract (18.3%), crude fiber (5.3%) and urease (0.02 pH rise). The ME of FFS was estimated from its chemical composition. Diets which met a minimum of 107.5% of NRC amino acid recommendations were formulated using the following ratios of FFS to soybean meal (SBM): 1) 0 FFS:100 SBM; 2) 25 FFS:75 SBM; 3) 50 FFS:50 SBM; 4) 75 FFS:25 SBM; 5) 100 FFS:0 SBM. Each diet was formulated to contain 3200, 3300, or 3400 ME kcal/kg in a 3 x 5 factorial arrangement. Diets were pelleted using steam; starter diets were crumbled. Six pens of 25 male broilers were assigned to each treatment from 1 to 42 d. At 42 d, samples of birds were processed to determine dressing percentage and abdominal fat content. There were no significant differences in BW at 21 d among birds fed diets with different ratios of FFS:SBM. At 42 d birds fed diets with 100% FFS replacing SBM had significantly higher BW than those fed the other ratios. At 21 d, birds fed diets with 3300 and 3400 ME kcal/kg had significantly higher BW than those fed 3200 ME kcal/kg; at 42 d there was no significant effect of diet energy level on BW. Feed conversion was significantly improved at both 21 and 42 d as SBM was replaced with FFS and as the dietary energy level increased. There were no significant effects of diet on dressing percentage or fat pad percentage at 42 d. These data confirm that properly processed soybeans can provide a good source of protein and energy to broiler feeds where economically beneficial.

**Key Words:** Broilers, Full-fat soybeans, Alternate ingredients

**S204 Breeder Age Alters Lipid Accumulation in the Developing Embryo and Newly Hatched Duckling.** Mickey Latour*1 and Christie Braun1, 2Purdue University.

The purpose of this study was to investigate the effects of breeder age (24 vs. 31 wk) and embryo/duckling (embryonic, Day 25 of incubation and newly hatched duckling, Day 28) on hepatic lipid accumulation. Lipids were quantified by electron microscope. The relative number of hepatic lipid droplets were significantly higher (1.5 times greater) in embryos from 31 wk old breeders as compared to embryos from 24 wk old breeders. Conversely, at hatch the relative number of hepatic lipid droplets were significantly lower (1.8 times less) in newly hatched ducklings from 31 wk old breeders as compared to ducklings from 24 wk old breeders. The relative size of lipid droplets followed the same pattern as number of lipid droplets. Relative yolk and liver weight were effected by breeder age; that is, hatch ducklings from 24 wk old breeders exhibited a significant (11-fold) decrease in relative liver weight compared to embryonic ones. Whereas the ducklings from 31 wk old breeders exhibited a significant (5-fold) decrease in relative yolk weight when compared to embryonic values. Embryos vs. newly hatched ducklings produced from 24 wk old breeders exhibited no difference in relative liver weight. Whereas, embryos vs. newly hatched ducklings produced from 31 wk old breeders exhibited a significant increase (1.34 fold) in relative liver weight. These data would indicate that lipid accumulation and metabolism are altered by breeder hen age.

**Key Words:** lipids, duck, breeder, age, liver