M1 Performance and mortality rate of various broiler breeds reared in Ogun State after brooding stage to slaughter. A. A. Mako*1, O. I. Abiola-Olagunju2, O. A. Ogunwole2, R. A. Hamzat3, O. K. Awobajo1, A. O. Igboesan1, and R. O. Ettu1, 1Tai Solarin, University of Education, Ijebu Ode, Ogun State, Nigeria, 2Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria, 3Purdue University, West Lafayette, IN.

This study focused on performance and mortality rate of various breeds of broilers (Cornish, Plymouthrock, White Rock, Marshall, Arbour acre, Anak 2000, Ross, Rhode Island Red and Red Sussex) reared in Ogun State from after brooding stage to slaughtering. For purpose of this study, Ogun State was divided into four provinces namely; Egba, Egbado, Ijebu and Remo. Data were collected through the use of questionnaires. A total of one hundred and thirty (130) questionnaires were administered in each province making 520 questionnaires in all. The collected data were analyzed with the use of simple percentage, analysis of variance and other statistic techniques. The result shows that there was significant differences (P<0.001) in the mortality rate with Red Sussex and Marshall having the lowest value (0.08%) and White Rock having the highest value (2.20%). The performance also vary significantly (p<0.001) with White rock recording the highest value of 3.00 Kg and Cornish recording the lowest value of 1.72 Kg. The result revealed that the major causes of mortality and poor performance of birds are type of breed, poor management on the farm in the area of feeding, hygiene, amongst others. The best breed of broiler with lowest mortality rate are Red Sussex and Marshall, while the best breed with the highest performance (weight at slaughter) is White Rock.

Key Words: performance, mortality rate, broilers, brooding stage, slaughtering

M2 Evaluation of alternative genotypes in Illinois for sustainable poultry production. L. Mejia*SC1, P. L. Utterback1, C. W. Utterback1, C. M. Parsons1, and J. L. Emmert2, 1University of Illinois, Urbana, 2University of Arkansas, Fayetteville.

Two experiments were conducted to evaluate the performance and quality of specialty poultry genetics for possible use in natural and organic markets. In both experiments males and females of two genotypes were used: a specialty slow-growing chicken (S) and the University of Illinois New Hampshire x Columbian crossbred chicks (NH x C). In experiment 1, a 40 d assay was conducted and a single diet was fed throughout the experiment. For Wk 0 to 3, the NH x C males and females had the highest (P<0.05) weight gain and feed intake, but both genotypes were similar in feed efficiency. For Wk 3 to 6, the NH x C males had the highest weight gain, feed intake and feed efficiency (P<0.05), whereas the S females had the lowest weight gain, feed intake and feed efficiency. Overall, the best growth performance occurred with NH x C males, and no differences were observed between S males and NH x C females. In experiment 2, an 83 d assay was conducted to evaluate weight gain, carcass yield and uniformity of S and NH x C chicks. Chicks were reared on litter in the same pen with a common diet. The NH x C males had the highest body weight and carcass yield (P<0.05), whereas the NH x C females had the highest breast meat yield. Males of both genotypes had higher leg yield but lower frame yield (P<0.05). NH x C birds exhibited lower standard deviation and CV values than the S birds, indicating a superior uniformity. These data indicate that the NH x C birds have better growth performance and uniformity than other slow growing genotypes, and thus may be useful in alternative production systems.

Key Words: alternative genotype, carcass yield, growth performance, uniformity

Carryover of medicated feed additives between batches of feed can potentially result in harmful drug residues in the edible tissues of food-animals. Flushing the equipment with an ingredient, such as ground grain, is one method used to remove any residual medicated feed from the system. It is generally recommended that the quantity of flush used be between 5 and 10% of the mixer’s capacity. However, there is little data that supports this recommendation. Therefore, two experiments were conducted to 1.) determine the minimum quantity of flush material required to prevent drug carryover; and 2.) quantify the interrelationship between flush size and drug concentration. In Experiment 1, feed medicated with nicarbazin (Nicarb 25%®; 0.0125%) was manufactured and conveyed from the mixer, through a drag conveyor and bucket elevator, and into a finished product bin. The system was then flushed using ground corn in the amount of 2.5, 5, 10, 15, or 20% of the mixer’s capacity (454.5 kg). Subsequently, a non-medicated diet was conveyed through the system and samples were collected and analyzed for nicarbazin. No significant (P > 0.05) differences were detected among the flush treatments, and all treatments were effective in preventing nicarbazin carryover to the non-medicated diet. In Experiment 2, feed medicated with three levels of monensin (Runomensin® 80; 100, 600, and 1,200 g/ton) was manufactured and handled in the same manner as in Experiment 1. The flushing treatments examined were: 1.0, 2.5, and 5% of the mixer’s capacity. Samples of the non-medicated diet which followed each treatment were collected and analyzed for monensin. Both concentration of monensin in the medicated diet and sampling location were significant (P < 0.05), while flush size showed a high tendency (P < 0.057) to become a significant source of variation in monensin carryover. Collectively, these studies demonstrate that existing flushing guidelines exceed what is required to prevent carryover of medicated feed additives.

Key Words: feed manufacturing, medicated feed, drug carryover, contamination, flushing

M4 Immune response and Salmonella clearance in broiler chickens fed arginine, vitamin E, and prebiotics. X. Liu*, A. Byrd2, K. Stringfellow1, M. Farnell1, J. Bautista-Ortega1, and C. A. Ruiz-Ferial1, 1Texas A&M University, College Station, 2USDA, College Station, TX.

Two experiments were conducted to evaluate the effects of arginine (ARG), vitamin E (VE), and mannanoligosaccharides (MOS) on the immune response and clearance of Salmonella in broilers. In each experiment, 1 d-old broiler chicks (n=160) were randomly distributed into 4 groups: CTL– (antibiotic-free diet), CTL+ (CTL– plus 40 mg/kg of bacitracin), AV (CTL– plus 0.8% ARG and 80 IU/kg VE), and AVM (AV plus 0.2% MOS). Birds were orally challenged with 1×106 CFU of a novobiocin– and nalidixic acid– resistant Salmonella enterica Serovar Typhimurium (ST) at day 7. Cecal populations of ST (log10) were determined in 10 birds/treatment at 3, 10 and 14 d after (Exp. 1) or 3, 7 and 14 d after challenge (Exp. 2). Blood samples were collected 5 and 9 d after challenge (Exp. 1) or 12 d after challenge (Exp. 2), and heterophils were isolated for in vitro determination of oxidative burst by monocytes (MOb) and heterophils (HOb), and lymphocyte proliferation (LPr). Three d after challenge, birds in the AVM group had lower ST counts (0.8 ± 0.3 CFU) than birds in the CTL– (2.9 ± 0.5) group, whereas the AV group (1.5 ± 0.5) and the CTL– group (2.04 ± 0.5) were not different from the other groups. The ST counts were not different at d 10 or 14 in Exp. 1, or at any sampling time in Exp. 2. Five d after challenge, birds in the AVM and CTL+ groups had similar, but lower MOB than the CTL– MOB, whereas the HOB was lowest in the AVM group, whereas the LPr was not significantly affected by dietary treatment. Nine d after challenge, birds in the AVM group had the highest MOB, whereas birds in the AV and AV groups had higher levels of LPr than the LPr in the CTL+ and CTL– groups. Twelve d after challenge (Exp. 2), birds in the AV and AVM group had higher HOB than the CTL– or CTL+ groups, and higher LPr than the CTL– group. Our results suggest that the combination of ARG, VE, and MOS, improve the innate immune response against a ST challenge, but more research is needed to fully understand all the variables that affect this response.

Key Words: arginine, immune response, lymphocyte proliferation, oxidative burst, Salmonella

M5 Reducing gangrenous dermatatitis: How probiotics can play a role in commercial poultry. C. R. Waneck*, J. L. McReynolds, J. A. Byrd, K. J. Genovese, S. E. Duke, and D. J. Nisbet, USDA-ARS-SPARC-FFSRU, College Station, TX.

Gangrenous dermatitis (GD) has become a major health problem among broiler flocks in the United States; resulting in high mortality, carcass condemnations and trimmed parts. Economic losses have been estimated to be as much as $1.31 per affected bird. GD is associated with various aerobic and anaerobic bacteria; however, Clostridium septicum, Clostridium perfringens type A, and Staphylococcus aureus, as individual isolates or in combination are most often identified as the etiologic agents associated with disease. This disease has been associated with birds that have a compromised immune system, and occurs as a sequelle to disease produced by opportunistic pathogens. It has long been known that the gastrointestinal tract is composed of a wide array of bacteria that play crucial roles in animal health and performance, as well as some recent human food safety issues. The development of a healthy normal microflora: aids in colonization resistance, by competing for intestinal attachment sites, as well as increased stimulation of the immune system. In the present investigation PoultryStar™ was administered to commercial broilers on two replicate farms (A and B) periodically throughout the grow-out cycle. During grow-out standard production practices were followed with the exception of therapeutic antibiotic administration to the probiotic treated houses. Production parameters were measured (weight, mortality and processing weights) on a weekly basis. On both farms the probiotic treated house had (P<0.05) lower mortality at the onset of disease, as well as an increase (P<0.05) in body weight gain. These experiments suggest that the application of PoultryStar™ in this field trial significantly altered the onset of Gangrenous dermatitis; most likely by providing the birds with normal flora that contributed to the overall health and well being during a commercial GD field challenge.

Key Words: gangrenous dermatitis, Clostridium, chickens, probiotic
M6 Evaluation of probiotic administration on coccidiosis vaccination in broilers: Effects on performance parameters and oocyst output. A. E. Klein*SC1, J. Lee1, M. Farnell1, L. Oden1, S. Pohl1, M. Mohn2, R. Beltran2, G. Schatzmayr2, C. Broussard3, S. Fitz-Coy4, and D. Caldwell4, 1Texas A&M University, College Station, 2Intervet-Schering-Plough Animal Health, Millsboro, DE.

Our laboratories recently reported that administering probiotic during coccidiosis vaccination may stimulate immunity and improve broiler performance during grow-out. The objective of this investigation was to evaluate coccidiosis vaccination (Coccivac®-B), with or without drinking water probiotic (Biomin® PoultryStar) administration, for protection against field strain Eimeria challenge during a 42 day pen trial. The trial consisted of a 2 x 2 factorial based design with vaccine and probiotic as experimental parameters. Straight-run broilers (n=1,800) were placed in 40 pens on built up litter. Probiotic was administered in the drinking water from day zero to day three, day eight to day 10, and then around feed changes. Field strain Eimeria were spray-applied to litter in each pen on day 14. Experimental parameters consisted of body weight gain, feed conversion, and oocyst output. Body weights in vaccinated broilers were reduced (P<0.05) on day 28 compared to non-vaccinated broilers, but were not different across experimental groups at termination. Similarly, feed conversion was increased (P<0.05) in vaccinated broilers during the grower phase compared to non-vaccinated broilers, but was improved (P<0.05) in vaccinated groups during the finisher and withdrawal phases. Probiotic administration significantly reduced (P<0.05) feed conversion during the withdrawal phase. Oocyst output (oocysts shed per gram in feces (OPG)) supported performance data throughout the trial. These data suggest that administration of a probiotic during coccidiosis vaccination may lead to improved vaccine efficacy and enteric health during broiler production.

Key Words: broiler, coccidiosis, vaccination, probiotic, performance

M7 Influence of diet on performance parameters in Coccivac®-D vaccinated replacement broiler breeders reared on new and used litter. L. A. Oden*SC1, D. J. Caldwell1, S. K. Pohl1, A. E. Klein1, S. Anderson1, S. Young2, C. Broussard3, S. Fitz-Coy3, L. Newmann3, and J. T. Lee1, 1Department of Poultry Science, AgriLife Research, Texas A&M System, College Station, 2Pilgrim’s Pride Corporation, Pittsburg, TX, 3Intervet-Schering-Plough Animal Health, Millsboro, DE.

Two consecutive experiments were conducted to evaluate the effect of dietary composition, with respect to protein concentration and amino acid profile, on performance parameters in two genetic lines of replacement broiler breeders (line A and line B) through six weeks of age. In experiment 1, replacement breeders were reared on fresh pine shavings while in experiment 2, rearing occurred on used litter from the previous experiment. Dietary formulation was based on either breeder specific recommendations or formulations of a broiler integrator. All breeders were weighed weekly to determine average body weight and flock uniformity. On day 28, males of each genetic line were added to female pens to evaluate the effect of co-mingling on male performance. During experiment 1, differences were not observed for body weight in males or females of line A, however, flock uniformity was improved (P ≤ 0.05) in line A males fed the integrator diet. Increased body weight and improved uniformity of Line B females was observed with the breeder recommended diet. Co-mingling negatively impacted (P ≤ 0.05) male body weight regardless of genetic line. In experiment 2, diet impacted average body weight in line A males, line B males, and line B females, however no impact on final flock uniformity was observed. Line A males fed the breeder recommended diet had increased (P ≤ 0.05) body weight at termination. Line B males and females fed the breeder recommended diet had increased (P ≤ 0.05) body weight throughout the experiment. Similar to experiment 1, negative effects (P ≤ 0.05) on male body weight resulting from co-mingling were observed. These data indicate that co-mingling negatively impacts male body weight and that flock performance can be influenced by dietary composition depending on genetic line and gender.

Key Words: broiler, protein, co-mingling, body weight, flock uniformity

M8 Evaluation of hydrolyzed yeast cell wall products on intestinal morphology and broiler performance during coccidia exposure. R. Van Wyhe*SC1, R. Dalloul1, M. Bedford2, and A. McElroy1, 1Virginia Polytechnic Institute and State University, Blacksburg, 2Ab Vista, Marlborough, Wiltsire, United Kingdom.

The poultry industry is under pressure to discontinue the use of sub-therapeutic levels of antibiotics as growth promotants. One promising alternative is the use of yeast cell wall products which act on the intestine by promoting growth of probiotic bacteria, binding to bacterial attachment sites, or by aiding in immune response. A study was conducted to evaluate the intestinal response of broilers to hydrolyzed yeast cell wall (YCW) products during exposure to an environmental coccidial challenge. 3024 day-old Cobb 500 chicks were placed in pens (42 chicks/pen, 8 replicate pens) on litter seeded with coccidia and fed 1 of 9 diets. Dietary treatments were 1) control(C); 2) cell wall (YCW, C+0.1% YCW); 3)mannanoligosaccharides (M, C+0.1%M); 4) glucans (G, C+0.1%G); 5) nucleotides (N, C+0.1%N); 6) peptides (P); 7) M+G (C+0.1%M+0.1%G); 8) P+N (P+0.1%N); and 9) all products (P+M+G+N). Body weight (BW) and feed intake (FI) were measured for 3 feeding periods of starter (d0-10), grower (d10-32) and finisher (d32-42) and cumulatively. At d21, 3 birds per pen were scored for intestinal coccidia lesions. At d10 and d21, 8 birds per treatment were selected for measurement of villus height (VH), crypt depth (CD), and villus height: crypt depth ratio in duodenum, jejunum and ileum. There were no significant differences between any of the diets for BW, FI or lesion score. On d10 and 21, VH in duodenum was significantly longer (P<0.05) in M fed birds as compared to birds fed M+G or P+M+G+N. In jejunum, VH in YCW fed broilers was shorter than in C fed birds at d10, but in contrast, longer at d21. In the ileum, YCW feeding resulted in deeper CD at d10 and shallower CD at d21 as compared to M, G, and M+G diets. While there were no significant differences in performance parameters, there were differences in intestinal morphology; however, these responses were inconsistent among intestinal sections. These results suggest that these yeast products did effect intestinal growth or recovery during the exposure to coccidia and may be section specific or have a limited time of effectiveness.

Key Words: broiler, mannans, glucan, intestine, yeast
M9  Effect of bismuth citrate, lactose and citric acid on necrotic enteritis in broilers. K. D. Stringfellow*SC1, J. L. McReynolds2, J. Lee1, J. A. Byrd2, D. Nisbet2, and M. Farnell1, 1Texas A & M University, Department of Poultry Science, College Station, 2U.S. Department of Agriculture, Agricultural Research Service, FFSRU, College Station.

Clostridium perfringens – associated necrotic enteritis causes significant losses and increased morbidity in poultry. The objective of this study was to evaluate the effect of bismuth citrate and acidifiers on the development of necrotic enteritis in broilers. The first study was a dose response that evaluated the effect of bismuth citrate at 50, 100, or 200 ppm on intestinal colonization and lesion development associated with a C. perfringens challenge model. The second study evaluated bismuth citrate with the addition of dietary lactose or citric acid on intestinal pH and lesion development. For the third study, we determined if dietary lactose would enhance the efficacy of bismuth citrate on intestinal colonization and intestinal lesion development associated with C. perfringens. Study 1: Intestinal colonization of C. perfringens and intestinal lesions of the 100 and 200 ppm treatment group were significantly reduced when compared to birds fed 50 ppm or 0 ppm bismuth citrate. After feeding 50 ppm bismuth citrate, intestinal lesion development was reduced (p < 0.05) when compared to the control group. Study 2: Dietary lactose and citric acid treatments failed to significantly enhance the protective effect of bismuth citrate on lesion scores. Study 3: A decrease (p < 0.05) in intestinal lesion scores occurred in birds fed 2.5% lactose with 100 ppm bismuth citrate, compared with the positive control group or dietary lactose group. There were no significant differences in bacterial populations. These data suggest that bismuth citrate with dietary lactose may promote gut integrity, subsequently reducing intestinal lesion development in broilers infected with necrotic enteritis.

Key Words: necrotic enteritis, chicken, bismuth citrate, lactose, citric acid

M10  Impact of dietary protein and litter temperature on commercial broilers. K. L. Ishee**SC1, J. L. Purswell2, L. Araujo1, C. Araujo1, C. D. Zumwalt1, and M. T. Kidd1, 1Mississippi State University, Mississippi State, 2United States Department of Agriculture, Mississippi State, MS.

Energy to heat litter before and during brooding represents a large cost for broiler growers. Although improvements in house tightness and winterization procedures improve grower brooding efficiency, this experiment assesses the impact of starter dietary CP level and its ability to overcome issues with low brooding conditions, as measured by low litter temperature. Eighteen hundred d old Ross 708 chicks from a 37 wk flock were obtained from a commercial hatchery and placed into 36 pens (50 straight-run birds/pen). Each pen was equipped with one drinker line, one tube feeder, built-up pine shavings, and one infrared hanging brooder which dictated litter temperature. Dietary CP treatments in crumble form fed from 1-14 d were: 1) 22% CP; 2) 21% CP; 3) 22% CP; 4) 23% CP; 5) 24% CP; and 6) 25% CP (6 replications/treatment). Treatment 1 represented high litter temperature (124 F, first 32 h after placement under brooder) and treatments 2 through 6 represented low brooding temperature (average of 103 F, first 32 h after placement under the brooder). Brooding temperature was reduced thereafter but treatments were maintained until 14 d. Common pelleted feed was provided from 14-28, 28-35, and 35-41 d. Chicks brooded on high litter temperature and fed 22% CP had poorer overall feed conversion than birds fed 24 and 25% CP reared on low litter temperature (P < 0.05). Other effects of brooding temperature did not occur. Results indicate that brooding temperature may have been too high in the experimental pen for the birds to migrate to their comfort zone. Birds fed 23% CP had improved tender yields (P < 0.05), but 24% CP was required to improve (P < 0.05) overall feed conversion. BW gain and other carcass traits at d 41 were not impacted by treatments.

Key Words: broiler, litter temperature, crude protein


Egg conductance may influence embryo growth and alter the way we need to incubate different breeds. Differences in egg components and embryonic growth between a high conductance and a low conductance breed were determined. 300 eggs from each breed, of the same breeder flock age and fed the same diet were numbered, weighed and set into a single incubator using a typical single stage incubation parameters at the PRS in Salisbury, NC. A group of eggs from each treatment were brought back to NCSU for evaluation of percentage yolk, albumen and shell weights. Embryos were sampled at d11, 14, 18 and 19 for incubation for embryo weight. Time of hatch was performed from d19 of incubation until hatch. At hatch, chick weight with and without yolk was determined, as well as heart weights. There were no significant differences in wet yolk, dry yolk or yolk as a percentage of initial egg weight. Dry albumen as a percentage of initial egg weight was significantly less in the high conductance breed, possibly indicating fewer nutrients in the albumen. Embryos without yolk were significantly larger as a percentage of initial egg weight in the high conductance breed at d11 and d19 of incubation, but there were no differences when chicks without yolks were examined as a percentage of initial egg weight at hatch. There was no difference in time of hatch. The low conductance breed demonstrated a significantly greater amount of yolk at hatch than the high conductance breed. Since there were no differences before incubation in yolk weight, the differences seen at hatch must be due to utilization of the yolk by the embryo during incubation indicating a possible increased reliance on anerobic energy sources. Since there were no differences in shell thickness before incubation, the differences in conductance are due to the number or the diameter of pores in the eggshell. The embryos of the low conductance breed accelerated growth after internally pipping when they were able to increase their aerobic respiration and attain a similar percent chick of initial egg weight as the high conductance breed.

Key Words: incubation, conductance, embryonic development

M12  Eggshell bacterial contamination of non-washed and washed eggs from caged and cage-free hens. J. F. Hannah**SC1, J. L. Wilson1, N. A. Cox2, L. J. Richardson3, J. A. Cason2, M. T. Musgrove2, and R. J. Buhr2, 1University of Georgia, Athens, 2USDA-ARS Russell Research Center, Athens, GA.

This study was conducted to evaluate the microbiology of non-washed and washed table eggs obtained from caged and cage-free laying hens housed on either all shavings or all wire slat environments. Both Hy-Line W-37 white and Hy-Line brown strains were used. On each of four replication sample days (at 24, 28, 32, 36 wk of age), 20 eggs were collected from...
each pen for bacterial analysis (n=120). Ten of the eggs collected from each pen were washed for 1 min with a commercial egg washing solution (50 C, pH 11), while the remaining 10 eggs were not washed prior to sampling the eggshell and membranes (crush-and-rub) for aerobic bacteria (APC), Escherichia coli (E. coli), and coliforms. Non-washed eggs produced in an all shavings environment had slightly higher bacteria numbers (APC 4.4 and coliforms 1.1 log_{10} cfu/mL) than eggs produced on slats (APC 3.9 and coliforms 1.1 log_{10} cfu/mL), which had significantly higher (P< 0.05) bacteria numbers than eggs produced in cages (APC 3.2 and coliforms 0.7 log_{10} cfu/mL). The washing of eggs from hens in cages, on shavings, and on slats significantly reduced APC counts by 1.1, 1.7, and 1.7 log_{10} cfu/mL of rinsate, respectively. E. coli and coliform counts were not influenced by housing type and were not significantly reduced by washing. Laying hen strain had no effect on eggshell bacteria recovery levels. No significant differences were found in APC, E. coli, and coliform counts on eggs obtained from the three housing types following washing. These results indicate that eggshell bacteria levels are similar following washing for eggs from hens housed in these cage and cage-free environments.

Key Words: eggshell bacteria, egg washing, housing type, caged hens, cage-free hens

**M13** Eggshell surface and deep bacteria recovered from non-sanitized and sanitized broiler hatching eggs. C. B. Stephens*SC1, N. A. Cox2, L. J. Richardson2, J. M. Mauldin1, and R. J. Buhr2, 1University of Georgia, Athens, 2USDA-ARS Russell Research Center, Athens, GA.

This study was conducted to evaluate the superficial and deep eggshell bacteriology of hatching eggs sanitized in a commercial hatchery. Two setting buggies of hatching eggs (5,040/buggy) were sanitized the day prior to placing the buggies into the setter for incubation. Eggs were either spray or foam sanitized with 1,200 ppm of Byotrol G5 (composed of 4 quaternary ammoniums and 1 biguanide biocide attached to a polymer core) and allowed to air dry in the egg holding room for 15 min. The control buggies of eggs from the same breeder flocks remained untreated. Ten eggs were aseptically removed from each setting buggy on the day of treatment, placed into individual plastic bags, and transported back to the lab. Each eggshell was rinsed in 20 mL 1% buffered peptone for 1 min and the rinsate collected. The eggshell was then aseptically opened, the internal contents discarded, and a modified crush-and-rub of the eggshell and adhering membranes conducted. The eggshell surface rinsate and the crush-and-rub rinsate were evaluated for aerobic bacteria (APC), Escherichia coli (E. coli), and coliforms. For non-sanitized eggs the recovered APC values were lower at 3.1 log_{10} cfu/mL for eggshell/membranes rinsates collected after the eggshell rinsates at 4.4 log_{10} cfu/mL. From the eggshell rinsate and the eggshell/membrane rinsate of spray sanitized eggs the recovered APC values were similar at 3.8 and 3.7, log_{10} cfu/mL of rinsate, respectively. From the eggshell rinsate and the eggshell/membrane rinsate from foam sanitized eggs the recovered APC values were identical 3.2 and 3.2 log_{10} cfu/mL of rinsate, respectively. The recovery of E. coli and coliforms was not significantly affected by sanitization as determined by eggshell rinse or eggshell/membrane rinse. These results indicate that sanitization of hatching eggs by spray or foam significantly reduces the level of bacteria on the eggshell surface recovered in a rinse, but spray or foam sanitization did not alter the level of bacteria within the eggshell/membranes recovered in a crush-and-rub rinse.

Key Words: eggshell surface bacteria, eggshell and membrane bacteria, hatching egg sanitization, aerobic bacteria, biguanide

**M14** Breeder age, egg storage, and rate of egg warming on broiler bone development and leg problems. P. E. Eusebio-Balcázar*SC, E. O. Oviedo-Rondón, M. J. Wineland, H. R. C. Evans, J. Whitely, J. Jornigan, and C. M. Rhyne, Department of Poultry Science, CALS, North Carolina State University, Raleigh.

Broiler bone development can be affected by maternal background and stressful environment early in life. This study aimed to evaluate the effects of breeder age, egg storage time, and egg warm-up rate on bone development at hatch and leg health in broilers at 42 d. Fertile eggs from two breeder flocks of 33 and 57 wks of age were collected and stored for 2 wks, and again at 35 and 59 wks, eggs were collected and stored for 3 d. Prior to incubation these eggs were warmed up to temperature in one incubator over periods of either 2 or 18 hrs, and later incubated under the same profile. This arrangement of treatments resulted in a 2x2x2 factorial design with hen breeder age: old (O) or young (Y), egg storage, fresh (FR) or stored (ST), and warm up rates, fast (F) or slow (S), as main factors. A random sample of 10 chicks per treatment were collected at hatch, weighed, sacrificed and residual yolk determined. Both legs were dissected and shank and femur weights, lengths, thickness, and ash contents were obtained. Relative asymmetry (RA) and weight relative (%) to BW without yolk (BWY) of each leg section were calculated. A total of 1008 chicks were randomly placed in 72 floor pens (14/pen). At 42 d, chickens were individually inspected for crooked toes, valgus/varus deformities, hock burns, foot pad dermatitis, and gait scores. Results indicated that heavier BWY, higher femur ash content, lower thigh weight and RA of shank length were observed on O breeders compared with Y. Chicks coming from FR eggs had lower RA of femur weight compared with chicks from ST. Chicks had heavier femur relative weights, but lower ash content when egg warming profile was S compared with F. Three way interaction was observed for valgus, and egg storage by warming profile interaction was observed in gait score 1 at 42 d. Broilers from Y breeders and FR eggs had lower valgus incidence, independently of warming profile, compared with O, FR, F broilers (56 vs 78%). No differences were observed in the incidence of other leg issues. Breeder age, egg storage time and egg warming rate influenced bone development and leg problems in broilers.

Key Words: leg problems, breeder age, egg storage, incubation

**M15** Impact of rate of egg warming on the embryo, hatchling and broiler performance in stored and fresh hatching egg. C. M. Rhyne*SC, H. R. C. Evans, M. J. Wineland, and K. M. Mann, North Carolina State University, Raleigh.

The objective of this trial was to determine the effect of rate of egg warm-up prior to incubation upon embryo growth, energy metabolism and grow out performance for broilers from fresh or stored eggs. 1080 eggs were obtained from a young flock of hens when 33 weeks of age, stored for 2 weeks and again at 35 weeks of age and stored for 3 days. Eggs from the 2 storage periods of either 2 weeks (stored) or 3 days (fresh) were equally divided and placed in 2 different incubators with 2 different warm-up profiles (fast and slow). Fast profile eggs were warmed up to temperature over a period of 2 hours and slow profile eggs were warmed up to temperature over a period of 18 hours. After the eggs attained incubation temperature, the profiles were kept the same. Chicks were grown out and weighed at 3 weeks and 6 weeks. Heart rates were determined at 13 days of incubation. Chicks were examined at hatch, and liver and heart samples were taken from 10 chicks per treatment to determine relative organ weight and glycogen content. Body weight at
M16 Effect of feeding NuPro® at different time intervals on the performance of commercial broilers. M. C. Shivakumar1, H. N. Narasimhamurthy1, and H. V. L. N. Swamy*2, 1KIFSU, Bangalore, India; 2Alltech Inc., Guelph, ON, Canada.

NuPro® (Alltech Inc.) is a yeast derived protein extracted from a specific strain, Saccharomyces cerevisiae1026. The objective of the current trial was to determine the effects of feeding NuPro at different time intervals on the performance and economic returns of commercial broilers. The trial lasted from 0 to 42 days, tested 880 birds on deep litter, conducting 4 treatments, 10 replications per treatment and 22 birds per replication. Four diets used in the trial are: a control (corn-soybean meal), 2% NuPro for 7 days, 2% NuPro for 14 days and 2% NuPro for 42 days. Body weight gain, feed intake, feed efficiency, mortality, European Production Efficiency Factor (EPEF) and return on investment (ROI) were evaluated. Data were subjected to ANCOVA and means were compared using Tukey’s multiple comparison test (SAS, P<0.05). Feeding NuPro for 14 days statistically increased feed intake as compared to Control birds. At the end of the trial, however, birds fed NuPro for 7 and 14 days consumed less feed than the Control. Weight gain was better in all the NuPro diets both on day 7 and 42 as compared to Control (P<0.05). Birds fed NuPro had lower FCR than the control birds on day 7 and 42 (P<0.05). This may be related to the role of the product in improving gut development and in turn the nutrient absorption. At the end of the trial, birds fed NuPro diets showed significantly less mortality as compared to control birds. Birds fed NuPro showed 37 to 68 better EPEF points has compared to control birds (P<0.05). Maximum profit (0.2 USD per bird) was obtained when NuPro was fed for 14 days, but maximum ROI (1:7.9) was obtained when fed for 7 days. To conclude, feeding NuPro enhanced broiler performance and economic returns. Though the best ROI was noticed when NuPro was fed for 7 days, it can be fed up to 14 days with significant economic benefits.

Key Words: broilers, yeast derived protein, functional nutrient, poultry, NuPro

M17 Effect of feeding NuPro® at different time intervals on immunity and meat quality of commercial broilers. M. C. Shivakumar1, H. N. Narasimhamurthy1, and H. V. L. N. Swamy*2, 1KIFSU, Bangalore, India; 2Alltech Inc., Guelph, ON, Canada.

NuPro® (Alltech Inc.) is a yeast derived protein extracted from a specific strain, Saccharomyces cerevisiae1026. The objective of the current trial was to determine the effects of feeding NuPro at different time intervals on the immunity and meat quality of commercial broilers. The trial lasted from 0 to 42 days, tested 880 birds on deep litter, conducting 4 treatments, 10 replications per treatment and 22 birds per replication. Four diets used in the trial are: a control (corn-soybean meal), 2% NuPro for 7, 14 and 42 days. One bird per pen was randomly allocated for studying the immune and meat quality parameters. Weights of heart, liver, spleen, bursa, thymus, gizzard, proventriculus and intestine were measured on day 7, 14 and 42 and expressed as % body weight. On day 42 weights of total dressed meat, breast, thighs, wings, drumstick and abdominal fat was measured and expressed as % body weight. Birds were vaccinated for Newcastle disease (ND) and antibody titers were measured on a weekly interval. Data were subjected to ANOVA and means were compared using Tukey’s multiple comparison test (GLM of SAS, P<0.05). On day 7 birds fed NuPro had significantly higher bursa and spleen weight than Control birds. This effect carried on till the end of the experiment. Only on day 14 birds fed NuPro had higher intestinal weight than Control birds (P<0.05). There was no significant effect of treatments on total dressing % and weights of thigh, drumstick and wings at the end of the trial. However, feeding NuPro for 7 days significantly reduced abdominal fat content of birds as compared to birds on Control diet. Breast weight was significantly higher in birds fed NuPro for 14 days as compared to birds on Control diet. Birds fed NuPro for 14 and 42 days had higher antibody titers to ND as compared to birds on Control diet (P<0.05). To conclude feeding NuPro has the potential to improve immunity of birds and can also assist in the production of leaner meat. Further research is needed to evaluate the effect of NuPro on cell mediated immunity.

Key Words: broilers, yeast derived protein, functional protein, NuPro, poultry

M18 The effect of dietary N,N-dimethyl glycine (DMG) on technical performance, plasma metabolites and broiler ascites syndrome: A challenge study. I. D. Kalmar1, J. Buyse2, and G. P. J. Janssens*1, 1Ghent University, Belgium; 2Catholic University of Leuven, Belgium.

Introduction DMG is reputed to enhance oxygen supply at cellular level. The primary condition of ascites, being hypoxemia, constitutes a possible application of DMG as a feed additive in broiler rations in order to abate losses due to broiler ascites syndrome and to improve technical performance. The current study intended to investigate these potential benefits of dietary DMG.

Materials In total sixty four 14-day-old broiler hens (Ross-308) were reared in 16 pens of 4 birds each until 40 days of age. The birds were challenged with a low environmental temperature (15 °C) and a diet enriched with poly unsaturated fatty acids in form of corn oil in order to provoke ascites. To each pen, one of two test diets was randomly assigned for the whole trial period: a control diet or the same diet added...
with 167 ppm DMG. Mortality, feed conversion ratio (FCR) and apparent metabolizability were recorded at pen level. Further, individual blood samples were taken at the end of the trial, on which hemocrit level (HCT), thiobarbituric acid reactive substances (TBARS) and selected plasma metabolites were analysed. Next, all birds were euthanized and manually dissected, which included assessment of ascites heart index (AHI), carcass and meat%.

**Results** Mortality, clinical ascites and overall FCR were numerically lower in the DMG supplemented groups compared to the controls. Moreover, FCR between 30d and 40d improved with a statistical trend (control:2.33; DMG:2.17; 0.1<P-value<0.05). Next, in contrast to similar HCT, AHI was significantly lower in the treatment groups (-18%, P<0.5). Whereas, meat and carcass% were similar between both feeding groups. Further, apparent dry matter metabolizability was significantly higher when fed the DMG supplemented diet (+3.7%, P<0.05). Finally, TBARS, as a measure of oxidative stress, numerically declined through provision of DMG.

**Conclusion** Dietary DMG benefits broiler production by improving apparent metabolizability and FCR and by diminishing progression towards ascites. The latter effect is probably at least partly due to an anti-oxidant effect.

**Key Words:** nutrition, broiler, feed additive, dimethyl glycine, ascites

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**M20 Effects of oregano essential oil on performance and livability of large broilers in a commercial setting.** M. A. Mellencamp*, P. A. Stayer1, R. Smith1, R. Dvorak1, and T. S. Cummings3, 1Ralco Nutrition, Inc., Marshall, MN, 2Sanderson Farms, Inc., Laurel, MN, 3Mississippi State University, Mississippi State.

Coccidiosis is an economically devastating disease in broilers. It impacts growth, mortality and susceptibility to other pathogens. With public pressure to reduce the use of antibiotics and anti-coccidials, the industry is investigating natural compounds to improve broiler performance. Oregano essential oil (OEO) is a natural feed flavorant that has been shown to improve broiler performance on farms with enteric challenges. This study investigated the effects of OEO on performance of large broilers on a commercial farm in south central US. Two of 4 tunnel-ventilated houses received OEO (Regano®, Ralco Nutrition). Two control houses received the current anti-coccidial program (24,400 birds/house). OEO was delivered in feed from d1-49 (d1-14: 0.88 lb/ton; d15-28: 0.75 lb/ton; d29-48: 0.6 lb/ton) and in water on d1-5 and 23-27 (3 oz Regano/gal at 1:128). Control birds received Nicarb/BMD (d1-14), Robenz/BMD (d15-28), Bicox/BMD (d29-48). All birds received Stafac on d49-59, followed by plain feed from d60-63. Necropsies were performed (10/house) on d21, 28 and 37 to assess intestinal health. Performance results showed that OEO birds were within 1.5% of control birds for final weight (8.569 lb v. 8.649 lb), average daily gain (0.134 lb v. 0.135 lb), and feed conversion (2.080 v. 2.081). Livability was similar in both groups (97.08% v. 96.85%). Clinical coccidiosis was not observed in OEO or control houses. However, mild (1+) to moderate (2+) intestinal lesions were seen in OEO-fed birds at d21 and d28 (100% and 65% of birds, respectively). No lesions were seen on d37. Control birds showed little coccidiosis at necropsy (10%, 15%, 0%, respectively). These results show that in the face of severe coccidia challenge, OEO birds remained healthy and performed well compared to birds fed an aggressive anti-coccidial program.

**Key Words:** oregano essential oil, broilers, coccidiosis, natural, performance

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**M19 Effect of aflatoxin culture on intestinal function and nutrient loss in laying hens.** T. J. Applegate*, G. Schatzmayr*, K. Prickel*, C. Troche†, and Z. Jiang†, 1Purdue University, West Lafayette, IN, 2Biomin Research Center, Tulln, Austria.

The negative effects of aflatoxins (AFLA) on hepatic necrosis and total tract digestibility of energy, nitrogen (N), and amino acids have been well documented. However, the question remains as to if this is an effect on nutrient metabolisability alone and/or an effect on the intestine resulting in increased endogenous nutrient loss and/or reduced nutrient digestibility. Therefore, a 2 wk feeding study with a crude AFLA culture was conducted with laying hens to measure endogenous losses and digestive functionality of the intestine. Hyline W36 hens were fed 1 of 4 experimental diets containing a crude AFLA culture from 20 to 22 wk of age. Diets were analyzed to contain 0, 0.6, 1.2, or 2.5 ppm AFLA. Dietary AFLA concentration had no effect on BW, egg production, or feed intake. Intestinal crypt depth (but not villus length) increased linearly with increasing AFLA concentration. Similarly, specific activity of the intestinal disaccharidase, maltase, increased quadratically by feeding up to 1.2 ppm AFLA and declined at 2.5 ppm AFLA. Although there was no impact of AFLA on goblet cell number, density, or crude mucin excretion, sialic acid excretion increased quadratically such that it was increased 12% when 0.6 and 1.2 ppm AFLA was fed versus the control. Digestibility of DM and N were unaffected by AFLA. Feeding of 0.6 and 1.2 ppm reduced the apparent digestible and AMEn of the hen by 10 and 4%, respectively. As intestinal characteristics (intestinal morphology, sialic acid production, and apparent digestible energy) were altered by AFLA feeding, it can be surmised that AFLA can have a direct and/or indirect effect on functionality of the gastro-intestinal tract.

**Key Words:** aflatoxin, energy, intestine, laying hen
(P < 0.05) in toms fed RAC for 14 d compared to control. This resulted in toms fed RAC for 14 days gaining 0.37 to 0.52 pounds more than controls. However, no RAC differences in ADG and G:F (P > 0.086) were observed in the 7 d duration. No RAC effects were observed in feed intake (P > 0.141). Feeding 5 to 13 ppm RAC for 14 d improved the ADG and GF compared to controls in finishing toms.

**Key Words:** turkey, toms, ractopamine-HCl, growth, finishing

### M22  Effects of ractopamine-HCl on finishing hen turkey performance.


A six site study across the United States and Canada was conducted and pooled to evaluate the effects of feeding ractopamine-HCL (RAC) in the final 7 days (d) or 14 d on hen average daily gain (ADG) and feed efficiency measured by gain:feed (G:F). A randomized complete block design with location as a blocking factor was conducted at each site. Treatment design consisted of two factors: duration (7 and 14 d) and RAC (0, 5, 9, and 13 ppm). At each site there were a total of forty-eight pens (6 blocks and 8 pens per block) for a total of 288 pens or 5,280 hens. Diets were formulated to contain industry average lysine (total) and metabolizable energy for the finishing phase (as fed); 0.96% lysine and 1,572 kcal/pound of feed. Following completion of the treatment phase, feed was withdrawn for about 4 hours and then hens were loaded and transported for at least 4 hours. Hens were either 15 wks of age (19.06 lb +/- 0.745; 14 d duration) or 16 wks of age (20.73 lb +/- 0.591; 7 d duration) at the start of the treatment phase. Hens fed RAC for either 7 d or 14 d had higher ADG and improved G:F than controls (P < 0.001). This resulted in hens fed RAC for 7 d gaining 0.23 to 0.32 pounds more than controls or birds fed RAC for 14 d gaining 0.34 to 0.71 pounds more than controls. No RAC effects were observed in feed intake for either duration (P > 0.10). Feeding 5 to 13 ppm RAC for 7 to 14 d improved ADG and G:F as compared to controls in finishing hens.

**Key Words:** turkey, hen, ractopamine-HCl, growth, duration

### M23  Bioplex Zn prevents from Zn-Fe interaction in broiler chickens.

Y. M. Bao1,2,3, and M. Choct1,2, 1University of New England, Armidale, NSW, Australia, 2Australian Poultry CRC, Armidale, NSW, Australia, 3Alltech Asia-Pacific Bioscience Centre, Bangkok, Thailand.

It is believed that mineral ions complexed with organic molecules are protected from interactions that interfere with their bioavailability. However, there is no direct evidence to demonstrate that organic trace minerals could prevent from this interaction. In an experiment, 8 replicates of groups of 6 birds were set into 3 treatments: 1) Bioplex Zn (Org-Zn): the control diet plus 30 mg organic Fe and organic Zn/kg diet; 2) Inorganic Zn(No-Zn): the control diet plus 30 mg inorganic Fe and inorganic Zn/diet; 3) Normal Zn: the same as treatment 1 but maintained till the end of the experiment. All birds were fed the organic or inorganic Zn deficient control diet at first week of age and then treated with experimental diets for two weeks. From three weeks of age, birds in treatments 1 and 2 were fed organic Zn or inorganic Zn deficient control diets until 42 days of age. Total tibia bone trace mineral contents and bone characteristics were analyzed statistically using one-way ANOVA with STATGRAPHICS software and the significance of difference between means was determined by Duncan’s™ multiple range test (Table 1).

**Table 1. Effects of depletion of Zn on tibia trace mineral contents and bone characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Cu (µg)</th>
<th>Fe (µg)</th>
<th>Mn (µg)</th>
<th>Zn (µg)</th>
<th>Strength (kg)</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Zn</td>
<td>7.1</td>
<td>225.9a</td>
<td>11.4</td>
<td>161.9b</td>
<td>21.5</td>
<td>53.4b</td>
<td>11.1a</td>
</tr>
<tr>
<td>Inorganic Zn</td>
<td>7.2</td>
<td>178.5b</td>
<td>10.0</td>
<td>191.2b</td>
<td>26.1</td>
<td>56.3b</td>
<td>9.9b</td>
</tr>
<tr>
<td>Normal Zn</td>
<td>8.0</td>
<td>234.6a</td>
<td>10.6</td>
<td>350.8a</td>
<td>19.8</td>
<td>62.3a</td>
<td>9.5b</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.05</td>
<td>NS</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
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</tr>
</tbody>
</table>

Thus, it confirmed that there was no Zn-Fe interaction when broiler diets were supplemented with Bioplex Zn and Fe. However, the deficiency of inorganic Zn significantly depressed inorganic Fe uptake in tibia bones.

**Key Words:** bioplex trace minerals, trace mineral interactions, zinc, iron, broiler chickens

### M24  Impact of broiler breeder nutrition on progeny performance and carcass characteristics.


Two progeny grow-out experiments were conducted to evaluate growth and carcass parameters of progeny from broiler breeders fed diets supplemented different vitamins and minerals. Two hundred forty Ross 708 hens received a control diet (containing a vitamin and mineral premix devoid of Se) or the control diet supplemental vitamin B (vitamin B12, 60 µg/kg; d-biotin, 500 µg/kg; folic acid, 4 mg/kg; niacin, 80 mg/kg; d-pantothenic acid, 25 mg/kg; vitamin B6, 10 mg/kg; riboflavin, 25 mg/kg, vitamin D (1 kg of HyD/ton), and vitamin E (120 IU/kg), the combination of the three vitamins, Se (0.3 mg/kg), Zn (30 mg/kg), Mn (40 mg/kg) from organic sources, the combination of the three minerals, and an additional diet containing the combination of all vitamins and minerals (10 treatments; 8 replications; 3 hens per replicate). A total of 450 eggs (45 eggs/treatment) and 1200 eggs (120 eggs/treatment) were obtained and set when breeders were 31 (experiment 1) and 34 (experiment 2) wk of age, respectively. At d 1, chicks were separated, weighed, and wing-banded by breeder treatment. In experiment 1, chicks were placed in a facility and separated only by wing-band. In experiment 2, chicks were placed into 80 pens (12 birds/pen) of an open-sided, floor pen facility. Chicks were placed as straight-run. Chicks were allowed access to common mash feed and water ad libitum from 0 to 41 d in both experiments. BW gain and feed conversion ratio were measured from 1 to 41 in both experiments. On d 42, all birds in experiment 1 and 6 birds per pen (3 male and 3 female) in experiment 2 were selected randomly and processed. The progeny experiment was a randomized complete block design. Breeder pen was the experimental unit for the progeny design. Significant improvements in progeny from hens fed Mn were noted in experiment 1 (d 7 BW gain, carcass and tender yields) and in experiment 2 (BW gain, feed conversion, and total breast and tender yields). Future research should further address the impact of breeder Mn level, source, and level to source ratio on progeny live performance and carcass characteristics.

**Key Words:** broiler breeder, manganese, progeny

Purified xanthophyll products used to pigment egg yolks share a common susceptibility to oxidation and thus loss of their pigmenting ability. Changes in the production processes of pigmenters can reduce their susceptibility to degradation. Objectively demonstrating slower degradation rates of one pigmenter compared to competing products would be an advantage in the market place. The results from a series of kinetic experiments have allowed the ranking of five commercially available pigmenting products. Employing a pseudo first-order kinetic model, the rate constants for the loss of total xanthophylls and trans-lutein contents were estimated for five neat pigmenting products and for the products when mixed with a vitamin and mineral feed premix. The results indicated that pigment losses were accelerated when mixed with the premix product and that there were statistically significant differences in the rates of degradation of color and lutein content. The advantage of using a kinetic description of the degradation process is that direct comparisons of time to lose a set proportion of the initial activity or the activity lost in a given time can be calculated and compared from separate experimental determinations.

Key Words: xanthophylls, pigmenter, stability, degradation, kinetics

M26 Comparison of commercial adsorbent products Using an in vitro binding assay. D. Sanders* and A. G. Yersin, Kemin Industries, Des Moines, IA.

Six commercial adsorbent products were tested for their ability to bind a series of mycotoxins using a two-step binding model. Each product was tested for binding efficiency at three dosages, 1, 3 and 5 mg/ml. The mycotoxins tested included aflatoxin (B1, B2, G1 and G2), zearalenone, deoxynivalenol, ochratoxin and fumonisin B1 at concentrations of 5 ppb each, 300 ppb, 1 ppm, 200 and 300 ppb, respectively. The in vitro assay includes an adsorption step, which is conducted at pH 3.0 and measures a reduction in mycotoxin solution concentration. The second step measures the degree to which the toxin can be desorbed and is determined by re-suspending the test material, with adsorbed mycotoxins, in a clean pH 6.8 buffer. Efficiency is determined by comparing the initial challenge toxin concentration to the final desorbed solution toxin levels. Several products showed binding efficiency (greater than 50%) for aflatoxins, zearalenone and fumonisin B1. However most products tested showed little (less than 10%) binding efficacy for deoxynivalenol or ochratoxin, with limited absorption seen in the former and complete desorption in the latter.

Key Words: zeolite, mycotoxin, desorption, adsorption, clinoptilolite


Shrimp waste meal is of high nutritional value, palatable and of pleasant aroma which is considered as a potential substitute for fish meal. This study was carried out to ascertain the effect of shrimp waste as a replacement for fish meal in broiler diet. One hundred and fifty day old chicks were allotted to five experimental diets with three replicates of 10 birds each for a period of 5 weeks in completely randomized design. Diets 1-5 contained 100% FM(Fish Meal) at 0% SWM(Shrimp Waste Meal), 75% FM at 25% SWM, 50% FM at 50% SWM, 25% FM at 75% SWM and 0% FM at 100% SWM accordingly. Diets were Iso-Nitrogenous. Diets were subjected to ANOVA(Steel and Torrie, 1980). At the end of the 5th week there were no significant difference (P ≤ 0.05) between the treatment mean for average weight gain, average dry matter intake, feed-gain ratio and protein efficiency. This suggest that SWM could replace FM for protein in diet of broilers.

Key Words: shrimp waste meal, replacement, fish meal, diet, broilers

Nutrition II

M28 Effect of protease enzyme on performance and ileal digestibility of broilers grown to 42 days of age in floor pens. A. Favero*, 1S. C. A. Maiorka, 1C. C. Rocha, 1M. D. Appelt, 1J. O. B. Sorbara, 1Universidade Federal do Parana, Curitiba, PR, Brazil, 2DSM Nutritional Products, Sán Paulo, SP, Brazil.

This experiment investigated the effects of supplementing diets with different levels of crude protein (CP) and apparent metabolizable energy (AME) with or without a protease (RONOZYME® ProAct declared 75000 PROT/g, analyzed 78067 PROT/g) on the performance, digestible energy (DE) and the ileal digestibility of nitrogen and fat of broilers. The diets were formulated to be similar to commercial diets with corn, soybean meal and meat-bone-meal. The experimental design was a 2 x 2 x 2 factorial arrangement of treatments to evaluate 2 CP and amino acid levels, 2 AME levels and 2 protease levels (0 and 200 ppm: 15000 PROT/kg feed). The difference between the two levels of CP was 7.5% while digestible Lys, TSAA and Thr differed by 15% from the control, and the difference between the two levels of AME was 3%. Each diet was fed to 11 pens of 22 male broilers raised in floor pens from d 1 to d 42. At d 42, five birds/pen were euthanized, for ileal collection and energy, nitrogen and fat digestibility was determined (1% of Celite was added to the withdraw feed as indigestible marker). No interaction (CP x AME x Enzyme) was observed in any performance parameters analyzed. Broiler performance was superior (P<0.01) in birds fed the higher levels of CP and AME. Protease supplementation significantly (P<0.01) improved feed conversion ratio compared to the non-supplemented groups. A lower daily feed intake (P<0.05) was observed during the grower period (21 to 42 d of age) on the treatments with the higher level of AME compared with the low level. Birds fed high CP levels improved (P<0.05) ileal nitrogen, fat and DE while high AME levels increased (P<0.01)
DE. Supplementation with the protease increased (P<0.01) ileal crude protein, fat and gross energy digestibility by proximally 5% when the treatments with the highest level of CP and AME were compared with and without protease. This study showed that protease supplementation significantly improved the performance of broilers raised to 42 days of age independent of the CP or AME levels of the diet.

Key Words: enzyme, protease, performance, digestibility


Two experiments were conducted to determine the optimum dietary calcium and total phosphorus (Ca:P) ratio and the effect of phytase on the retention of dry matter (DM), apparent metabolizable energy (AME), crude protein (CP) and trace minerals including Cu, Mg, Zn, K and Fe in broiler quail. Experimental design for both experiments was completely randomized design. In the first experiment 360 locally bred (IKTA) Japanese day-old broiler quails were randomly allocated to 3 treatments, with 4 replicates of 30 birds. Three iso-caloric and iso-nitrogenous corn-soy bean meal (C-SBM) diets were formulated to contain Ca and P at ratios of either 1.66 (based on NRC recommendation, Treat 1), 1.81 (Treat 2) and 1.96 (Treat 3) and fed ad libitum from day 1 to 21. Gain: feed (G:F) was measured on a weekly basis. DM, AME, CP and microminerals retention were determined by measuring chromium oxide as an indigestible marker in feed and feces at 3 weeks of age. The results showed increasing the Ca:P ratios decreased gain: feed (P<0.05) significantly. Increasing the ratios of Ca:P from 1.66 to 1.96 significantly (P<0.05) increased retention of DM, AME and Mg. However, there were no significant difference (P>0.05) in retention of CP and Fe. There was a significant (P<0.05) decrease in retention of Cu, Zn, K with increase in Ca:P ratios. Based on the above results the Ca:P ratio of 1.81 was found to be the optimum ratio for improved response to the addition of dietary phytase to the diet. In the second experiment 600 day-old broiler quails of similar breed were randomly allocated to 5 treatments, with 4 replicates of 30 birds. Five iso-caloric and iso-nitrogenous C-SBM diets supplemented with different levels of phytase namely 0 FTU (Treat A), 250 FTU (Treat B), 500 FTU (Treat C), 750 FTU (Treat D) and 1000 FTU (Treat E) were fed from day 1 to day 21. Graded dietary phytase enhanced retention of DM, AME, Cu, Zn, CP significantly (P<0.05). However, the retention of Mg, Fe and K increased slightly, but were not significant. It can be concluded supplemental phytase had positive effect on AME, CP, DM and other microminerals in broiler quails.

Key Words: phytase, calcium phosphorus ratio, broiler quail, retention, microminerals

M30 Effect of incremental red blood cell (RBC) addition on growth performance of broilers. E. Fruge*SC, S. Powell, T. Bidner, and L. Southern, Louisiana State University, Agricultural Center, Baton Rouge.

Three experiments (Exp.) were conducted to determine the effect of RBC addition (0, 0.5, 1, 2, 3, 4, 5, 6, and 7%) on growth performance of broilers fed diets with supplemental L-Arg and L-Ile (AA-adequate) or diets with no supplemental L-Arg and L-Ile (AA-deficient). Male (Exp. 1) or male and female (Exp. 2 and 3) Ross 708 broilers (0 to 18 d of age) were used in brooder batteries. Treatments had 5 to 7 reps with 6 chicks per pen. In all Exp., Diet 1 was a C-SBM control diet with no added RBC. Diet 2 had 0.5% RBC, which is the level of RBC that does not require supplemental L-Arg and L-Ile. All Diets were formulated to contain 1.36% total Lys and TSAA:Lys of 0.75, and all other nutrients (except for Arg and Ile in the deficient diets) were formulated to meet or exceed the NRC requirements. In Exp. 1, the dietary treatments were 0, 0.5, 1, 2, and 3% RBC with supplemental L-Arg and L-Ile. There was no effect (P>0.10) of RBC addition on growth performance. In Exp. 2, the RBC additions were 0, 0.5, 1, 2, 3, 4, 5, 6, and 7% with supplemental L-Arg and L-Ile as needed. With increasing levels of RBC, there was a linear and quadratic effect on gain (ADG, P < 0.01) and feed intake (ADFI, P < 0.02) but not gain:feed (G:F, P > 0.10). The RBC addition increased or did not affect ADG up to the 6% addition. The response in ADFI was similar but the 7% RBC addition decreased (P<0.04) ADFI. Experiment 3 was similar to Exp. 2 but the RBC additions were with or without supplemental L-Arg and L-Ile. Broilers fed AA-adequate diets had a linear and quadratic effect (increase then decrease) in ADG (P < 0.01) and ADFI (P < 0.07) but a linear increase in G:F (P < 0.01). The RBC did not affect ADG up to 6% with supplemental AA, but ADG was decreased by 7% RBC. The response in ADFI was similar, but ADFI was decreased (P<0.02) by 6 and 7% RBC. Feed efficiency was increased by RBC. Broilers fed the AA-deficient diets had a linear and quadratic decrease in ADG, ADFI, and G:F (P < 0.01). Red blood cell addition up to 6% can be added with supplemental AA, and up to 2% RBC without supplemental AA with no detrimental effects on growth performance.

Key Words: broiler, red blood cells, growth


An experiment was conducted to evaluate the effects of dietary enzymes on broiler performance, bone ash, and gut morphology when using a live coccidia oocyst vaccine. One-day-old, Cobb 500 straight run broilers were obtained from a commercial hatchery and half were sprayed with a live coccidia vaccine. Chicks were weighed and placed in battery brooders according to eight dietary treatments (n = 108/treatment). Dietary treatments were positive control (PC; 0.90% Ca and 0.45% npP), negative control (NC; 0.80% Ca and 0.35% npP), NC + phytase (NC+P), NC + protease (NC+Pr), NC + xylanase (NC+X), NC+P+Pr, NC+P+X, and NC+P+Pr+X. Birds were weighed and feed intake measured on days 7 and 18. Enzyme supplementation did not significantly affect feed intake (FI) or body weight gain (BWG). Phytase supplementation improved (P < 0.05) feed conversion (FC) compared to protease supplementation at day 7. Phytase or xylanase improved FC compared to the NC and NC+Pr at day 18. Feed conversion was not different among any other dietary treatments. Coccidia vaccination reduced FI and BWG but did not affect FC. There were no diet and vaccine interactions. Percent tibia ash was reduced in NC, NC+Pr, and NC+X diets compared to all other diets at day 7. Similarly at day 18, percent tibia ash was
reduced in NC+Pr and NC+X diets compared to NC+P and NC+P+X diets. There were no differences in tibia ash among any other dietary treatments or with vaccination. Gut morphology was significantly affected by diet, vaccination, and interaction of diet and vaccination. Villi height, crypt depth, and villi height to crypt depth ratio were significantly different between diets. Vaccination with live coccidia oocysts increased villi height in the duodenum and jejunum, and diet by vaccine interactions affected gut morphology in as well. Mortality was not affected by diet or vaccination. These data indicate selected dietary enzymes may improve broiler performance during live coccidia oocyst vaccination by improving gut morphology, which may result in improved intestinal integrity.

Key Words: phytase, protease, xylanase, broilers, coccidia


An experiment was conducted to evaluate the effects of three phytase enzymes on performance and bone quality of broilers. Male Ross 708 chicks (960) were placed on new bedding in 48 pens (20 birds/pen with 8 reps/rtt). All birds were fed a corn-soybean meal diet (22% CP, 3086 kcal/kg) adequate in all nutrients but available phosphorus (ap). Dietary treatments were created using 3 ap levels and 3 phytase enzymes: 1) standard P (.45% ap), 2) marginal P (.35% ap), 3) low P (.25% ap), 4) low P + phytase A, 5) low P + phytase B, 6) low P + phytase C. All 3 enzymes are classified as a 6-phytase with optimal activity occurring at pH 2.5-3.5, 5-5.5, and 4.5, respectively. Phytases A and B were of bacterial origin, while phytase B was fungal derived. All diets were pelleted at 79 °C, crumbled, and provided through 35 days of age. Individual body weights and feed consumption were recorded weekly and feed efficiency was corrected for mortality. Each week, 24 birds per treatment were sacrificed for tibia evaluation. Each tibia having its associated muscle was broken using a TA-HDI texture analyzer (Texture Technologies, Scarsdale, NV). Supplementation of the low P diet with phytases A and C improved body weight (P<0.001) similar to birds on the standard P diet, while phytase B supplemented birds led to weights parallel to the marginal P level. Generally, consumption from 0-35 d was only reduced (P<0.01) for birds receiving the low P diet. Broiler tibia strength most resembled (P<0.001) birds on the standard P diet when phytases A and C were included in the low P diet while birds given phytase B had strengths corresponding to the moderate P through week 4 which rose to the standard P treatment in the final week. These results suggest that broiler performance and bone mineralization responded best to either phytase A or C given the parameters of this study.

Key Words: feed enzymes, broilers, amylase, protease, xylanase

M34  Effect of dietary nucleotide supplementation on performance, intestinal tract development and histology of broilers. B. Y. Jung4SC and A. B. Batal, University of Georgia, Athens.

Two experiments (Exp) were conducted to determine the effects of nucleotide supplementation on broiler performance, intestinal tract development and histology. In Exp 1, 1-d-old male broilers were placed in Petersime battery brooders and maintaining on a 24h lighting schedule in a thermostatically controlled room. Chicks were randomly assigned to 3 dietary treatments; 0, 0.25 and 0.50% Torula yeast supplementation which contained approximately 62% nucleotides (0.38, 0.53, and 0.66% calculated nucleotide contents, respectively) with 6 replicate pens containing 10 chicks each per treatment. In Exp 2, male broilers fed the NC+XAP diet (2712 g) were heavier at 41 d than those fed the PC diet (2412 g), while male broilers fed the NC diet (2437 g) were intermediate. Similarly, in Experiment 2, male broilers fed the NC+XAP diet (2712 g) were heavier than those fed the NC (2637 g) and PC (2641 g) diets, while the NC+PXP diet (2653 g) was intermediate. Female BW, FCR, and carcass traits at 41 d did not differ between treatments. Results suggested that supplementation of a combination of XAP and PXP enzymes was more effective than using PXP alone and was able to increase male broiler BW (by 69 g at 41 d of age) when diets contained corn/soy/DDGS as primary ingredients.

Key Words: available phosphorus, bone strength, broiler, phytase
stocking density stress. Nucleotides supplementation may be beneficial for birds during periods of stress.

**Key Words:** nucleotides, broilers, performance, stress

**M35** Dietary N,N-dimethyl glycine (DMG) improves technical performance in broilers depending on dosage and dietary fat source. I. D. Kalmar*SC1, J. Buyse2, and G. P. J. Janssens1, 1Ghent University, Belgium, 2Catholic University of Leuven, Belgium.

**Introduction** DMG, which is a modified aminoacid that is in small amounts ubiquitously present in organic material, is reputed to be involved in a variety of biological roles. The current large-scale study intended to evaluate effects of dietary DMG in broiler rations, with either vegetal oil or animal fat as main fat source, on production and slaughter performance.

**Materials** 1500 one-day-old broilers (Cobb-500) were housed in 50 pens of 30 birds each until day 42. The study comprised a complete block design in which 5 doses of DMG (0, 100, 200, 500 and 1000 ppm) were added to rations with either animal fat (chicken fat) or vegetal oil (soy oil) as main fat source. Following performance traits were calculated: feed conversion ratio (FCR), weight gain, mortality and production value (PV). Next, at the end of the trial, one bird per pen was euthanized and systematically dissected.

**Results** In general, weight gains were quite high (2760 g after 42 days) and FCR was very good (1.634), further the average mortality rate was relatively low (4.5%). Yet, numerically, weight gain and FCR generally improved with increasing DMG level when fed the vegetal oil diet and showed optimal values at 500 ppm when fed the animal fat diet. Moreover, a significant positive linear effect was found between DMG level and PV as final economical response value, when fed the vegetal oil diet (P<0.05). Next, significant quadratic and linear effects on slaughter characteristics were all in favour of the tested feed supplement. Finally, DMG showed a significant, negative linear effect on TBARS when fed the vegetal oil diet.

**Discussion** This trial demonstrates several beneficial effects of DMG in spite of the limited margin for improvement of technical performance due to the overall highly efficient growth in this trial. Further, these data indicate that the nature and magnitude of effects as well as optimal dose of DMG depend on the main fat source of the diet.

**Key Words:** nutrition, broiler, feed additive, dimethyl glycine, technical performance

**M36** Effects of post pellet liquid fat application accuracy on broiler performance. C. Chewning*SC, C. Stark, and J. Brake, North Carolina State University, Raleigh.

A study was conducted to evaluate the effects of the accuracy of post pellet fat application on broiler performance. Fat application is routinely used to monitor feed quality and explain shrink at feed mills and poor application of fat is believed to affect bird performance and production cost. The study was designed to test the effect of over and under application of poultry fat to broiler feed post pelleting. A total of 1,024 male broiler chicks were randomly assigned to one of four treatment diet series with 8 replicate pens per treatment and 32 birds per pen. Fat was applied post pelleting to a common corn-soy diet to produce three treatment fat levels (80, 100, and 120% of target), birds on the fourth treatment were randomly fed the 80, 100, and 120% fat diets to match the nutrient package fed to birds assigned to the 100% treatment. Diets were formulated to contain a total of 7.7, 7.4, and 6.3% fat in the starter, grower, and finisher feeds, respectively. BW and feed consumption were determined at 14, 35, and 45 d of age and feed conversion (FCR) calculated. Feed was analyzed for crude fat and the percentage total fat fed to the birds was calculated for each diet. Results showed that the birds received 84%, 103%, and 124% of target in the starter feed, 85%, 101%, and 121% of target in the grower feed, and 78%, 98%, and 115% of target in the finisher feed for the respective 80, 100, and 120% treatments. There were no effects on BW and FCR at 35 d of age but birds fed the diet that contained 80% fat from 35 to 45 d exhibited poorer FCR in comparison to the other treatments (1.74 versus 1.59, 1.62, and 1.63). The results indicated that under application of fat (80%) to finisher feed produced poorer FCR with males that reached 3,161 g BW at 45 d while over application of fat simply increased feed costs and will create shrink at the feed mill.

**Key Words:** post pellet fat application, broilers, pellets, poultry fat, feed mill shrink

**M37** The effects on broiler growth performance of glycine supplementation at varying levels of dietary methionine and cystine in low crude protein diets. S. Powell*SC, T. D. Bidner, and L. L. Southern, Louisiana State University, Agricultural Center, Baton Rouge.

Two experiments were conducted to investigate Gly addition to reduced crude protein corn-soybean meal diets for Ross x Ross 708 broilers with varying levels of TSAA achieved by varying dietary Met and Cys levels. Treatments had 6 replicates with 6 broilers per pen. The experiments were conducted in brooder batteries and were from 0 to 18 d posthatching. All diets contained 0.394% Biologs and were formulated to provide a standardized ileal digestible (SID) Lys of 1.27%. In Exp. 1, there were 8 diets: Diets 1 to 3 were 3 ratios of Met to Cys (60:40, 50:50, and 40:60) calculated on a mole for mole basis at a TSAA:Lys of 0.68; Diet 4 was a positive control with Met:Cys ratio of 50:50 at 0.76 TSAA:Lys; and Diets 5 to 8 were Diets 1 to 4 with added Gly to a total of 2.32% Gly+Ser. Glycine did not affect gain (ADG) or feed intake (ADFI); however, gain:feed (GF) was increased (P < 0.03) by Gly supplementation. An increase in Cys and a decrease in Met resulted in a decrease (P < 0.03) in ADG but no effect on ADFI or GF. In Experiment 2, SID Met was kept constant at 0.45% and SID Cys was increased in 0.05% increments from 0.35 to 0.50%; and these diets were fed without and with supplemental Gly to a total of 2.32% Gly+Ser. Glycine supplementation had no effect on ADG, ADFI, or GF. There was a linear increase (P < 0.09) in ADG and weight gain (ADFI) with increasing Cys supplementation; however, there was no effect on GF. The Gly addition tended to increase GF in diets with 0.35 or 0.4% Cys but had no effect or decreased GF in diets with 0.45 or 0.5% Cys (P < 0.11). These data indicate that Gly increased GF in broilers fed suboptimal levels of Met and Cys but not at Cys levels at or above the requirement.

**Key Words:** broilers, glycine, cystine, methionine

Various factors such as phytase supplementation, vitamin D derivatives, and organic acids (including 2-hydroxy-4-methylthio butanoic acid (HMB)) have been demonstrated to influence phytate phosphorus utilization in poultry. The objective of this study is to quantitate the effect of methionine source, phytase and 1-alpha-OHD<sub>3</sub> and their interactions on phytate phosphorus utilization in broiler chicks. An experiment with 240 Cobb x Cobb chicks were conducted in a battery brooder from 1-16 days of age. The chicks were randomly allocated to 2 x 2 factorial arrangement of treatments with 2 methionine sources (DL-Methionine (DLM) and HMB) added at 0.2% of the diet, phytase added at 0 or 500 U/kg diet, and 1-alpha-OHD<sub>3</sub> at 0 or 5 µg/kg. All supplements were added to a P-deficient diet containing 0.5% total P, and 0.25% available P. The criteria measured were body weight gain (BWG), feed efficiency, incidence of phosphorus-deficiency rickets, bone ash, and phytate P disappearance from the GI tract.

HMB supplemented chicks had higher BWG, and bone ash (mg/tibia), and lower P-deficiency rickets incidence compared to the birds fed DLM. Phytase and 1-alpha-OHD<sub>3</sub> reduced P deficiency rickets incidence and increased bone ash (%). There were no 3 way interactions between the factors for any of the criteria measured. There were methionine source x phytase, and methionine x 1-alpha-OHD<sub>3</sub> interactions for P rickets incidence. The reduction of P rickets incidence by addition of phytase or 1-alpha-OHD<sub>3</sub> was diminished when HMB was fed (DLM vs HMB = 33.5% vs 15.5% reduction by phytase; and 25.5% vs 1.5% by 1-alpha-OHD<sub>3</sub>). An interaction between methionine source and 1-alpha-OHD<sub>3</sub> was also observed for percent bone ash. The addition of 1-alpha-OHD<sub>3</sub> increased bone ash (%) in chicks fed DLM, but not in chicks fed HMB.

While phytase and 1-alpha-OHD<sub>3</sub> have been reported consistently to increase phytate P utilization, addition of organic acid (in this case HMB) can influence the birds’ responses to phytase and 1-alpha-OHD<sub>3</sub>.

Key Words: phytate phosphorus, 1-alpha-OH cholecalciferol, phytase, bone ash, methionine source

M40  In-ovo feeding effects on post-hatch development of the small intestinal epithelium of turkey poults. D. V. Bohórquez<sup>SC</sup>, J. E. de Oliveira, C. M. Ashwell, and P. R. Ferket, North Carolina State University, Raleigh.

Post-hatch survival and growth characteristics are associated with enteric development and function in turkeys. In-ovo feeding (IOF) enhances digestive capacity, feeding behavior and quality of poults, but little is known about its influence on the morphometrical and ultrastructural development of small intestine epithelium during the perinatal period. Two groups of eggs were injected at 23 days of incubation with either 0.4ml of a 0.4% saline solution or 0.4ml of an IOF solution. At hatch, 120 poults from each treatment were randomly distributed among 24 cages (10 poults/cage) and reared to 11d. Body weights (BW), cumulative feed conversion ratio (cFCR) and mortality rates were evaluated at 1, 4 and 11d. Samples were collected for jejunal histomorphometry (light microscopy) and ultrastructural (electron microscopy) analysis at each time point. Jejunum gene expression was surveyed at 4d using a focused microarray designed for 320 unique gene sequences selected from the chicken genome. Also, expression of membrane-bound MUC1 and secretory MUC2 mucin genes was evaluated by real-time PCR at 4d and 11d. Although there were no treatment effects on BW at hatch, the IOF group had 16% greater (P<0.05) apparent villus surface area than controls and electron micrographs revealed they also had more mucus secretion. At 4d, IOF down-regulated gene expression involved in smooth muscle growth, and up-regulated gene expression of intestinal disaccharidases, epithelial cell growth, thyroid receptors, and innate immune response (P<0.01). MUC1 and MUC2 were up-regulated (P<0.05) in the IOF group at 4d, and MUC2 up-regulation persisted in IOF poults until 11d. Although histomorphometrical differences dissipated with age, the IOF birds had 5% higher BW (P<0.05) and 6% lower cFCR (P<0.05) by 11d compared to controls. In-ovo feeding turkey embryos enhances enteric development and function in turkeys.

Key Words: gut development, electron microscopy, gene expression, turkeys

A set of experiments was conducted to determine the effects of distillers dried grains with solubles (DDGS) on pellet quality and pelleting performance when used in corn-soy diets. All batching and mixing, processing, and subsequent testing was completed at the Department of Grain Science Feed Processing Center at Kansas State University. Observations on the viability of using DDGS were based on pellet durability index (PDI), energy usage measured in kilowatt-hours per ton (KWH/ton), production rate, and bulk density. In the pilot experiment DDGS were added to a non-nutritionally balanced diet as a replacement for corn at levels of 10%, 20%, 30%, and 40%. There were no observed significant differences in pellet quality across all levels of DDGS addition, but there were differences in production rate and bulk density. In the second experiment DDGS were added to a formulated diet at levels of 10%, 20%, 30%, and 40%, and each was compared to a control diet. In this experiment all ingredients were varied to retain nutritionally similar diets. In this case energy consumption showed no significant differences among treatments, while pellet quality, throughput, and bulk density all showed significant differences. In the final experiment DDGS were pelleted and then reground and added at levels of 10%, 20%, and 30% to a formulated diet. These diets were then pelleted and compared to a control diet with no added DDGS and to diets with unprocessed DDGS added at the same levels. At levels above 10% the diets containing unprocessed DDGS had significantly lower pellet quality than the control, while the diets containing pelleted and reground DDGS showed no significant difference from the control at any level. Significant effects were also observed for production rate, energy consumption, and bulk density. The researchers concluded that the use of standard DDGS in pelleted feeds is certainly feasible, and although pellet quality may be significantly lower for feeds containing DDGS, the practical value is likely not affected. Further, the data demonstrates some benefits of using DDGS that have been pelleted and reground.

Key Words: DDGS, pelleting, PDI, throughput, reground


Two experiments were conducted to evaluate growth performance of Ross x Ross 708 broilers fed supplemental Gly, creatine, or fishmeal (FM) in corn-soybean meal (C-SBM) diets. Both experiments were conducted in brooder batteries from 0 to 18 d posthatching. Treatments had 6 reps with 6 birds per pen. In both experiments, all diets were formulated to provide 1.27% standardized ileal digestible Lys. In Exp. 1, dietary treatments were: control (C), C + 0.283% Gly, C + 0.05% creatine, C + 0.11% creatine, and C-SBM + 3% FM. The addition of FM increased (P < 0.10) gain (ADG) and the Gly addition tended to increase ADG compared with broilers fed the C diet. Gain:feed (GF) was increased (P < 0.04) by the Gly addition, both creatine levels, and by FM compared with the C diet. In Experiment 2, the purpose was to determine the additive effects of supplemental Gly, creatine, and FM. The dietary treatments were control (C), C + 0.357% Gly, C + 0.05% creatine, C-SBM + 3% FM and all possible 2 way combinations. The data were analyzed as three 2x2 factorially arranged experiments (Gly x FM, Gly x creatine, and creatine x FM). In the Gly x FM analysis, FM increased (P < 0.02) ADG and feed intake (ADFI), and Gly increased (Gly x FM, P < 0.05) GF more in broilers fed the C diet than in those fed the diet with FM. In the Gly x creatine analysis, creatine increased (P < 0.05) ADG, and Gly increased (Gly x creatine, P < 0.08) GF in broilers fed the C diet but not in those fed the diet with creatine. In the creatine x FM analysis, FM increased (P < 0.02) ADG and ADFI. In general, there was an increase in ADG and GF in broilers fed FM compared with those fed the C diet, but there was no further increase in these responses by addition of Gly or creatine to the diets with FM. The individual or combined additions of Gly and creatine increased ADG and GF to levels that were not different from those of broilers fed the diet with FM. These data suggest that FM increased growth performance of broilers and that all or part of this response is due to the FM providing Gly and creatine.

Key Words: broilers, glycine, creatine, growth


This study was conducted to compare the organ weights of Arbor acre and Marshal MY strains of broiler chickens at both starter and finisher phases. A total of 198 a-day old broiler chickens (99 birds per strain) were used in the experiment which lasted 28 days (1-28days) for the starter and 28 days (29-56days) for the finisher phases, respectively. The birds were replicated thrice to contain 33 birds per replicate. The data obtained were subjected to a t-test at 5% level of significance. The results showed that live weights of the birds increased (P<0.05) with age but higher in Arbor acre (1.33) at the finisher phase. However, the dressing percentage (P<0.05) gave higher values of 72.5 and 85.5 for Marshal MY strain at the starter and finisher phases, respectively. In addition, Marshal MY strain had the higher percent liver values of 2.66 and 2.18 at both starter and finisher phases, respectively but showed significant (P<0.05) difference only in the starter phase. It was concluded that Marshal MY strain is a better strain to Arbor Acre when the dressing percentage is considered in poultry meat production.

Key Words: Marshal MY, arbor acre, organ weights, liver, dressing percentage

M44  Cacass evaluation of finishing broilers fed fermented cocoa bean shell–based diets.  A. O. Akinsoyinu*, M. D. Olumide1, and R. A. Hamzat3, 1Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria, 2Kolmat Farms Limited, Erunmu, Ibadan, Oyo State, Nigeria, 3Purdue University, West Lafayette, IN.

Proper handling of many agro-allied by-products has the potentials of enhancing their utilization as feed ingredients. Cocoa bean testa constitutes economic waste in that the cocoa industries in Nigeria invest huge
amount of money in disposing it. Theobromine is an established anti nutritional factor in cocoa bean testa. Hence this study focused on evaluating the effect of fermentation on the carcass of finishing broiler.

Three hundred and seventy five (375) broiler chickens were randomly allotted to five dietary treatments replicated thrice in a completely randomized design. The dietary treatments were: A (0% CBT – control); B (5% fermented CBT); C (10% fermented CBT); D (15% fermented CBT); and E (20% fermented CBT). After feeding the birds for eight weeks, ten finished broilers per replicate were randomly selected for carcass evaluation. The parameters studied were: plucked, eviscerated, visceral organ, dressed, breast, drumstick and thigh weights. The breast, dressed, drumstick, head, leg neck, gizzard, liver heart and thigh percentages were also determined. Significant differences (P < 0.05) occurred in all carcass parameters studied in all the diets. The noticeable trend in the result indicated that fermentation of the cocoa bean testa, enhances the carcass values of finishing broilers.

Key Words: fermentation, cocoa bean testa, broilers, carcass evaluation

M45 Evaluation of a live Salmonella vectored coccidiosis vaccine with TRAP Upstream (TRAP US) and CD 40L epitopes in broilers. S. ShivaramaiahSC, S. L. Layton1, J. R. Barta2, Y. M. Kwon1, A. D. Wolfenden1, L. R. Berghman3, B. M. Hargis1, and G. Tellez1, 1University of Arkansas, Fayetteville, 2University of Guelph, Guelph, ON, Canada, 3Texas A&M University, College Station.

Coccidiosis is caused by parasites of the genus Eimeria, belonging to Phylum Apicomplexa. EmTFP250 is a high molecular mass, asseal stage antigen from Eimeria maxima (E.maxima) strongly associated with maternal immunity in newly hatched chickens. Cloning and sequence analysis predict the antigen to be a novel member of the Thrombospondin-related anonymous protein (TRAP) family. Members of the TRAP family are microneme proteins, associated with host cell invasion and apicomplexan gliding motility. Three novel attenuated Salmonella Enteritidis strains (ASE) expressing TRAP oligopeptides in association with a potential immune-enhancing CD 40L sequence, on the outer membrane protein LamB, were developed. Broiler chickens were grouped based on treatment and 10⁴ cfu/bird of one of three sequences, or vehicle alone, was orally administered to each group. At 21d of age, all groups were challenged with 10⁴ spore oocysts of E. maxima orally. The mortality at 5d post-challenge was: TRAP -7/43 (16.3%); TRAP US/1 of 46 (2.2%); TRAP Downstream (DS) -6/43 (11%) and control -10/46 (21.7%). These observations led to the conclusion that TRAP US may have a protective effect in E. maxima infected birds. To evaluate the efficacy of TRAP US as a potential vaccine candidate, a similar study was conducted based on the lines of the previous experiment. Broilers were orally vaccinated with 10⁴ cfu/bird vehicle with TRAP US and CD 40L or sham vaccinated with saline. Coccidia challenge was performed with sporulated oocysts of E. maxima (10⁴ oocysts/bird) at 3 wk of age. Body weight gain and lesions were evaluated 7 d post-challenge. Immunized birds, with an ~31%* reduction in weight gain when compared to the controls, showed marked improvement in performance. Further, in a second trial, mortality in the vaccinated birds (6/48)* was significantly lower than the controls (17/50) and performance was better in the vaccinated birds, even though not significant. These three studies underscore the potential of EmTFP250 as a candidate for a recombinant vaccine targeting coccidiosis in chickens. (*p< 0.01 as compared to control).

Key Words: Eimeria, Salmonella, coccidiosis, apicomplexa, TRAP

M46 Effects of supplemented arginine and antioxidant vitamins on xanthine- and NADH-oxidase activities in the lung of hypoxic broilers. J. Bautista-OrtegaSC, E. A. Ellis, and C. A. Ruiz-Feria, Texas A&M University, College Station.

Two trials were ran to study the effects of supplemented arginine (Arg) and antioxidant vitamins (E and C) on Xanthine- (XO) and NADH-oxidase activities and nitrotyrosine in lung tissue of broilers exposed to hypoxia (simulated 10000 ft). They were kept in wire cages with continuous light and free access to feed (ME 3200 kcal/kg and CP 23%) and water. In both experiments, chicks were assigned to 3 dietary treatments: CTL (corn-soy), HA (CTL + Arg 0.8%) and AEC (HA + vitamin E 200 IU /kg + vitamin C 500 mg /kg). Chicks were kept in normoxia for 4 days and then exposed to hypoxia for 38 days (trial 1, n=60) or from day 7 to 28 (trial 2, n=51). Five additional control birds were raised in normoxia and fed the CTL diet. Weekly hematocrit, right ventricle/total ventricle weight ratio (RV/TV), heart rate, S-wave amplitude ECG and PHS incidence were measured. In trial 1, lung samples were collected from 3 6-wk-old birds per treatment and from 5 normoxic broilers (2 10-day-old and 3 5-wk-old birds) fed the CTL diet. We made a non-quantitative cytochemical determination of xanthine-(XO) and NADH-oxidase (NDHO) activities with the CeCl₂ method, which detects H₂O₂. Nitric oxide (NO) was localized by the presence of nitrotyrosine. There were no differences in the variables measured in both trials. There were similar high XO and NADHO enzymatic activities in the lung tissue from broilers fed the 3 experimental diets as well as from the 5-wk-old normoxic broilers. We observed a low enzymatic activity in lung samples from the 10-day-old control broilers. To our knowledge, this is the first time that nitrotyrosine and H₂O₂ have been localized in broiler lung tissue in connection with XO and NADHO. NO bioavailability plays a key role in pulmonary hypertension syndrome and it is important to accurately determine its concentration and cellular localization. A quantitative study of enzymatic activity and nitrotysonine will identify the effects of antioxidant vitamins and Arg at a cellular level in broilers younger than 6 weeks.

Key Words: nitrotyrosine, hypoxia, arginine, antioxidant vitamins, pulmonary hypertension syndrome

M47 Incubation temperature and post-hatch transport stress effects on innate immunity and heat shock response in commercial broilers. J. SottosantiSC, 1A. Barri1, M. Wineland2, R. Dalloul1, and A. P. McElroy1, 1Virginia Polytechnic Institute and State University, Blacksburg, 2North Carolina State University, Raleigh.

Manipulation of environmental conditions induces subsequent immune and stress responses. Heat shock proteins play a role in reaction to cellular stress and work with the innate immune system to maintain homeostasis. This study evaluated effects of embryonic incubation temperature and post-hatch transport stress on gene expression of heat shock protein 70 (Hsp70) and a defensin, gallinacin-2 (Gal2), in the intestine and immune organs of broilers. Cobb 500 eggs were incubated with the following shell temperatures during early and late incubation: low (L:36.7°C), standard (S:37.5°C), and high (H:39°C). Eggs were incubated at S or H during late (E15-21) incubation, yielding low (L:36.7°C), standard (S:37.5°C), and high (H:39°C). Eggs were incubated at S or H during late (E15-21) incubation, yielding three incubation treatment groups: LH, LS, SH, and SS. Chicks were separated into two transport groups at hatch: control (1) and stressed (2), for 8 total treatments: LS1, LH1, SS1, SH1, LS2, LH2, SS2, and SH2. On d0, 4, and 6 post-hatch, bursa, spleen, thymus and small intestine
were collected from each treatment to evaluate Gal2 and Hsp70 expression. Changes in intestinal Gal2 expression were most responsive over time (temp x age) to LS treatment. Birds from LS incubation had the highest Gal2 expression at d0; however, expression was comparable to other treatments at d4 or d6. Control and stressed transport birds had similar Gal2 expression to d4 (transp x age), with an expression increase in stressed groups by d6. Immune organ expression of Hsp70 was comparable in the LH and SS group, which were both lower than the LS group. Incubation under LH conditions impacted Hsp70 expression the most dramatically (temp x age) with the lowest expression at d0 and an increase to d6, while other treatments decreased from d0 to d4 and increased to d6. Transport stress caused differential responses of incubation groups with increasing post-hatch age (temp x transp x time) to LS treatment. Birds from LS incubation had the highest Gal2 expression at d0; however, expression was comparable to other treatments at d4 or d6. Control and stressed transport birds had similar Gal2 expression to d4 (transp x age), with an expression increase in stressed groups by d6. Immune organ expression of Hsp70 was comparable in the LH and SS group, which were both lower than the LS group. Incubation under LH conditions impacted Hsp70 expression the most dramatically (temp x age) with the lowest expression at d0 and an increase to d6, while other treatments decreased from d0 to d4 and increased to d6. Transport stress caused differential responses of incubation groups with increasing post-hatch age (temp x transp x age) in the intestine. Results suggest that stress-inducible proteins may be either protective or detrimental in response to external stressors, directly impacting overall post-hatch performance.

**Key Words:** incubation, heat shock protein, gallinacin


The effects of in ovo injection of L-carnitine on hatchability and subsequent growout performance of 672 Ross x Ross broiler chicks from a young breeder flock were determined. Fertilized eggs were injected in the amnion with L-carnitine (0.5, 2.0, or 8.0 mg / 100 µl commercial diluent) on Day18 of incubation using an Avitech Intellilab™ injector. Three control groups (non-injected, and injected with or without diluent) were also included. Incubation length (hatch time) was recorded every 4 h beginning at 468 h and ending at 516 h. Embryonic mortality and hatchability were examined, and on Days 0 and 3 posthatch, 2 birds from each of 4 replicate groups (tray levels) within each treatment were necropsied for collection of liver, yolk sac, and breast, pipping, thigh and gastrocnemius muscle samples. On Day 10 posthatch, liver, and breast, thigh and gastrocnemius muscle samples were also collected from 2 birds from each replicate group and weighed. Relative weights of the liver, yolk, and gastrocnemius muscle samples, and moisture contents of all the tissues sampled were determined. Mortality, BW gain and feed conversion were calculated at regular intervals through Day 10 posthatch. There were no treatment effects on embryonic mortality, hatchability, hatch time, or relative tissue weights. These results are in agreement with previous work conducted using SCWL eggs. However, on Day 3 posthatch, the 0.5 mg L-carnitine treatment resulted in a significantly higher moisture content of the pipping muscle when compared to the 8.0 mg treatment and the diluent-injected control group. In ovo injection of L-carnitine at 0.5, 2.0 and 8.0 mg / 100 µl did not influence embryogenesis, hatchability, or broiler chick performance through 10 d posthatch.

**Key Words:** hatchability, in ovo, L-carnitine, moisture, pipping muscle

**M49 Blood, pipping muscle, and liver metabolic relationships in broiler embryos preparing for hatch.** R. Pulikanti*SC, E. D. Peebles, R. W. Keirs, L. W. Bennett, S. K. Womack, and M. M. Keralapurath, Mississippi State University, Mississippi State.

The developmental relationships between blood, liver, and pipping muscle compositions of broiler embryos during incubation were determined. Ninety eggs obtained from a commercial source were incubated on 3 replicate tray levels (30 eggs per tray) for 19 d. On Days 15 and 19 of incubation, 10 live embryos per tray level were necropsied to collect plasma, liver and pipping muscle samples. The liver and pipping muscle samples were analyzed for glucose, glycogen, fat, and protein concentrations, and plasma samples were analyzed for refractive index (RI), and glucose, lactate, triglyceride, protein, and calcium concentrations. Changes in liver and pipping muscle compositions between Days 15 and 19 have previously been reported. In the current study, increases in plasma triglyceride and lactate concentrations were observed between Days 15 and 19. On Day 15, RI was negatively correlated with liver glucose, pipping muscle fat and plasma lactate concentrations, and Day 19 RI was positively correlated with Day 15 plasma calcium concentration. Day 19 plasma triglyceride and Day 15 pipping muscle glycogen concentrations were positively correlated, and Day 15 plasma calcium concentration was positively correlated with Day 19 RI and liver protein concentration. Furthermore, on Day 19, plasma glucose was negatively correlated with liver glycogen concentration. These results suggest that the hydration status of Day 15 embryos, as reflected by RI, is inversely related to Day 15 plasma lactate, liver glucose, and pipping muscle fat concentrations, and that Day 15 pipping muscle glycogen is positively related to subsequent plasma triglyceride concentration on Day 19. Additionally, on Day 19, liver glycogen and plasma glucose concentrations are inversely related. This and previous studies suggest that plasma RI in a Day 15 broiler embryo may serve as an indicator of subsequent hatching success.

**Key Words:** broiler, embryo, metabolic profile, pipping muscle, plasma

**M50 Small bird programs: Impact of phase-feeding and strain on yield, fillet dimension, and meat quality of broilers.** V. B. Brewer*SC, J. L. Emmert, J-F. C. Meullenet, and C. M. Owens, University of Arkansas, Fayetteville.

Phase-feeding (PF) has been effective at maintaining broiler growth while reducing production cost, but the impact on different broiler strains grown in a small-bird production scenario has not been assessed. An experiment was conducted to determine the effects of decreasing dietary amino acid (AA) levels using the PF approach on yield, fillet dimensions, cook loss, and tenderness of three commercial broiler strains selected for small-bird markets (40 d old). During PF, birds were fed one of two dietary treatments: diets with average industry nutrient levels, or diets with phased levels of AA. PF treatments were formulated to match the nutrient requirements at 18d (high nutrient) and 40d (low nutrient). High and low nutrient density diets were blended to produce rations containing AA levels that matched the predicted PF requirements over two-day intervals; diets were switched every other day. Treatments were replicated in 6 pens; each pen contained 15 males and 15 females. 180 birds per treatment (2 diets X 3 strains) were commercially processed at 40 and 42d. Breast fillets were harvested at 2, 4, and 6 h postmortem (PM). Muscle pH was measured at time of debone, and fillet dimensions (FD), color (L*a*b*) and pH were measured at 24 h. Fillets were cooked to 76 C and cook loss was calculated, followed by Meullenet-Owens Razor shear (MORS) analysis. Diet, strain and gender had little impact on fillet yield. Strain, gender, and debone hour had significant effect (P < 0.05) on FD. Strain A had significantly longer fillets than strain C, and B was intermediate. Strain A had significantly wider fillets than strains B.
and C. There were no differences in FD due to PF; however uniformity was improved (indicated by SD and CV). Deboning early resulted in significantly shorter and narrower fillets. Strain and PF treatment did not affect pH, color, cook loss or MORS. Deboning at 2h PM resulted in higher MORS energy indicating decreased tenderness. The results of this study suggest PF does not adversely affect yield or meat quality of broilers in small-bird programs regardless of strain.

Key Words: broiler, phase-feeding, strain, fillet dimensions, tender-ness

M51 Recovery of muscle proteins extracted from broiler dark meat by pH shifting processing. V. Moayedi Mamaghani*SC, Y. Xu, and M. Betti, University of Alberta, Edmonton, AB, Canada.

Over the past 25 years, emphasis has been placed on improved distribution and marketing of further processed breast meat products. This has resulted in excess supplies and depressed returns for broiler dark meat. The major problems with broiler dark processed meat are color, higher fat content, and stability. One approach to increase the utilization of dark meat is to remove pigments and fat to make the resulting product more acceptable for the production of further processed meat products. The purpose of this experiment was to examine the use of alkali extraction, ranging from pH 10.5 to 12.0, to recover myofibrillar proteins from broiler leg meat. Meat was finely chopped with added water and proteins solubilized by adjusting the pH in 0.5 increments between 10.5 and 12.0 with 2 N NaOH. Following solubilization, the pH was adjusted to 5.2 with 2 N HCl to precipitate the proteins which were then centrifuged and recovered to determine protein yield, fat removal, total heme pigments concentration and protein denaturation measured as protein solubility. The experiment was replicated using 4 independent batches of meat (N = 16). The results indicated that protein yield (wet basis) increased from 81.3% to 94.2% with extraction pH (p < 0.01). A significant negative correlation was found between protein yield and total protein solubility (r = -0.79; p < 0.001), indicating that higher pH of extraction resulted in more denaturation. Total protein solubility had the lowest value at pH extraction of 12.0 (40.8 mg/g vs. 45.4, 63.2, 67.2 mg/g for pH 11.5, 11, 10.5 respectively; p < 0.001). Around 50% of the fat was removed from broiler dark meat by the extraction with no significant differences within treatments. On average, the fat content of the extracted meat was 3.0%. Total heme pigments content was decreased to values comparable to those found in the breast meat (0.6 mg/g).

Key Words: dark meat, pH shifting, alkali extraction, myofibrillar proteins, further processing


Salmonella is an important foodborne pathogen often associated with poultry and highly prevalent in poultry processing plants. In this study, efficiency of BioSealed for Concrete™ for prevention of bacterial attachment, colonization, and antimicrobial effects of this product on multiple strains of Salmonella (S. Enteriditis, S. Kentucky, S. Typhimurium, S. Seftenberg and S. Heidelberg) in concrete cement blocks was evaluated. Cement blocks were divided into four different treatment groups: A) No Biosealed application, B) Biosealed applied before inoculation, C) Biosealed applied after inoculation, or D) Biosealed applied before and after inoculation. The cultures were prepared by inoculating Salmonella strains into brain and heart infusion broth (BHI) and incubating at 39 °C for 24 h. Cement blocks were inoculated by submerging in BHI broths containing one of the five Salmonella strains and incubated at 39 °C for 24 h (ca. 10^9 CFU/ ml). External surfaces of the blocks were swabbed using sterile swabs, which were placed in 10 mL peptone water (PW). The cement blocks were broken in half and interior surfaces were swabbed to determine Salmonella spp. levels. Following 24 h of incubation of XLD plates at 39 °C, survival population of Salmonella on internal surfaces varied among strains. On the external surface of cement blocks, significantly lower populations of all the five strains of Salmonella (P<0.05) were observed for treatments C and D when compared to treatments A and B. When comparing treatments A and C, as well as groups B and D, Biosealed was shown to be efficient for biofilm removal on concrete surfaces. No significant difference was found when comparing groups A and B suggesting that the product has poor residual effect. Therefore, Biosealed for concrete is a potent antimicrobial but should not be substituted for good sanitation practices, nor should it be utilized as an isolated measure to control bacterial colonization on concrete surfaces.

Key Words: Salmonella, biofilms, concrete, sealer, antimicrobial

M53 Organoleptic and compositional effects of feeding distillers dried grains with solubles on broiler meat. R. E. Loar*SC, M. W. Schilling, and A. Corzo, Mississippi State University, Mississippi State.

Recently, associated feed costs have reached record highs due to recent increases in ingredients used in diet manufacturing for broilers. As a result, there has been a gradual shift towards the use of alternative feedstuffs such as distillers dried grains with solubles (DDGS). In the current study, we evaluated the effects of feeding DDGS on meat quality and the consumer acceptability of broiler breast meat. A randomized complete block design with 12 replications per treatment (12 broilers/ experimental unit) was used to determine the effects of DDGS inclusion on breast and thigh meat quality. Ross × Ross 708 males were grown on diets that contained either 0 or 8% DDGS. At 42d, birds were processed and boneless skinless breast meat and thighs were collected for evaluation from birds within each treatment group. Fatty acid profile and lipid peroxidation (TBARS) tests were performed on the thigh meat while the breast meat samples were evaluated for pH, color (CIE L*, a*, b*), cooking loss, shear force and taste panel data. No differences (P>0.05) were found in breast meat between treatments with regard to pH, cooking loss, shear force, breast meat color and consumer acceptability of texture. As far as flavor and overall acceptability were concerned, consumers preferred (P<0.05) the control treatment over the DDGS treatment. However, in the sensory difference test, consumers could not distinguish (P>0.05) between the DDGS and control treatments. The DDGS treatment showed some differences (P<0.05) in fatty acid composition of the thigh when compared to the control. With higher percentages of linoleic and total polyunsaturated fatty acids it is possible that the DDGS treatment may be more susceptible to oxidation. Overall, the inclusion of 8% DDGS in the diet did not adversely affect the resulting broiler meat, and both treatments resulted in high quality breast and thigh meat.

Key Words: broiler, distillers dried grains with solubles, sensory testing
M54  A survey of the microbiological profile of chicken carcasses at the sell-by date.  S. M. Russell*, University of Georgia, Athens.

A study was conducted to determine the differences in the microbiological profiles of chicken carcasses at their sell-by date. Groups (14) of carcasses (3 each with the same P-number, sell-by date, and label) were purchased from local retail outlets. Groups were separated based on label information. The groups included: 1) eight groups of normally produced (N) carcasses using antibiotics during growout and chemical disinfection during processing; 2) two groups of antibiotic free, normally processed (NAF) carcasses, 3) three groups of all natural, antibiotic free, all vegetable diet, normally processed carcasses (NAFAV), and 4) one group of all natural, free range, antibiotic free, organically grown and organically processed chickens (AFORFR). Carcasses were stored at 3°C until their sell-by date, then sampled by rinsing. Aerobic plate counts (APC), E. coli counts (EC), and psychrotrophic plate counts (PPC) were conducted. Log10 APC for the N groups were 6.43, 7.51, 7.09, 5.88, 7.34, 6.65, 6.05, and 4.59, for the NAF groups were 6.18 and 7.40, for the NAFAV groups were 6.41, 6.03, and 5.53, and for the AFORFR group was 7.16. Log10 EC for the N groups were 1.07, 0.03, 1.09, 0.64, 0, 0.51, 0.26, nad 1.88, for the NAF groups were 0 and 0.66, for the NAFAV groups were 1.72, 1.37, and 2.18, and for the AFORFR group was 0.76. Log10 PPC for the N groups were 7.11, 7.98, 7.83, 7.77, 7.89, 7.52, 6.59, and 6.45, for the NAF groups were 7.14 and 7.53, for the NAFAV groups were 7.25, 7.77, and 7.24, and for the AFORFR group was 8.32. Chickens reared without antibiotics on all vegetable diets produced carcasses with significantly higher (P=0.026) E. coli counts (average of 1.76); however, these carcasses also had the lowest average APC’s (average 5.99). It is possible that, because no antibiotics were used during growout, the potential for E. coli infections that cause air sacculitis and inflammatory process (IP) in these groups is increased. Interestingly, the chickens reared free range, organically with no antibiotics had significantly higher (P=0.0065) spoilage bacterial counts (8.32), but EC were fairly low (0.76).

Key Words: broiler, carcass, sell-by date, E. coli, psychrotrophic plate count

M55  A new method for analyzing yolk contamination in egg white preparations. W. Berry*, S. Oates, L. Stevenson, and P. Curtis, Poultry Science Department, Auburn University, Auburn, AL.

Yolk contamination impairs the functionality of egg white preparations and increases the potential for bacterial growth in egg white products. The usual upper limit for yolk contamination of egg whites at 0.05%. However, measuring the actual amount of yolk contamination is difficult. Current methods for analyzing yolk contamination in egg white are based on measurement of lipid. These methods are complex and error prone. They often require the use of toxic solvents or involve significant expense for purchase and maintenance of equipment. It is clear that a rapid, simple, accurate, and inexpensive method for measuring yolk contamination in egg white is needed for industrial applications. Objective: Develop a sensitive assay capable of detecting 0.01% yolk contamination in egg white. Methods: The assay is based on quantifying a yolk associated marker protein by an enzyme-linked immunosassay rather than by assaying yolk lipids. The initial challenge was to identify and evaluate candidate immunological reagents. The required range of avian-specific antibodies are not currently available, so antibodies directed at other species had to be evaluated. The second problem was interference from the complex egg white matrix. It was desirable to avoid extraction steps for the sake of speed and simplicity of the assay in an industrial environment. Various reagents were tried for ameliorating interference from the egg white matrix. Results: Eventually two commercially available antibodies were found to be suitable for the assay and combination of reagents and procedures were found which reduced matrix interference to an acceptable level. An example of a typical assay result is presented in the table. Current efforts are directed towards refining the method to make it as simple, rapid, and robust as possible for use in industrial quality assurance programs. A provisional patent application protecting this technology was filed with the U.S. Patent and Trademark Office in late 2007.

Percent Yolk in Egg White

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Key Words: yolk, egg white, contamination, assay, analysis

M56  Influence of water hardness on the ability of water to rinse bacteria from the skin of processed broilers. A. Hinton Jr.* and R. A. Holser, Russell Research Center, Athens, GA.

Experiments were conducted to examine the effect of water hardness on the ability of water to rinse bacteria from the skin of processed broiler chickens. Very hard water (200 ppm total hardness) was prepared by dissolving 0.38 g calcium chloride (CaCl2) and 0.175 g magnesium chloride hexahydrate (MgCl2-6H2O) per liter of distilled water. Moderately hard water (100 ppm total hardness) was prepared by diluting 1 part very hard with 1 part distilled water, and distilled water was used as a soft water rinse. Skin samples were taken from breasts of broiler carcasses obtained from a local processing facility, cut into 1 g pieces, and stored at 4°C. Five consecutive 1 min rinses of skin samples were performed in 20 ml, fresh aliquots of distilled, moderately hard, or very hard water. Rinsed skin samples were stomached in a solution of 0.01 M potassium phosphate buffer with 0.025% ethylenediaminetetraacetic acid (EDTA) to recover bacteria remaining on the skin. Rinsates from stomached skin were decanted, and bacteria in the rinsates were enumerated on Plate Count (PC), Levine Eosine Methylene Blue (EMB), Campylobacter (CA), Pseudomonas (PS), and Staphylococcus (ST) Agars. Results indicated that significantly (P < 0.05) fewer bacteria were recovered on CA and PS Agars from skin rinsed in distilled water than from skin rinsed in moderately or very hard water, and significantly fewer bacteria were recovered on EMB Agar from skin rinsed in distilled water than from skin rinsed in very hard water. There was no significant difference in the number of bacteria recovered on ST or PC agar from skin washed in distilled, moderately hard, or very hard water. Findings from these experiments indicate that water hardness can play a role in the ability of water to rinse away intestinal bacteria, such as campylobacters and Enterobacteriaceae, and spoilage bacteria, such as pseudomonads, from the skin of processed broiler chickens. Poultry processors may be able to reduce the number of these bacteria on processed poultry by monitoring and controlling the hardness of water used in processing operations.

Key Words: water hardness, bacteria, broiler skin
M57  Hatchability of broiler breeder eggs following eggshell sanitization by repeated treatment with a combination of ultraviolet light and hydrogen peroxide. J. Wells*¹², C. Coufal², A. Kiess¹, H. Parker¹, and C. McDaniel¹, ¹Mississippi State University, Mississippi State, ²Texas A & M University, College Station.

Exposing eggs multiple times to ultraviolet light (UV) and 3% hydrogen peroxide (H₂O₂) results in a greater reduction of eggshell bacteria compared to eggs treated only once with this combination. However, it is unknown if this repetitive treatment will have any effect on hatchability. Therefore, the objective of this experiment was to determine if hatchability would be affected by reducing eggshell bacteria with repeated use of UV and H₂O₂. A total of 2,208 eggs from 47 wk old broiler breeders were collected from a commercial house and transported to the lab. Half of these eggs were treated and the other half served as controls. The treated eggs were misted with H₂O₂ and then exposed to 2 min of UV. This procedure was repeated a total of 6 times. Thirty-six eggs per treatment were used for bacterial enumeration. The remaining eggs were weighed and placed in 8 separate incubators (4 control and 4 treated). At 18 d of incubation, the eggs were weighed to determine egg moisture loss and placed in hatching baskets. At hatch, bacterial counts in the incubator air and chick weights were determined. Also, meconium samples were obtained from 10 randomly selected chicks from each incubator to determine the presence of intesinal bacteria. All chicks from each incubator were placed into a corresponding grow out pen, one pen for each incubator. Hatch residue analysis was performed on unhatched eggs. At 5 d post hatch, yolk sacs from 20 chicks per room were removed, weighed, and yolk sac material was plated for presence of bacteria. A 4 log reduction in eggshell bacteria was observed for eggs treated with UV and H₂O₂ compared to control eggs. There were no differences in hatchability, hatch residue, chick weight, residual yolk weight, egg moisture loss, or bacterial presence in meconium, residual yolks, or incubator air samples between control and treated groups. In conclusion, multiple applications of UV and H₂O₂ effectively reduced bacteria on the eggshell with no effects on the hatchability of broiler breeder eggs.

Key Words: ultraviolet light, hydrogen peroxide, hatchability, egg sanitization, broiler breeder


Broiler breeder producers are faced with the challenge of producing rapid growing broilers while attempting to control body weight in the parent stock. One of the more difficult tasks when raising broiler breeder cockerels is controlling weight gain in the rearing house without inflicting excess stress. This is a period of time for the young male when many portions of their reproductive system are in the formative stages and, if neglected, can have life long effect on their reproductive performance. The objective of this study was to raise males under various management programs which produced the recommended target body weight of 3.060Kg for males at 12, 15, 18, 21 and 24 weeks of age. Males were placed at three week intervals so that all males were light stimulated at the same time but at different ages. All males were reared in the same light controlled house at the University of Arkansas research farm. Males were light stimulated and testes development, complete semen analysis, fertility and mating activity and behavior being recorded for each group of males. Results show that the growth of the testes accelerated in all treatments between six and three weeks prior to lighting regardless of their age. At lighting there was no significant difference in testes weight (1.44g, 1.36g, 0.77g, 0.70 and 1.09g respectively), testes weight as a percent of body weight (0.0429%, 0.04481%, 0.0229%, 0.0208% and 0.0294% respectively), or body weight. Rearing broiler breeder males to sexual maturity at younger ages has the potential to reduce stress levels caused by feed restriction during the rearing phase, reduce production costs of the males, and potentially better utilize rearing facilities by producers and integrators.

Key Words: broiler breeder, testes, lighting, mating behavior, sperm production

M59  Effect of two feeding to peak programs on two strains of broiler breeders. N. Lekrsisompong* and J. Brake, North Carolina State University, Department of Poultry Science, Raleigh.

A study was conducted to examine how two female feed increase programs from photostimulation to peak egg production affected the reproductive performance and mortality of Ross 308SF or Ross 708SF broiler breeder females. Pullets were reared with a single feeding program to 21 wk of age and then assigned to two feed increase programs (slow or fast) from photostimulation to peak egg production. The flock was moved to the laying house and photostimulated at 21 wk of age when Ross 344 males were added to create 16 pens with 60 females and 7 males each in a 2 x 2 design. Egg production and mortality were determined on a daily basis while percentage fertility and fertile hatchability were evaluated on a weekly basis from sets of 90 eggs per replicate pen. BW was determined on a regular basis. The slow feed increase program significantly decreased female mortality and percentage floor eggs but did not affect male mortality. Males mixed with 308 females exhibited lower mortality than males mixed with 708 females. The 708 females exhibited better fertile hatchability than 308 females due to fewer late dead embryos. There were no differences in egg production, fertility, or fertile hatchability due to the main effects of feed increase program or strain and there were no interactions for any variable measured. It was concluded that a slow feed increase from photostimulation to peak production was beneficial for broiler breeder females irrespective of strain.

Key Words: broiler breeders, feed program, mortality, egg production, fertile hatchability

M60  Broiler performance of progeny produced from breeders fed low dietary crude protein levels. S. M. Whipple*¹², J. R. Moyle¹, D. E. Yoho¹, K. J. Wilson², and R. K. Bramwell¹, ¹University of Arkansas, Fayetteville, ²Georges Inc., Springdale, AR.

Dietary crude protein levels in Broiler Breeder diets have been evaluated by researchers and commercial producers with respect to breeder performance. There is ample evidence that lower dietary protein levels

Poult. Sci. 88 (Suppl. 1)
can improve egg production in addition to lowering feed cost. In addition, there is speculation that dietary intake by parent stock can affect progeny performance, but the results have varied and are inconsistent. The objective of the current study was to rear broilers produced by breeders fed varying levels of dietary crude protein to determine if sire and dam dietary crude protein would affect progeny performance. Parent stock broiler breeders were fed diets containing either (15.5% CP; T1; 14.5% or 13.5% CP; T2 and T3, respectively) at onset of egg production and for the remainder of the production cycle. At 30, 40, and 50 weeks of hen age, a total of 60 birds per pen with a total of 3 pens of each treatment were hatched and placed in replicate broiler pens with all birds fed the same diet on industry produced broiler feed program. Body weight was obtained weekly for each group and final feed conversion obtained for each group after the 38 day growout period. At the conclusion of the growout period, a random sample of 10 male and 10 female were selected and processed to determine process weight, and part yield, being wings, fillet, tenders, legs, rack, and fat, for each treatment group. Weights at processing were not significantly different between treatments (1,819g T1, 1,832g T2, and 1,849g T3). Analysis of the parts at processing also revealed no significant difference between treatments. Results of this experiment indicate that altering the dietary crude protein levels in parent stock breeders did not affect progeny broiler performance.

Key Words: broiler growth, broiler performance, parental dietary intake

M61 Feeding low crude protein levels and their effect on broiler breeder hatching egg production.  D. E. Yoho*SC1, J. R. Moyle1, R. S. Harper1, S. M. Whipple1, C. N. Coon1, K. J. Wilson2, and R. K. Bramwell1, 1University of Arkansas, Fayetteville, 2Georges, Inc., Springdale, AR.

Managing Broiler Breeders for optimum production is a constant challenge for commercial producers. Feed management programs are critically important factors that affect desired results regardless of the formulated diet. In the past, crude protein levels in Broiler Breeder diets have been manipulated with mixed results depending upon the conditions in which they were implemented. However, there is ample evidence that lower dietary protein levels can improve egg production in addition to lowering feed cost. The objective of the current study was to test if one could control diet (15.5% CP; T1) and two lower protein diets (14.5% and 13.5% CP; T2 and T3, respectively) at onset of egg production and measure reproductive parameters such as: hen body weight, egg production, egg weight, egg shape, and eggshell thickness. 500 female and 100 male commercial strain broiler breeders were raised separately from eight weeks to 21 weeks of age on the same diet and were fed according to industry standards. At 21 weeks of age, hens were randomly assigned to one of the three treatment groups with three males and 25 females randomly assigned in pens with six replicate pens per group. Hens were fed an identical ration until egg production reached five percent for an entire treatment group, at which time the treatment group was placed on a T1, T2, or T3 CP diet and fed daily allotments to meet industry recommended levels. All groups peaked in the same week at 81.1, 81.4, and 78.4 %, respectively. There was no significant difference in egg weights, but T3 hens produced more eggs per hen housed (149.3, 149.7, and 153.4 for T1, T2 and T3 groups, respectively) through 60 weeks of age. In this study, results indicate that lowering dietary crude protein improved egg production while lowering overall feed costs.

Key Words: broiler breeder, protein, egg production

M62 Evaluating the effects of in-house composting on litter in commercial broiler houses.  K. J. Barker*SC1, M. T. Kidd1, J. L. Pur- swell2, J. D. Davis3, C. D. Coufal2, C. D. McDaniel1, and A. S. Kiess3, 1Mississippi State University, Mississippi State, 2USDA, Mississippi State, MS, 3Texas A&M University, College Station.

In-house composting of litter between flocks may be an effective method to reduce pathogens and improve the quality of the environment in which new chicks are placed. In this study, different methods of in-house composting were tested in a commercial setting to determine the effects each would have on litter composition. Three composting treatments and one uncomposted treatment were applied to two commercial broiler houses containing litter that was used over multiple flock grow-out cycles. Each composting treatment involved windrowing with either the addition of water, turning, or leaving the windrow undisturbed for 8 d. Two commercial broiler houses were each divided into sixteen 20 x 20 ft. plots with each treatment being applied to four plots per house. Litter from each plot was analyzed for moisture content, pH, ammonia, and bacteria counts over a 17 d period, with d 17 representing d after chick placement. The results indicated that moisture content was significantly lower in uncomposted litter when compared to all composting treatments. All treatments showed decreases in pH from d 0 to d 17. Ammonia levels significantly decreased from d 10 to d 17. Composted litter with no added water or turning resulted in a significant decrease in anaerobic counts on d 17 compared to the uncomposted litter. In conclusion, in-house composting may be beneficial for newly placed chicks by changing the litter environment as well as reducing the population of pathogenic anaerobes that are detrimental to bird health and production.

Key Words: ammonia, anaerobe, composting, in-house, windrow

M63 Spatial variation of manure nutrients in commercial high-rise laying-hen houses.  S. A. Roberts*SC, R. J. Swestka, H. Li, and H. Xin, Iowa State University, Ames.

Poultry manure is a valuable source of nutrients for crop production when properly managed. Before manure can be sold or land-applied, the nutrient contents must be accurately assessed. The objective of this field study was to determine how many manure samples must be collected for a typical high-rise laying-hen house to accurately determine the nutrient contents of the manure while minimizing labor and analyses costs. A novel manure-sampling probe was developed and used for sample collection. Eighteen samples were collected at 9 locations evenly spaced in 6 high-rise laying-hen houses, each containing approximately 70,000 hens, on a farm in central Iowa. There were 108 total samples collected. Each barn had 5 cage rows and, thus, 5 manure piles. Collection was performed in the fall immediately before yearly manure removal. Samples were stored at −20°C before freeze-drying and grinding thorough a 1 mm screen. Samples were then analyzed for dry matter and total Kjeldahl N contents. Results are reported for N content on a dry-matter basis. Data were analyzed by comparing different sampling scenarios to the value obtained when all 18 manure samples in each barn were considered. Results showed that duplicate samples at a location were not necessary; hence the 2 samples per location were averaged to yield 9 values per barn. Six scenarios were considered: 2 sets of 3 samples diagonally along the length of the barn, 2 sets of 3 samples along the length or width of the middle pile, 1 set of 4 samples—one at each corner of the barn, and one sample collected at the center of the barn. The scenario with the lowest difference from the 9-sample average (reference), consistently for all 6 barns, was considered the best sampling method. Results revealed that
M64 Identification of an inflammatory compound for chicks in soybean meal--II. D. M. Anderson1, H. Y. Hsiao1, and N. M. Dale2, 1ChemGen Corp., Gaithersburg, MD, 2University of Georgia, Athens.

Previous studies have shown that β-galactomannan (β--mannan) in soybean meal (SBM) stimulates an innate immune response in chickens. SBM is the principal source of β--mannans in most commercial feeds. Plasma levels of the acute phase protein AGP (β--1 acid glycoprotein) were used to reflect the degree of innate immune response. Studies were conducted to verify (1) the relationship between β--mannan content in diets and degree of immune response and (2) the dosage effect of β--mannanase enzyme (Hemicell16, ChemGen Corp.) on the reduction of immune stress. Mixed sex broiler chicks were reared to 14 days of age in battery brooder units and plasma AGP levels were determined. The test diets contained 19.0% isolated soy protein (ISP), 25.4% soy protein concentrate (SPC) or 34.0% SBM. The mannose content in these diets was also determined. As soy products become more refined, the plasma AGP levels were significantly reduced (i.e., less immune response). A linear relationship was calculated between AGP levels and mannose content in testing diets.

In the same study, three doses of β--mannanase (60, 100, 150 million units per ton feeds) were applied on SPC diets and SBM diets. In SBM diets, β--mannanase addition significantly reduced circulating AGP levels in birds. In the relatively low mannan SPC diets, enzymatic hydrolysis of β--mannan consistently, but not significantly, reduced AGP in chicks. It is concluded that normal broiler diet formulations can stimulate an innate immune response, and that β--mannan in SBM appears to be a causative agent. Plant derived β--mannan can thus be considered to be a PAMP (pathogen associated molecular pattern) analog for poultry, engendering a metabolically expensive over--stimulation of the innate immune system. Feeding β--mannanase can result in the reduction of immune stress in chicks.

Key Words: β--mannanase, soybean meal, α--1 acid glycoprotein, β-galactomannan, chickens

M65 Effect of diet formulation on a total or digestible amino acid basis and amino acid concentration on broiler performance and carcass yield. M. de Beer1, T. J. Applegate1, K. A. Walter1, and D. Burnham1, 1Aviagen, Inc, Huntsville, AL, 2Purdue University, West Lafayette, IN.

Two experiments were conducted to determine the effects of diet formulation on a total (TOT) or digestible (DIG) amino acid (AA) basis and AA concentration on broiler performance and carcass yield. The first experiment determined the standardized ideal AA digestibility (SIAAD) and AMEn of a corn DDGS and a poultry product meal (PBM). The standardized Lys digestibility was 62.5 and 45.6% for the DDGS and PBM, respectively; whereas the AMEn was 2792 and 2537 kcal/kg, respectively. A subsequent broiler grow-out experiment was conducted with diets formulated using determined SIAAD and AMEn values for DDGS and PBM and average values for corn and SBM from previous experiments. The grow-out study was designed as a 2 x 2 factorial contrasting 0 vs. 10% DDGS, TOT vs. DIG, and 100% vs. 90% of 2007 Aviagen amino acid recommendations for Ross x 708 broiler chicks. Each diet was fed to 9 male and 9 female pens containing 20 birds/pen from 0 to 13, 13 to 26, 26 to 42, and 42 to 56 d of age. During each phase, dietary inclusion of PBM was fixed across diets at 3.5, 4.5, 5.5, and 6.5%, respectively. Formulation on a DIG basis vs. a TOT basis increased BW by 56 and 61 g and reduced FCR by 0.03 at both 42 and 56 d of age. Similarly, formulation to 100 vs. 90% increased 42 and 56 d BW by 53 and 43 g and reduced FCR by 0.04 and 0.03 at 42 and 56 d, respectively. Additionally, formulation on a DIG vs. TOT basis increased total white meat yield by 0.33 and 0.41%-units and lowered abdominal fat by 0.18 and 0.10%-units at 42 and 56 d of age, respectively. Likewise, formulation to 100 vs. 90% increased total white meat yields by 0.60 and 0.72 %-units and lowered abdominal fat by 0.22 and 0.24 %-units at 42 and 56 d of age, respectively. Despite potential increases in diet cost by formulating on a DIG vs. TOT AA basis or with a higher AA concentration, FCR and carcass yield differences improve broiler profitability.

Key Words: amino acid, broiler, digestibility

M66 Effect of amino acid formulation and dietary probiotic supplementation on egg production and characteristics of laying hens. T. J. Applegate1, E. Onyango2, R. Angel3, and W. Powers4, 1Purdue University, West Lafayette, IN, 2East Tennessee State University, Johnson City, 3University of Maryland, College Park, 4Michigan State University, East Lansing.

An experiment was conducted to determine whether probiotic supplementation could alleviate a marginal amino acid deficiency in Hyline 36 laying hens from 33 to 44 wk of age. A 2 by 4 factorial experiment with or without a commercial probiotic (1.4 kg /1000 kg) and 4 levels of amino acids (an amino acid adequate diet fed ad libitum (AAL); or an amino acid adequate (A90), marginal (M90) or deficient (D90) diet fed at 90 g/hen/d. Each dietary regimen was fed to 24 cages containing 2 birds per cage (780 cm2/hen). Dietary CP concentration was analyzed to be 17.4, 16.6, and 15.5% for the adequate, marginal, and deficient diets, respectively. Egg characteristics (yolk, albumen, or shell proportions and yolk or albumen solids) were not affected by diet (P > 0.05). Probiotic supplementation did not improve nor hinder egg production or egg mass despite consuming 10, 4, 7, 6.5, and 7.5 mg of Lys, Met, TSAA, Thr, and Ile less per hen per d, respectively. Probiotic supplementation reduced feed intake-to-egg mass ratio by 2.4% and 3.4% from 33 to 36 and 41 to 44 wk, respectively. Numbers of eggs laid, egg weight (g/egg) and egg mass (kg/feeding period) were maximized when the AAL and A90 were fed vs the M90 or D90 diets. Total eggs laid and egg mass were greatest when at least 14.4 g CP, 804 mg Lys, 382 mg Met, 601 mg TSAA, 502
mg Thr, and 609 mg Ile were consumed per hen per d from 33 to 44 wk of age. In conclusion, probiotic supplementation was not able to alleviate a marginal amino acid deficiency in laying hens but did improve feed intake-to-egg mass ratios during 8 wk of the 12 wk study.

**Key Words:** amino acid, egg production, laying hen, probiotic

**M67** The digestible lysine requirement of fast-feathering, straight-run, 35 to 49 day old Cobb x Cobb 500 broilers. R. B. Shirley*, J. L. Usry, and P. B. Tillman, Ajinomoto Heartland LLC, Chicago, IL.

In a completely randomized block study, the digestible Lysine (dLys) requirement of fast-feathering, straight-run, Cobb x Cobb 500 broilers was determined for the withdraw phase (35 to 49 days of age). The experiment was conducted in the South-East USA in late summer; and the broilers were raised on litter that had been used by 4 previous flocks. Day-of-hatch, straight-run broiler chicks were randomly allotted across 96 floor pens (four rooms with 24 pens per room; 3 replicates from each treatment in each room; 12 replicates per treatment; 50 chicks per pen).

All chicks were fed a common starter diet (0 to 7 days), grower diet (7 to 21 days) and finisher diet (21 to 35 days); the amino acid levels of each diet were formulated to exceed the current Cobb 500 nutrient guidelines. On day 35, the number of birds/pen was adjusted down to 46, with an approximate even split between males and females per pen (weights across all pens were equalized). The eight dose levels of dLys that were evaluated were: 0.60, 0.68, 0.76, 0.84, 0.92, 1.00, 1.08 and 1.16%; the energy (3,215 kcal/kg) and ideal essential amino acid ratios were maintained across all treatments. The intermediate dose levels of dLys were met by blending the 0.60% and 1.16% dLys diets. Broken-line (BL) dLys requirements were determined for feed consumption (FC), feed conversion (FCR) and total white meat yield (TWMP; the sum of total Pectoralis major and minor parts). The dLys requirement for FC was 0.88% (BL response = 2.218 g/bird), 0.99% for FCR (BL response = 2.42) and 0.95% for TWMP (BL response = 22.30%); mortality was greatest in the 0.60% dLys treatment (p = 0.0274). This study demonstrates that the fast-feathering Cobb x Cobb 500 broiler responds positively to higher dLys in the 35 to 49 day period.

**Key Words:** Cobb 500 broiler, digestible lysine requirement, broiler performance, meat yield, lysine

**M69** An empirical model to study nutritional effects on broiler growth and development. L. F. Romero*1 and M. J. Zuidhof2, 1Danisco Animal Nutrition, Marlborough, United Kingdom, 2Alberta Agriculture and Rural Development, Edmonton, AB, Canada.

An empirical platform to measure nutritional effects on broiler growth and breast yield was developed to provide an alternative to fixed-age analyses. This study evaluated the effect of energy and protein intake levels on three exponential relationships: cumulative feed intake (CFI; kg) as a function of age (d); eviscerated body weight (EBW; kg) as a function of cumulative metabolizable energy intake (MEI); and breast weight (BrW; kg) as a function of EBW. Data from 2070 Cobb x Avian 48 broilers placed in 60 floor pens was used. Birds were assigned to 3 metabolizable energy (ME) levels, 5 protein levels balanced for 6 total amino acids relative to lysine, and 10 processing ages from 21 to 56 d. A flexible functional form (trans-log) was used to optimize fit and measure derivatives with respect to energy and protein intake. All dependent variables were significant at P<0.05.

The following maximum fit models were selected:

\[
\ln(\text{CFI}) = a + b \ln(\text{Age}) + c \ln(\text{Age}) + d \ln(\text{ME}) + e \ln(\text{CP}) + f \text{Sex}; \\
\text{MSE} = 0.059 \text{ kg}^2;
\]

\[
\ln(\text{EBW}) = a + b \ln(\text{ME}) + c \ln(\text{Age}) + d \ln(\text{ME}) + e \ln(\text{CP}) + f \text{Sex}; \\
\text{MSE} = 0.015 \text{ Mca}^2;
\]

\[
\ln(\text{BrW}) = a + b \ln(\text{EBW}) + c \ln(\text{ME}) + d \ln(\text{CPI}) + e \text{Sex}; \\
\text{MSE} = 0.0003 \text{ kg}^2.
\]

Where ME (Mcal/kg) was mean energy density of the diet, CP (g/kg) was mean crude protein of the diet, and sex was a dummy variable (1 if male; 0 if female). The percent change of CFI in response to 1% change in ME was -0.12 x ln(Age), whereas the response to 1% change in CP was -0.03 x ln(Age). The percent change of EBW in response to 1% change in CPI was 0.02 x ln(MEI). The percent change of BrW in response to 1% change in MEI was -0.07 x ln(EBW), whereas the
response to 1% change in CPI was 0.05 x ln(EBW). Increased dietary ME exhibited negative effects on rate of feed intake, and the allometric relationship of breast muscle. Increased dietary CP exhibited negative effects on rate of feed intake, and positive effects on energy retention, and on the allometric relationship of breast muscle. This platform allowed dynamically evaluating nutritional effects on variables affecting broiler performance.

Key Words: empirical model, broiler chicken, breast meat, metabolizable energy, crude protein

M70 Effects of feed formulation and level of feed intake on the energy partitioning of finisher broiler chickens. S. Gomez*1,2, M. L. Angeles1, E. Ramirez1,2, and V. Mondragón1, 1CENIDFyMA - INIFAP, Ajuchitlan, Queretaro, Mexico, 2FES-Cuautitlán-UNAM, Ajuchitlan, Queretaro, Mexico.

A balance trial and slaughter experiment were carried out to evaluate the true metabolizable energy (TMEn) and the efficiency of conversion from gross energy (GE) to TMEn and from TMEn to net energy (NE) for protein (p) and fat (f) deposition in broiler chickens from 39 to 49 days of age fed different amounts of diets based on sorghum (S) or corn (C) and with or without the inclusion of dry distillers grains with solubles (DDGS). Forty eight Ross B308 male broilers allocated in individual pens were assigned to 12 treatments in a complete randomized design with a factorial arrangement of 2 grains (S or C), 2 levels of DDGS (0 and 10%) and 3 feeding levels (90, 120 and 150 g of feed/day). The last two days, total excreta were collected and in an additional group of birds the endogenous excretion of nutrients was determined. At the end, birds were killed to determine de energy retained in protein and fat. Chickens killed at the beginning of the trial were used to correct for the initial composition. There were four birds per treatment and results were subjected to analysis of variance. The nutrient excretion was lower and the nutrient retention, TMEn and the energy conversion from GE to TMEn were greater for C than for S (P < 0.05). The TMEn was lower but the energy conversion from TMEn to NEp and to NEp+f (P < 0.05) were greater for DDGS0 than for DDGS10 (P < 0.05). As the FL increased, the retention of nutrients, the TMEn, the total protein and fat in the body, the energy retained in protein and fat, the conversion from GE to TMEn and from TMEn to NEp, NEf and NEp+f showed linear increments (P < 0.01). Diets based on corn had a greater energetic value than diets based on sorghum; the inclusion of 10% DDGS reduced the energy retained in fat; broiler chickens fed at the highest feeding level showed the greatest efficiency of nutrient retention and conversion from gross energy, to true metabolizable energy and to net energy retained in protein and fat.

Key Words: broiler chickens, GE, TMEn, NE

Physiology

M71 Comparison of egg hatchability between two breeds of layers. O. K. Awobajo*1, A. A. Mako1, O. I. Abiola-Olagunjii, O. A. Oggunwole2, R. A. Hamzat3, A. O. Igosanu1, and R. O. Ettu1, 1Tai Solarin, University of Education, Ijebu Ode, Ogun State, Nigeria, 2Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria, 3Purdue University, West Lafayette, IN.

This study was carried out to compare hatchability between Rhode Island Red and White Leghorn. The hatchability records were collected for one year on each breed selected from the hatchery farms in Ijebu-Ode local Government. The result were subjected to statistical analysis. The result of the analysis (including T-test) revealed no significant differences (P<0.001) between rejected eggs (3.97%) from Rhode Island Red and (3.93%) from White Leghorn breeds. There was no significant difference (P<0.001) between the infertile eggs of Rhode Island Red (29.04%) and White Leghorn (24.82%). Significant differences (P<0.001) occurred in the egg hatchability of Rhode Island Red (64.29%) and White Leghorn breeds (68.61%). The White Leghorn had higher egg hatchability percentage than Rhode Island Red.

Key Words: hatchability, layers, breeds, rejected eggs, infertile eggs


Pre-warming of hatching eggs prior to incubation is to prevent condensation and to reduce variation in egg temperatures. The pre-warming profile might affect embryo viability, as it might affect cell death especially when cell viability is reduced after prolonged storage. The aim of this research was to investigate the effect of storage time and pre-warming profile on hatchability and chick quality. Eggs from a Ross broiler breeder flock with an age of 41 to 50 weeks were used. The experiment was a 2*3 factorial design: 2 storage times (4 and 14 d), and 3 pre-warming profiles (in 30 minutes, 4 h, or 24 h from 17°C to 37.8°C). All eggs were stored at 17°C. Eggs pre-warmed in 30 min were warmed in a water bath with water of 37.8°C. The other eggs were pre-warmed during 4 and 24 h in air. During incubation egg shell temperature was maintained at 37.8°C in all treatment groups. Infertility and embryonic mortality was determined macroscopically. Chick quality was evaluated 12 h after hatch by measuring chick length and yolk free body mass. No interaction was found between storage time and pre-warming profile for hatchability and chick quality. Although no significant interaction was found, there was a numerical difference in first week embryonic mortality between 24 h of pre-warming and 30 min and 4 h of pre-warming in eggs stored for 14 d (3.4%, 11.1%, and 9.4%, respectively, P=0.34). Storage time and pre-warming profile did not affect hatchability. Pre-warming profile did not affect chick quality. Fourteen days storage resulted in 0.1 cm shorter chick length (P=0.003) and 0.4 g lower yolk free body mass (P=0.006) compared with 4 d storage. In this experiment no effect of pre-warming profile on hatchability or chick quality was found.

Key Words: storage time, pre-warming profile, hatchability, chick quality
M73  Number and distribution of sperm-storage tubes in four strains of broiler breeders. M. R. Bakst*,1, S. M. Whipple2, R. K. Bramwell2, D. E. Yoho2, J. R. Moyle2, G. Liu3, and A. M. Donoghue4, 1ABBL, ARS, USDA, Beltsville, MD, 2Department of Poultry Science, University of Arkansas, Fayetteville, 3Yangzhou University, Yangzhou, Jiangsu, P.R. China, 4PPPSRU, ARS, USDA, Fayetteville, AR.

Restricted to the utero-vaginal junction (UVJ) in the hen’s oviduct are tubular invaginations of the surface epithelium collectively referred to as the sperm-storage tubes (SSTs). One would expect that a larger number of SSTs would be positively correlated with longer, sustained fertility. However, only two studies have reported SST numbers. Goodrich-Smith & Marquez (1978) estimated between 20,000-24,000 SSTs for the turkey while Birkhead & Hunter (1990) observed 1000-2000 SSTs in finches. We report our preliminary results of SST numbers, number of mucosal folds lining the UVJ, and the length (mm) of the mucosal fold with SSTs present in four strains of broiler breeder hens. Two hundred commercial pullets from each strain were reared according to industry standards. Hens were light stimulated at 21 wk and at 33-38 wk, 6 hen per group were randomly selected and euthanized. The vagina was dissected free of connective tissue, UVJ mucosa exteriorized and the number of mucosal folds counted. Six UVJ folds per hen were isolated, placed on a stereomicroscope and the portion of the UVJ fold containing SSTs was measured. The fold was then placed on a slide and a coverslip pressed firmly over the fold. The squash preparation was photographed and SSTs were counted off the images. Preliminary data (2 hens per strain) revealed no statistical variation between strains. However, the following was observed: total number of SSTs, 2,923-5,765; number of UVJ mucosal folds per hen, 16-19; length of UVJ folds containing SSTs, 14-27mm. Interestingly, the total number of SSTs for these broiler strains fell between that reported for turkeys and finches. Future analyses may reveal correlations between the SST numbers, strains, and sustained fertility as the study will be repeated when the hen flock reaches 60 wk of age.

Key Words: broiler breeder, oviduct, reproduction, birds, sperm-storage tubule


Feed enzymes are used extensively and are tested for several parameters when they are evaluated, such as pH profile, temperature profile, thermostability. A new, important parameter to test is stability during passage through the gastrointestinal tract. This is crucial to check if the enzymes can remain active after contact with the endogenous proteases and low pH in the digestive system. An experiment was run to test if in vitro stability corresponds to stability measured in vivo. Several enzymes were tested. The pig was used as model animal, because it is possible to collect bigger samples, which is needed to study the enzymes stability. Furthermore, it was evaluated, that the challenge in the pig digesta was higher due to lower pH in the stomach compared to a broiler digesta system. Three male cannulated pigs were fed a basal diet, formulated using barley/wheat/SBM and including a marker. The diet was heated treated to remove all endogenous enzyme activity. Test enzymes were added to the basal feed. Blank samples were taken at day 0 before the animals were fed the enzyme test diets. Digesta samples were collected at two time points post AM feeding. Enzymes were tested in triplicate and enzyme treatments were randomised between the three animals. Feed, duodenum and ileum samples were analysed for marker and enzyme activity. The stability of the enzyme in the digestive system was then calculated. The in vivo stability was compared to the stability found in an in vitro experiment. In the in vitro test each enzyme was incubated at low or neutral pH with increasing level of pepsin or pancreatin, to mimic the Gizzard/stomach region or ileum/small intestine region, respectively. After two hours of incubation, enzyme activity was determined. The stability of the enzymes varied from total resistance towards the challenging environment to no detected activity after incubation. Results show that there are differences between the stability of the tested enzymes depending of the origin of the enzymes.

Key Words: enzymes, stability, pH, in vitro, in vivo

M75  Development of a quail embryo model for the detection of botulinum neurotoxin activity. R. J. Buhr*,1, D. V. Bourassa1, N. A. Cox1, L. J. Richardson1, R. W. Phillips3, and L. C. Kelley2, 1USDA-ARS Russell Research Center, Athens, GA, 2USDA-FSIS Russell Research Center, Athens, GA.

Clostridium botulinum is a ubiquitous microorganism that under anaerobic conditions produces botulinum neurotoxins. In regards to both food-borne illness and the potential use of botulinum toxin as a biological weapon, the capability to assess the amount of toxin in a food or environmental sample efficiently is critical. Currently the mouse toxicity and neutralization assay is used for assessment of botulinum toxin activity and can detect 20 pg/mL. There is growing pressure to replace the mouse LD₅₀ assay for ethical concerns over the use of death by asphyxiation of the mice as the test endpoint. The objective of this study was to develop and evaluate a screening assay for detecting biologically active botulinum neurotoxins using Japanese quail embryos. Quail embryos at day 15 of incubation were injected into the neck/shoulder area with botulinum toxin type A (0.05 to 250 ng / 0.05 mL) and types B, E, and F (10 to 80 ng). At 3 d post-injection, embryos injected at 0.1 ng or higher with type A toxin had significantly more embryos than the control determined to be non-viable (21.5 vs. 2.5%). Neurotoxins B, E, and F were all detected at 10 ng/embryo with 40, 90, and 70% of embryos determined to be non-viable. Premixing of the toxin type A with type A specific antibody demonstrated that the depression in the ability of the quail embryos to pip and hatch was indeed attributable to biologically active toxin (80 vs. 14%). These experiments demonstrate that the Japanese quail embryo is an effective vertebrate animal model to detect the biological activity of botulinum neurotoxins A, B, E, and F. The minimal detectable dosage by the quail embryos of type A toxin is 100 pg (14 µg/kg of body weight). Utilization of a quail embryo may be a beneficial model for the analysis of botulinum toxins activity by enhancing personnel safety and since BoNTs does not kill the quail embryo, but restrict the ability of the embryo to progress to pipping into the aircell and through the eggshell, non-viable embryos can be presumptively euthanized upon detection.

Key Words: botulinum toxin, toxin types A B E and F, quail embryo, embryo viability, bioassay
M76 Genetic selection increases parthenogenesis in Chinese Painted Quail (Coturnix chinensis). H. M. Parker* and C. D. McDaniel, Mississippi State University, Mississippi State.

Parthenogenesis, embryonic development of an unfertilized egg, occurs naturally in turkey, chicken, and quail species. In fact, parthenogenesis in turkeys and chickens can be increased by genetic selection for this trait. However, it is unknown if genetic selection for parthenogenesis is effective in quail or if parthenogenesis affects hatchability of fertilized eggs. Therefore, the objectives of this study were to determine if the incidence of parthenogenesis in quail could be increased by genetic selection, and if parthenogenesis and hatchability characteristics are correlated. To prevent fertilization, 917 females were caged separately from males at 4 wk of age and then caged individually at 6 wk of age to monitor egg production. Eggs were collected daily, labeled with hen number and date, and stored for 0 to 3 d. After 10 d of incubation, 20 unfertilized eggs from each hen were examined to determine the occurrence of parthenogenesis and embryo width. In the first generation (P) and subsequent generations (F1 to F3), hens laying eggs containing parthenogenetic development and males whose sisters or mothers exhibited parthenogenesis were used for breeding. Weekly, eggs from breeding stock were set, and hatch residue analyses were performed on unhatched eggs. When compared to the P generation, the percentage of hens exhibiting parthenogenesis was greater as generation of selection increased. With each successive generation, percentage of eggs positive for parthenogenesis increased linearly (r²=0.99). Parthenogenesis was 72% greater among eggs from the F3 generation (7.9%) when compared to the P generation (4.6%). There was a quadratic increase in embryo size as generation increased (r²=0.99), and embryonic size for each generation was greater than the P generation. Percentage of eggs exhibiting parthenogenesis was negatively correlated with egg production yet positively correlated with percentage of early dead embryos from breeding stock. In conclusion, genetic selection for parthenogenesis increased the incidence of parthenogenesis and embryonic size and also influenced early embryonic mortality.

Key Words: parthenogenesis, quail, fertility, hatchability

M77 Effects of lithocholic acid and cholecalceolar in plasma Ca and expression of calbindin and Ca ATPase in commercial broiler chickens. A. Liem*, G. M. Pesti, R. B. Beckstead, and H. M. Edwards Jr., University of Georgia, Athens.

Lithocholic acid (LCA) is one of the main bile acid found in mammals and birds. While bile acids are predominantly known for their function in digestion, LCA has been reported to act as a signaling molecule on the vitamin D pathway in mice by increasing expression of calbindin, TRPV6 (a calcium channel), and ATP2B1 (CaATPase) in intestinal mucosa. Since there are similarities between mammalian and avian vitamin D receptor, we tested the hypothesis that LCA would have similar D3 signaling capacity in chicken.

To investigate if LCA has vitamin D activity in chicken, 240 Heritage broilers were randomly assigned to 6 treatments and raised from d1-16 in a battery brooder. The first 3 experimental diets were administered from day 1 to 16: basal diet deficient in vitamin D (B), B+ 0.2% LCA, B+ vitamin D3. The next 3 experimental diets were fed from day 8-16 (birds in these treatments received B diet from day 1-7): B + 0.1% LCA, B+0.2% LCA, B + vitamin D3. Each treatment had 4 replicate pens, with 10 mixed sex chicks in each pen. Body weight, liver weight, bone ash, leg score (incidence of vitamin D deficiency rickets, and P deficiency rickets), and plasma Ca were measured. Intestinal mucosa samples were collected to determine the expression of calbindin, and CaATPase.

As expected, vitamin D3, added since day 1 or day 8 increased body weight gain (BWG), increased plasma Ca, reduced the incidence of Ca rickets, and increased expression of calbindin and ATP2B1. At the levels fed, LCA did not affect BWG, linearly increased plasma Ca and liver weight, and reduced incidence of Ca rickets. At 0.1%, LCA increased expression of calbindin, but did not significantly affect expression of ATP2B1. At 0.2%, LCA had no effect on the genes tested.

In conclusion, similar to mice, vitamin D3 increased plasma Ca and expression of calbindin and ATP2B1 in chicken intestinal mucosa (p<0.05). At 0.1%, LCA appears to have some vitamin D activity in chickens. While at 0.2%, LCA is toxic to the birds and might cause an overall disruption of metabolic processes.

Key Words: vitamin D, lithocholic acid, calbindin, ATP2B1, plasma calcium

M78 Haematology of egg-type chickens fed fermented and enzyme–treated cocoa bean testa based–diets. M. D. Olumide*1, R. A. Hamzat2, and A. O. Akinsoyinu3, 1Kolmat Farms Limited, Erunmu, Ibadan, Nigeria, 2Purdue University, West Lafayette, IN, 3Department of Animal Science, University of Ibadan, Nigeria.

One of the limiting factors to the growth of poultry industries in Nigeria is high cost of feed ingredients. This is why animal nutritionists are therefore investigating into some agro allied wastes that have potential as feed ingredients. Cocoa bean testa (CBT) is in of such that constitutes economic waste in all cocoa industries in Nigeria. Measurements of haematologic parameters is an important part of evaluating health status in avian species. This study hence focused on evaluating the haematology of layers fed cocoa bean testa based diets.

Two hundred and ten (210) six – week –in –lay hens were used for this trial with thirty birds, randomly allotted to seven experimental diets containing ten birds per replicate in a 3 X 3 factorial design. These diets were: A (0% CBS – control); B (5% raw CBS); C (10% raw CBS); D (5% CBS with enzyme); E (10% CBS with enzyme); F (5% fermented CBS); and G (10% fermented CBS). The layers on each diet were offered feed and water ad – libitum throughout the experimental period. The hematological parameters studied were the red blood cell, hemoglobin, white blood cell, packed cell volume, erythrocyte mean cell haemoglobin concentration, erythrocyte mean cell volume and erythrocyte mean cell haemoglobin. Differences in the hematological parameters of the layers in the different treatments were not appreciable (p > 0.05).

Key Words: fermentation, enzyme treatment, cocoa bean testa, egg-type chickens, haematology
M79  Dietary immunomodulation of gut immunity to enhance disease resistance against mucosal pathogens.  H. S. Lillehoj and S. H. Lee*, ARS-USDA, Beltsville, MD.

For many economically important diseases of poultry, there is an increasing interest to develop drug-free alternative control strategies against many infectious diseases due to increasing consumers' concerns about chemical residues in poultry meat. One promising new avenue to achieve this goal is the use of natural and herbal products, hyperimmune IgY antibodies, oligodeoxynucleotides (ODNs), or probiotics to enhance host defense against microbial infections. Recent studies from our laboratory provided clear evidence that dietary supplements which enhance innate immunity decreased immunopathology associated with infections with pathogenic enteric pathogens. In this report, molecular changes associated with enhanced innate immunity following dietary immunomodulation will be presented using microarray analysis. Alternative prevention and/or treatment measures such as non-chemical dietary supplements that effectively enhance productivity and activate non-specific immunity will help limit the use of antibiotics. However, there is a critical need for more fundamental research to understand poultry immune system and host-pathogen immunobiology in order to develop effective disease prevention strategy.

Key Words: passive immunity, immune enhancement, innate immunity, cell-mediated immunity, mucosal pathogens

M80  Evaluation of clinical and sub-clinical Eimeria challenge methods in broilers.  S. Pohl1SCI, J. Lee1, S. Anderson1, S. Fitz-Coym2, L. Oden1, A. Klein1, D. Caldwell1,1Texas A&M University, College Station, 2Intervet-Schering Plough Animal Health, Millsboro, DE.

The current study was conducted to determine the effectiveness of various Eimeria challenge methods in broilers. The main experimental objective was to compare clinical against subclinical or natural exposure-based challenge methods. Challenge methods expected to induce clinical infection were performed seven days post-placement and included oral gavage, feed delivery, and direct litter application of field strain Eimeria. Subclinical or natural exposure methods were performed on day of placement and included a low-level oral gavage and pre-seeded litter application of Eimeria. Broilers from clinical challenge groups were subjected to necropsy for gross and microscopic intestinal lesions 14 days and 21 days post-placement. Subclinical or natural exposure challenge groups were necropsied on days nine and 16 post-placement. Oocyst output was determined microscopically by counting shed oocysts per gram of feces collected in all experimental groups beginning six days post-challenge. Of all broilers necropsied in clinical challenge groups, broilers subjected to feed-based Eimeria challenge were associated with higher overall gross and microscopic intestinal lesions in all regions on day 14. Litter challenge broilers were associated with the highest overall gross and microscopic lesion scores on day 21. Of the sub-clinical challenge groups, pre-seeded litter challenged broilers were characterized by higher gross lesion scores in the mid-intestine and lower intestine, compared to low-level gavage broilers on days nine and 16. Microscopic lesion scores supported gross lesion scores in sub-clinical challenge groups. Oocyst output in all groups, on all sample days supported lesion scores. These data suggest that various challenge methods can be used under different research settings to more accurately simulate natural routes of Eimeria exposure to broilers within commercial rearing environments.

Key Words: Eimeria, challenge, coccidiosis, lesion, broilers

M81  Immunomodulation of the avian gastrointestinal tract with probiotics and coccidiosis vaccine.  M. B. Farnell1*, J. T. Lee1, 1University of Georgia, Athens, GA, 2Texas A & M University, College Station, 3Intervet-Schering Plough Animal Health, Summit, NJ.

The oral administration of probiotics has been demonstrated to improve gut health, reduce incidence of pathogens, increase feed efficiency and stimulate immune function in chickens. The gastrointestinal tract is arguably the largest and most important immune organ; interacting with sizeable numbers of commensal and pathogenic organisms on a continual basis. The hypothesis of this study was that stimulation of the avian mucosa with probiotics (Biomin PoultryStar®, Biomin GmbH) would prime the immune system to better respond to coccidiosis vaccination (Coccivac®-B, Schering-Plough Animal Health). Day-of-hatch, straight-run broilers were placed onto equal parts fresh pine shavings and used litter for 49 days. Treatments consisted of a negative control, a probiotic only treatment, a vaccine only treatment and a combination probiotic vaccine treatment. Four pools of peripheral blood were collected from each group on days 15, 30, 40 and 49. Heterophil and mononuclear cell fractions were each assayed for oxidative burst using a fluorescent substrate and a synthetic agonist. Lymphocyte proliferation was determined using a formazan based colorimetric indicator and a plant derived mitogen. Heterophil oxidative burst was increased (P<.05) in each of the treatment groups on days 40 and 49, when compared to the negative control. The probiotic and vaccine combination was the only group with improved (P<.05) heterophil oxidative burst on day 15. Monocyte oxidative burst was increased (P<.05) in each of the treatment groups on day 15, when compared to the negative control. Increases (P<.05) in monocyte oxidative burst were also observed on day 30 with the probiotic group, days 40 and 49 with the vaccine group and day 49 with the combined treatment. Lymphocyte proliferation was greater (P<.05) on day 15 with the combination group, day 40 with the vaccine group and day 49 with the probiotic and vaccine groups, when compared to the negative control. These data demonstrate the immune potentiating effects of probiotic bacteria and coccidiosis vaccine on the avian mucosa.

Key Words: probiotic, coccidiosis, mucosal immunity, vaccine, heterophil


Coccidiosis is one of the most important diseases in poultry farming worldwide with high impact on production economy and animal health. Outbreaks in broiler flocks are mainly controlled by preventive use of
anticoccidial drugs. Frequent emergence of parasite resistances implies the need of effective and cost-efficient alternatives.

The EU-funded research project SAFEWASTES (http://www.safe-wastes.info) had the aim of investigating organic waste material and by-products from food-processing and the pharmaceutical industry. These materials are assumed to still contain various interesting and valuable compounds which could justify their use as feed additives.

In this study, their effects on different stages of in vitro development of *Eimeria tenella* were investigated by a set of bioassays: a sporozoite vitality assay (SVA) measured parasite vitality after incubation with test compounds, an invasion inhibition assay (IIA) detected effects on the invasion of animal host cells and a merozoite production assay (MPA) measured the production of first generation merozoites. MDBK (Madin Darby bovine kidney) cells were used as animal host cells for the parasites.

Of 16 tested samples, eight showed activity in the MPA, four of which also inhibited host cell invasion (IIA), while one of them also showed direct effects against free sporozoites (SVA). A heptane extract of willow bark (*Salix alba*) exerted >50% parasite inhibition in each assay in concentrations ranging from 125 - 500 ppm. Monensin as a positive control exhibited reproducible anticoccidial activity in a range of 25 - 100 ppb. It is concluded that the assays provided valid information on the activity of plant extracts.

More testing is necessary with respect to elucidation of the active principle(s) of extracts. Furthermore, in vivo challenge trials will have to prove that the applied methods provided transferrable results.

**Key Words:** coccidiosis, *Eimeria*, SAFEWASTES, plants, *in vitro*

M83  Quantitative real-time PCR assay for *Clostridium septicum* in poultry gangrenous dermatitis associated samples.  A. P. Neumann*, S. M. Dunham, T. G. Rehberger, and G. R. Siragusa, Agtech Products, Inc., Waukesha, WI.

*Clostridium septicum* is a spor-forming anaerobe frequently implicated in cases of gangrenous dermatitis (GD) and other spontaneously occurring clostridial infections of poultry. Virulence of the organism is primarily attributable to the secretion of a lethal, pore-forming cytolysin designated as alpha toxin. *C. septicum* can be readily cultured from diseased tissues but is difficult to isolate and is often overgrown by more predominant organisms on nonselective media typically used for its cultivation. Here we developed and validated a quantitative real-time PCR assay in order to more accurately evaluate the levels of *C. septicum* in healthy as well as GD poultry samples. The assay was specifically designed to target the *C. septicum* alpha toxin gene, csa, which is to our knowledge carried by all strains of *C. septicum* and has been shown to be essential for virulence. Genomic DNAs from 22 bacterial species other than *C. septicum*, including the closely related species of *C. chauvoei*, *C. carnis*, *C. tertium* and *C. perfringens*, all failed to produce a positive reaction using this assay. A diverse collection of twelve poultry *C. septicum* strains and the type strain, ATCC 12464, all produced a positive signal. The sensitivity of the assay was determined to be approximately 10^3 cfu/g of *C. septicum* DNA. Standard curves were generated by spiking extracts from conventionally raised 6 week old broiler GI tracts, livers and breast muscles as well as poultry litter with known quantities of *C. septicum*. Approximately 10^3 cfu/g of *C. septicum* was consistently detected in spiked GI tract, liver and litter samples. Surprisingly, a detection limit for spiked breast muscle samples could not be determined due to apparent background levels of resident *C. septicum* populations in the two muscle samples tested. This assay will serve as an important tool in the continuing research effort aimed at gaining a better understanding of the nature of *C. septicum* and how this organism contributes to the development of GD.

**Key Words:** gangrenous dermatitis, *Clostridium septicum*, quantitative PCR


This research was conducted to measure the differences in physiological responses of broiler chickens during three methods for emergency mass depopulation. The depopulation methods tested were carbon dioxide (CO₂) gas, argon-carbon dioxide (70% to 30% mixture) gas and water based foam. Physiologic responses to each of the three methods were quantified using electrocardiogram (ECG), electroencephalogram (EEG), and motion sensing equipment. Each broiler was placed individually into a treatment chamber and exposed to a single depopulation method. Physiological responses and motion of the birds were monitored and recorded for fifteen minutes post-treatment application. The mean time to EEG silence for broilers treated with foam was 161 seconds. Mean EEG silence for CO₂ gas was 158 seconds and EEG silence for Ar-CO₂ was 224 seconds. Mean times of ECG suppression (cardiac relaxation) 142 seconds for foam, 158 seconds for CO₂ gas and 195 seconds for Ar-CO₂ treatments. The times for EEG silence and cardiac relaxation will be independently compared to motion cessation for each depopulation treatment.

**Key Words:** depopulation, foam, accelerometer, electrocardiogram (ECG), electroencephalogram (EEG)


The current control strategies for Avian Influenza (AI) and other highly contagious poultry diseases include surveillance, quarantine, depopulation, disposal, and disinfection. The purpose of this experiment was to determine the physiological effects of depopulating broiler chickens with water based foam compared to that of foam infused with carbon dioxide (CO₂) gas. The effects of the treatment were monitored by the use of an electrocardiogram (ECG), electroencephalogram (EEG) and motion detection instrumentation (accelerometer). The results of this experiment show that when the foam infused with CO₂ is compared directly to the water based foam it was equally effective at depopulating the birds based on the motion cessation and the EEG silence data. EEG silence using the water based foam occurred within 240 seconds with one outlier and in 140 seconds with one outlier using the foam.
infused with CO₂ gas. The motion cessation data showed that with the water based foam induced cessation within 240 seconds and within 180 seconds for the foam infused with CO₂ gas.

**Key Words:** depopulation, foam, electrocardiogram (ECG), electroencephalogram (EEG), carbon dioxide

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**M86 Scald tank water and foam as sources of carcass contamination during early poultry processing.** K. Liljebjelke*, K. D. Ingram, A. Hinton, Jr., and J. A. Cason, USDA/ARS, Russell Research Center, Athens, GA.

_Salmonella_ remains a leading cause of bacterial foodborne illness in the United States, with poultry consumption associated with forty percent of outbreaks for which vehicles are identified. Identifying sources of _Salmonella_ contamination and cross-contamination within poultry processing is imperative to developing effective control programs. We enumerated Enterobacteriaceae, coliforms, and _Escherichia coli_, and isolated _Salmonella_ from scald tank water, scald tank foam, and defeathered carcasses obtained from a commercial poultry processing plant during the second processing shift for nine consecutive weeks. Using Biolog GM metabolic fingerprinting, we identified Enterbacteriaceae from these samples to species. Sixty percent of isolates were identified as _E. coli_, with _Vibrio sp._, _Escherichia sp._, _Salmonella sp._, _Aeromonas sp._, _Enterobacter sp._, and _Raoultella sp._ making up the majority of other Enterobacteria identified. _Salmonella_ serotypes were isolated from carcass rinsate, water, and foam samples. The total Enterobacteria count from carcass rinsates (n=102) was mean log 3.7 cfu/ml. Total Enterobacteria counts from scald tank water decreased significantly (P<0.05) from the first tank to the third (mean log cfu/ml: 3.4, 2.5, 1.7). Enterobacteria counts from foam samples did not decrease significantly from tank-to-tank (mean log cfu/ml: 2.6, 2.2, 2.1), but contained significantly (P<0.05) fewer cfu than equal volumes of water from the same tanks. Despite high temperatures in the scald tanks (mean 50–53 °C), Enterobacteria survive in the water and in lesser amounts in surface foam. The organic foam layer that builds up on the scald tanks during processing may serve as a source of bacterial contamination during the early steps of poultry processing when carcasses pass through the foam.

**Key Words:** _Salmonella_, _E. coli_, processing, scald water, broilers
**Environment & Management III**

**T87** Effect of egg shell and yolk colour on sales of eggs in Nigeria: A case study of egg producers in Ogun, Nigeria. A. A. Johnson*, O. A. Ogunwode1, E. O. Uwagboe1, O. I. Abiola-Olagunju2, and R. A. Hamzat1, 1Tai Solarin University of Education, Ijebu Ode, Ogun State, Nigeria, 2Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria, 3Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria.

Demand for colour of egg shell and yolk had significantly affected the sales of eggs among egg producers in Nigeria and this study is focused on the effect of these parameters on the sale of eggs in the study area. Five communities; Ijebu-Ode, Odogbolou, Ikenne-Remo, Ijebu East and Ijebu North local government areas were purposively selected for this study as they are major producers of eggs in Ogun state Nigeria. One hundred and fifty respondents were randomly selected for the study. The result revealed that majority 60(40%) of the respondents were between ages of 41 and 50 which indicated that they were in their prime age. Majority 110(73.3%) were males while 40 (26.7%) were females which shows that more males are into egg production than the females in the study area. Majority of the respondents rear between 1001 and 3000 layers while few 5(3.3%) rear between 50 and 100 layers. All 150(100%) of the respondents indicated that customers prefer brown eggs. Majority 110(73.3%) of the respondents agreed that breeds of birds determine egg colouration while 30(20%) agreed that it is feed and 10(6.7%) had no idea of the cause. Majority 135(90%) of the respondents indicated that customers select eggs based on shell colour and 140(93.3%) agreed that customers dislike white eggs mainly because it is similar to native eggs. Chi-square result revealed that there is significant difference in the consumers preference between brown and white eggs shell ($\chi^2=11.65, P=0.05$).

In conclusion, egg buyers prefer brown shell and yellow yolk eggs which influence producers sales. It is recommended that egg producers rear breeds of layers that produces brown shell and yellow yolk, and also use feed that has the ingredients that is capable of meeting these requirements.

**Key Words:** effect., egg shell, egg yolk, sales, Nigeria


The traditional combination of research and training at colleges of Agriculture, Animal Health and Production Technology have contributed significantly to the strength of today’s poultry industry in Nigeria. According to survey carried out on major poultry companies, government agencies and agro-allied industries that employed middle level manpower. It has been discovered that their performance have been encouraging. Rural farmers are also eager to listen to extension worker in view of the diverse methods of technology transfer employed. These include on visit, demonstration project, field studies drama and short play on video. Extension /outreach program are relevant, current applicable within the economic confines of this sector. Emphasis is on frequent assessment and timely implementation to technology to enhance productivity and efficiency of poultry. The worldwide poultry and feed industry will continue to need highly qualified specialists, therefore a continued efforts to keep up with international development is essential and also link with information in internet. The study focus on the extension service, research and training in agricultural colleges, research institute and government agencies in Nigeria.

**Key Words:** training, manpower, diploma

**T89** Effect of die thickness and pellet mill throughput on pellet quality. C. R. Stark*, North Carolina State University, Raleigh.

Nutritionists and purchasing agents control approximately 60% of the factors that affect pellet quality, primarily through diet formulation, ingredient specifications, supplier selection, and particle size. Feed mill managers and pellet mill operators can affect pellet quality through die selection, conditioning, cooling, and production rate. The objectives of this experiment were to evaluate the effect of die thickness and pellet mill throughput on pellet quality and pellet mill efficiency. A corn-soybean meal diet containing 3% poultry fat added in the mixer was used in the study. The experimental design was a 3 x 3 factorial arrangement of treatments: production rate (545, 1,091, and 1,636 kg/h) and pellet die thickness (29, 35, and 44 mm). There were three replications per treatment. The calculated L/D ratios (thickness/hole diameter) of the dies were 6.6, 8.0, and 10.0, respectively, based on a 4.4 mm diameter pellet die hole for all dies. Results of the pelleting study showed positive effects on pellet quality (as measured by pellet durability index (PDI, %)) with thicker dies and improved pellet mill efficiency at higher production rates with no interactions. Increased die thickness resulted in a linear decrease in pellet mill efficiency (97.5 to 89.8 kg/hp), and, as expected, a linear improvement in pellet quality (31.8% to 60.0%) was observed with thicker dies. The increase in pellet mill throughput produced a linear increase in pellet mill efficiency (73.3 to 112.4 kg/ hp) and a linearly reduction in pellet quality (55.4 to 30.2%). Hot pellet temperatures after the die increased linearly as die thickness increased due to friction between the die and feed. The results of this study confirm the positive effect of die thickness on pellet quality. Additionally, these data demonstrated that throughput should be added to the list of dependant factors (along with feed formulation, particle size, conditioning, cooling, and die specifications) that influence pellet quality.

**Key Words:** feed manufacturing, pelleting, pellet quality, die thickness, efficiency
T90  Limited broiler breeder feeder and drinker space decreases the incidence of floor eggs. M. Gucbilmez1, O. Elibol1, and J. Brake*2, 1Department of Animal Science, Faculty of Agriculture, University of Ankara, Ankara, Turkey, 2Department of Poultry Science, North Carolina State University, Raleigh.

Three experiments were conducted to determine the effect of broiler breeder female feeder space after photostimulation on egg production and percentage floor eggs. A fourth experiment investigated the effects of drinker space. All experiments were conducted in enclosed fan-ventilated deep litter commercial houses that housed 8,000-10,000 hens each. Ross 344 males and Ross 308 females were grown sex-separate in light-controlled facilities on an 8 h photoperiod. A floor-feeding system was utilized during rearing with 9 pullets/m2 and 9 pullets per nipple drinker. All management and infrastructure factors during the production period were the same except feeder or drinker space. Eggs were collected four times daily from the nests and floor and recorded separately. In the first experiment two houses were divided into two pens each so that four 12.9 x 72 m pens were used. Two or three chain feeder lines provided 10.5 cm or 15 cm of feeder space per female, respectively. In the second experiment four 14 x 120 m houses were used and two or three chain feeder lines provided either 12.2 or 17.5 cm of feeder space per female, respectively. In the third experiment a single house was divided into two 12.4 x 68.5 m pens and two or three chain feeder lines provided 12.2 or 18.4 cm of feeder space per female. In the fourth experiment three 14 x 120 m houses were employed. Two or three nipple drinker lines resulted in 7.9 or 5.3 females per nipple, respectively. Hen-housed egg production and female mortality from 25 to 37 wk of age were not affected by feeder or drinker space. However, percentage floor eggs was less for the lesser feeder or drinker space in all experiments.

Key Words: broiler breeders, feeder space, floor eggs, drinker space, drinkers

T91  Molting Leghorn hens using a Pecan Natural Fiber™ product. P. L. Ruszler*1, C. L. Novak2, and J. Nizio3, 1Virginia Polytechnic Institute and State University, Blacksburg, 2Land O’ Lakes Purina Feeds, Kansas City, MO, 3Southeastern Reduction Company, Valdosta, GA.

A by-product of pecan processing, Pecan Natural Fiber™ (PNF), may have beneficial properties affecting a total ovarian rest when fed to laying hens. To evaluate the effectiveness of these properties, molt diets containing PNF were compared with full fed and 4-day feed withdrawal molting programs. Five treatments (tmt) of 18 hens each were compared. Treatments A & B were full fed a 9.7% CP/1430 Kcal ME/kg molt diet. Treatment C was full fed a 14% CP/2778 Kcal ME/kg molt diet and tmt D was full fed an 11% CP/1681 Kcal ME/kg molt diet, both blended with PNF. Both tmt C & D diets had 20% PNF added for the first 7 days then 15% PNF added the next 7 days followed by 9% added for 14 more days. Treatment E (control) was molted by a 4-day feed withdrawal, followed by limit feeding a 14% CP/2778 Kcal ME/kg molt diet to day 33 then full fed a 15.5% CP/2816 Kcal ME/kg layer diet. At 29 days post-molt, tmt A was fed a 14% CP/2778 Kcal ME/kg diet, tmt B a 14% CP/2816 Kcal ME/kg diet while tmts C & D were fed 15.5% CP/2816 Kcal ME/kg layer diets. Treatments A, B & C reached 50% production by 7 wks post-molt while tmts D & E took 8 wks. Body weights as a percent of initial weight for tmts A,B,C,D & E were 96.6, 98.9, 100.9, 97.8 & 99.2, respectively at 8 wks. Treatments A & B produced 1% or fewer eggs for 4 wks during the molt, while tmts C & D produced no eggs compared to 5 wks with no eggs for tmt E. Egg weights at 8 wks post-molt were similar (65 - 66 g) for all tmts. Egg production at 12 wks was 90, 85, 86, 83 and 91 percent for tmts A, B, C, D and E, respectively. Daily feed intake per hen at 12 wks was 127, 129, 120, 117 and 128 g, respectively for each treatment. Treatment D consuming the least protein and energy during the molt was the slowest to return to full production. The results suggest that, although the PNF product has potential as a full fed molt inducing ingredient, further study is warranted.

Key Words: pecan product, molting, egg & body weight

T92  Effects of American and proposed European lighting programs on broiler live and processing performance. R. J. Lien*, J. B. Hess, and S. F. Bilgili, Auburn University, Auburn, AL.

To determine effects on live and processing performance, broilers were subjected to lighting programs meeting US National Chicken Council (NCC) guidelines or European Union (EU) guidelines proposed in 2005. Eighty male broilers were placed in each of twelve 3.0 by 3.7 m light controlled rooms. Four rooms were provided NCC photoperiods and dim intensity (20D treatment) (1-7 d, 23L:1D and 0.5 FC; 8-40 d, 20L:4D and 0.1 FC; 41-47 d, 23L:1D and 0.1 FC). Four rooms were provided an EU intensity and photoperiod with a split dark period (14B treatment) (1-3 d, 23L:1D; 4-44 d, 14L:4D:2L:4D; 45-47 d, 23L:1D; all at 2 FC), and four were provided an EU intensity and single dark period (16B treatment) (1-3 d, 23L:1D; 4-44 d 16L:8D; 45-47 d, 23L:1D; all at 2 FC). Twenty birds per room were processed at 47 d to determine parts weights and yields. At 47 d, the 14B and 20D treatment BW were greater than 16B; otherwise, BW was unaffected by treatment. Similarly, at 47 d feed consumption was greater in the 14B treatment than 16B, and 20D was intermediate. Feed conversion was unaffected by treatments. Uniformity at 22 d did not differ between treatments; however, at 47 d it was greater in the 20D treatment than 16B, and 14B was intermediate. Overall mortality did not differ between treatments; however, mortality to 22 d was greater in the 20D treatment than in 16B, and 14B was intermediate. Carcass, total breast, fillet, tender, and thigh weights and yields did not differ between treatments. Drumstick yield was greater in the 16B treatment than 14B, and 20D was intermediate. Wing yield was greater in the 20D and 16B treatments than 14B; however, drumstick and wing weights were unaffected by treatments. Results indicate splitting an 8 hr daily dark period into two 4 hr blocks improves live performance relative to a single 8 hr dark period, and that although the yield of minor parts was reduced by splitting the dark period, breast weights and yields were unaffected.

Key Words: broiler, chicken, photoperiod, light intensity, lighting

T93  Effects of fan staging on airflow uniformity in layer houses. J. L. Purserwell*1, J. D. Davis2, and S. L. Brantley1, 1USDA-ARS Poultry Research Unit, Mississippi State, MS, 2Mississippi State University, Mississippi State.

Modern poultry facilities rely on power ventilation to manage temperature, humidity, and air quality within the house. Variations in air flow occur naturally from friction losses along the sidewalls and obstructions, making it difficult to achieve uniform air velocities and thermal condi-
tions within a house. Different fan staging methods were investigated to determine which progression yielded more uniform air velocity in a layer and pullet house. The layer house was an open ceiling type with a 16 ft peak and was equipped with eight 48'' fans and one 36'' fan; the pullet house had a flat dropped-ceiling and was equipped with six 48'' fans. Two fan staging progressions were compared to determine the effect on airflow uniformity: 1) staging from the center pair of fans outward and 2) staging from the outer fans towards the center pair. Air velocity was measured in each of five aisles in both houses using a high-accuracy anemometer. The initial stage (2 fans) starting with the center pair of fans produced a more variable air velocity distribution when compared to starting with outer pair of fans in the layer house (CV = 37% vs. 6.4%, respectively). The next stage (four fans) in the layer house showed the least variation (CV = 11.3%) when the four outer fans were running vs. the inner four fans (CV = 31.9%) and the outer pair plus the inner pair (CV = 16%). Similar patterns held for the pullet house as well, with the minimum CV for the initial stage occurring with the two outer fans (5.6%) and for the secondary stage occurring with the four outside fans (8.8%).

Key Words: layers, ventilation, airflow

T94 Efficacy of the adsorbent Calibrin-A in ameliorating the toxic effects of aflatoxin in broiler chicks. D. R. Ledoux1, A. J. Bermudez1, and J. N. Broomhead1, 1University of Missouri, Columbia, 2Amlan International, Vernon Hills, IL.

An experiment was conducted to determine the efficacy of the adsorbent Calibrin-A (CA) in ameliorating the toxic effects of aflatoxin (AF) in broiler chicks. A second objective was to determine if Calibrin-A at 0.5% of the diet would negatively affect chick performance. Three hundred and twenty day-old male broiler chicks were assigned to 8 dietary treatments, with 8 replicate pens of 5 chicks per treatment. Dietary treatments included: 1) 0 AF, 0 CA; 2) 0 AF, 0.5% CA; 3) 2 mg/kg AF, 0 CA; 4) 2 mg/kg AF, 0.25% CA; 5) 2 mg/kg AF, 0.50% CA; 6) 3 mg/kg AF, 0 CA; 7) 3 mg/kg AF, 0.25% CA; and 8) 3 mg/kg AF, 0.50% CA. The addition of CA to chick diets at a level of 0.50% did not negatively affect (P > 0.05) chick performance or relative liver weight or cause any liver lesions. Compared with controls, feed intake (FI) and body weight gain (BWG) were depressed (P < 0.05) in chicks fed AF, with greater reductions in FI and BWG observed in birds fed 3 mg/kg AF compared with those fed 2 mg/kg AF. The addition of 0.25% or 0.50% CA to the AF-contaminated diets significantly (P < 0.05) improved FI and BWG. Compared with controls, relative liver weights were higher in chicks fed AF (P < 0.05), and the addition of CA (0.25% or 0.5%) to the AF diet containing 2 mg/kg AF reduced (P < 0.05) the increase in liver weight. Compared to controls, with a lesion score of 1 (no lesions), liver lesion scores in birds fed AF averaged 2.69 (moderate aflatoxicosis). The addition of 0.25 or 0.50% CA to the 2 mg/kg AF diet reduced the lesion scores to 2.25 and 1.63, respectively. Results indicate that Calibrin-A at 0.50% of the diet did not negatively affect chick performance, relative liver weight, or cause any liver lesions indicating that this level of CA did not negatively affect nutrient content of the diet. Calibrin-A at 0.25 or 0.5% of the diet significantly ameliorated the toxic effects of 2 and 3 mg/kg AF in young growing chicks.

Key Words: aflatoxin, adsorbent, broiler chick, Calibrin A


Water is the most important nutrient o poultry birds. The requirement for water far exceeds that for protein and energy. Decrease in water intake directly leads to decrease in feed intake and feed conversion. However, it is very important that the water supply is clean and does not contain harmful microorganisms and minerals. The drinking water plays an important role in the transmission of many pathogenic agents among poultry. This work was done to investigate the occurrence and quantity of bacterial and fungal contaminants in poultry drinking water and to high light the consequent risk of infection to poultry birds. Water samples were collected from the drinking water source of ten poultry farms. Characterization and identification via staining, sugar hydrolysis, catalase, oxidase and motility tests as well as colony counting were done. Coliforms were found in two of the water samples E and F at 1.20 x 10^3 cfu/ml and 2.0 x 10^3 cfu/ml respectively. The water samples from all ten farms had high bacterial counts ranging between 1.04 x 10^4 cfu/ml and 2.43 x 10^5 cfu/ml. The samples from three farms B,F and I contained fungi/yeasts in the following concentrations: 10 x 10^3 cfu/ml, 1 x 10^3 cfu/ml, and 1.2 x 10^3 cfu/ml. The number of microorganisms in the drinking water of birds should not exceed 100 cfu/ml for total bacteria and 50 cfu/ml for coliforms [Cater and Sneed,1996; Reddy et al 1995]. The results of the total bacteria counts and coliforms in the water sample from each of the visited farms are far in excess of these values. Disease outbreaks on poultry farms require closer investigation of the environment and management for disease-associated risk factors and consequent removal of the same instead of only drug administration. The cause and epizootiology of the disease should be considered in order to prevent disease recurrence and drug-resistance which could develop after a period of time. Microbial contamination of poultry drinking water is a potential public health risk and has immense economic implications.

Key Words: poultry, water, contaminants, bacteria, fungi

T96 A novel chlorination technique to improve the safety, efficacy, and handling of chlorine in watering systems. D. A. Anderson1,2, and D. Pennock1, 1Prairie Poultry Services, Loveland, CO, 2Penturk, LLC, Berthoud, CO.

Water sanitation efforts in the poultry industry are often granted less attention and importance than it should receive. To resolve a waterborne bordetellosis problem, a uniquely engineered ORP system was developed to deliver effective levels of active chlorine throughout the water delivery system. It proved to be successful, but had the drawback of excessive storage quantities of liquid chemicals that could present a hazardous situation. To circumvent this problem a novel combination of dry chemicals were tested in the current system and assessed for efficacy, safety, and improved ease of handling. The novel chlorination system proved to be equally efficacious, safe, and was a vast improvement over the handling and cost of the liquid chemicals.

Key Words: chlorine, water, ORP, sanitation, chlorination
ABSTRACTS OF PAPERS

T97  Effect of broiler rearing environment on the transmissibility of F Strain Mycoplasma gallisepticum. S. L. Branton*, J. L. Purswell1, I. D. Evans1, S. A. Leigh1, S. D. Collier1, H. A. Olanrewaju1, W. B. Roush1, and G. T. Pharr2, USDA-ARS Poultry Research Unit, Mississippi State, MS, Mississippi State University, Department of Poultry Science, College Station.

Four layer chickens were eyedrop inoculated with F Strain Mycoplasma gallisepticum (FMG) vaccine and placed in a pen together with 16 broiler chickens at one week of age (Pen A). Twenty broilers were housed in each of five additional pens (Pens B-F) which were situated relative to Pen A so as to be 1) across and adjacent and separated by a short, solid partition (Pen B), 2) upstream (toward the air inlet) and separated by a pen width (Pen C), 3) downstream (toward the exhaust) and separated by a pen width (Pen D), 4) downstream and separated from Pen A by four pen widths (Pen E), and 5) downstream and separated from Pen A by eight pen widths (Pen F). Temperature and ventilation were maintained for broiler growth through the 9 week study. At the termination of the study, 12 of the 16 broilers and all four layers housed in the same pen demonstrated MG seroconversion via SPA test. Culture results yielded MG from 10 broilers and each of the four layers housed in Pen A. No other broilers in the study either seroconverted or yielded MG subsequent to culture of either the trachea or choanal cleft.

T98  The effect of a soil fumigant on reducing bacterial numbers in broiler litter. K. S. Macklin* and J. T. Krehling, Auburn University, Auburn, AL.

Most litter treatments used on commercial broiler farms rely on a reducing litter pH to either kill or inhibit bacterial growth. C. perfringens is the primary causative agent for two important poultry diseases. Hence a reduction of its levels in the litter plays an important role in bird health. Since C. perfringens is a spore former it often times is unaffected by a reduction in litter pH. Finding a suitable antimicrobial to control this important pathogen in the litter is important. Herein is tested the soil fumigant metam-sodium, at the application rate of 6 gal/ton to determine its ability in reducing C. perfringens, total aerobic and total anaerobic bacteria counts in built up litter. The experiment was performed by placing approximately 11 kg of used litter into eight 0.6x0.4x0.4 m plastic containers, then following one of four possible treatments. The four treatments consisted of adding 1x10¹⁰ C. perfringens (CP) to the litter, adding 1x10¹⁰ C. perfringens and metam-sodium (CPM), adding metam-sodium only (M) or nothing (CON). After the addition of the treatments, lids were affixed to the containers. Samples were collected 5 days post experiment initiation and bacterial counts were determined. Bacterial counts (cfu/g) were transformed using log10 transformation then analyzed using GLM with P<0.05 and significant means were separated using Tukey’s HSD. Results indicated that metam-sodium reduces total aerobic bacterial counts 2-3 logs and total anaerobic bacterial counts 1-2 log for all metam-sodium treated treatments, compared to CON and CP. In this study C. perfringens numbers were unaffected by the addition of metam-sodium.

Key Words: metam-sodium, litter, bacteria

T99  High energy electron-beam irradiation to inactivate Salmonella for the production of immuno-modulators in poultry. J. L. McReynolds*, P. R. Jesudhasan2, H. He1, K. J. Genovese1, J. A. Byrd1, S. E. Duke1, M. A. Davidson1, M. A. Cepada1, D. J. Nisbet1, and S. D. Pillai1, USDA-ARS-SPARC-FFSRU, College Station, TX, Texas A&M University, Department of Poultry Science, College Station.

Our laboratories are investigating the use of High Energy (10 MeV) Electron-Beam (E-beam) Irradiation for is potential use in vaccine development. It is well known that ionizing radiation damages the nucleic acids by “direct and/or indirect” effects thereby inactivating the organism. Though the cells are inactivated, our studies suggest that the surface antigenic properties of Salmonella Typhimurium (ST) are unaltered. The present investigations (3 replicates) were performed to evaluate the efficacy of the vaccine on heterophil function and ST colonization in broilers. Broiler embryos on day 18e were equally divided into 5 trt. groups: pos/neg controls, E-beam ST, CPG-ODN dideoxynucleotide (CPG), E-beam ST/CPG, and injected with 100ul of saline, 100ul of 1X10⁸ E-beam ST, 25ug of CPG, or 100ul of 1X10⁸ E-beam ST/25ug of CPG respectively. Blood was collected from each trt. group on d 4 and functional assays were performed. On d 21 the chicks were challenged orally with 1 X 10⁶ ST, 4d post challenge the experiment was terminated to determine ST colonization. Heterophil function was measured using several in vitro assays. To evaluate the oxidative burst of heterophils, phorbol 12-myristate acetate was used to stimulate collected cells from each trt. group. The E-beam ST/CPG oxidative response was increased (P<0.05) when compared to all other trt. groups. During the degranulation assay heterophils were stimulated with opsonized ST for one hour. Results showed E-beam ST/CPG oxidative response was increased (P<0.05) when compared to all other trt. groups. ST colonization of the ceca was also reduced (P<0.05) in the E-beam ST, E-beam ST/CPG groups. The results show that the immunological effects of these intact ST immuno-modulators in broilers do stimulate the immune system and provide protection against ST colonization.

Key Words: chicken, electron beam, Salmonella, vaccination

T100  Persistence of Campylobacter in broiler litter. Z. Williams and Y. Vizzier-Thaxton*, Mississippi State University, Mississippi State.

The source of Campylobacter contamination of broilers has been investigated by numerous researchers. Litter has often been associated with this work. However, most projects involved litter that had broiler on it at the time of sampling or immediately after their removal. Preliminary work in our lab indicated that there a factor or combination of factors such as litter type, litter moisture or presence or absence of birds. In this study, the persistence of Campylobacter in artificially inoculated broiler litter was tested over 5 day periods. The first 2 experiments utilized different types of litter, sand, pine shavings and rice hulls. In both experiments the litter was inoculated with Campylobacter to obtain a concentration of at least 10⁵ cfu/g of litter and 1 g samples were taken at the initial inoculation and every 24 hours sampling and beyond. The third and fourth experiments used pine shavings litter in varying conditions: aerobic atmosphere versus microaerophilic atmosphere and moisture content. In this study Campylobacter was recovered in all treatments at the initial sampling. By the 12 hours sampling time only the added moisture and microaerophilic atmosphere yielded recoverable Campylobacter. After 24 hours, there was no recoverable Campylobacter in any treatment.

Key Words: Campylobacter, litter, broilers
T101  Effect of pure protease enzyme and dietary protein/amino acids levels on broiler performance.  A. P. Rosa1, A. Sche1, C. Stefanello1, E. Diaz1, V. Duarte1, N. Oichenz1, and J. O. B. Sorbara2, 1Laboratório de Avicultura (LAVIC) - Universidade Federal de Santa Maria, Santa Maria, RS, Brazil, 2DSM Nutritional Products, São Paulo, SP, Brazil.

Extensive research has demonstrated the importance of enzymes in poultry nutrition. However, there is limited information about the efficacy of a pure protease enzyme on broiler performance. This study was conducted to evaluate the addition of a pure protease enzyme (RONOZYME® ProAct, activity 75000 PROT/g) to broiler diets with different levels of crude protein/amino acids. A total of 600 Cobb male broilers chicks acquired at day-old, housed Petersime brooding units were distributed in 60 cages. A 3×2 factorial design was used, with three crude protein and amino acid (CP/AA) levels (21.50, 20.85 and 20.21 % CP; and 1.15, 1.115, and 1.08% Dig Lys and 0.82, 0.795, 0.77% Dig TSAA respectively) with and without RONOZYME® ProAct (200 ppm). There were 10 replicates of 10 birds each. Diets were formulated to current industry standards for starter phase (1-21 days) based on corn, soybean meal and meat bone meal. Diets with 20.85% and 20.21% CP levels were respectively three and six percent lower in CP and AA than the control (21.50% CP). Addition of protease increased (P<0.05) body weight, weight gain, and feed intake. CP and AA reduction of 6% significantly (P<0.05) reduced the performance of broilers, but at 3% CP and AA reduction had no effect. Birds fed diets with 6% CP and AA reduction supplemented with 200 ppm of the enzyme had similar body weight, weight gain and feed consumption as birds fed with full CP level (21.50%) in the diet. This study indicates that the protease had a positive effect on protein utilization in broilers fed protein deficient diets.

Key Words: enzyme, protease, crude protein, amino acid, performance

T102  Broiler chicken performance and ileal digestibility is improved by a protease used in corn/soybean meal/meat bone meal diet.  A. Maiorka1, A. Favero1, R. F. P. Meurer1, M. T. T. Moraes1, and J. O. B. Sorbara2, 1Universidade Federal do Paraná, Curitiba, PR, Brazil, 2DSM Nutritional Products, São Paulo, SP, Brazil.

The effect of a protease (RONOZYME® ProAct/activity 75000 PROT/g) on the performance, digestible energy (DE) and the ileal digestibility of crude protein (CP), fat, gross energy and amino acid (AA) was investigated in broiler chicks fed diets with (200 ppm: 15000 PROT/kg feed) or without supplementation (control diet). The diets were formulated with corn, soybean meal and meat-bone-meal. The study was a complete randomized design and treatments were replicated by eight groups of 22 birds each raised floor pens. Body weight (BW), feed intake and feed conversion ratio (FCR) were determined at 7, 21, 35 and 42 days. Insoluble ash (Celite™) at 1.0% was included as an indigestible marker, and at 42 days the birds were sacrificed to collect the ileal contents to determine digestible energy and nutrient digestibility. There was no significant difference (P>0.05) in body weight gain between broilers from control diet and those fed the enzyme-supplemented diet. Differences in daily feed intake were observed during the grower period (21 to 42 d of age) and the FCR was significantly (P<0.05) improved for the enzyme-supplemented diet (1.821 kg/kg) compared with control diet (1.862 kg/kg). For the total production period (1 to 42d) the enzyme-supplemented diet improved (P<0.05) FCR (1.644 vs 1.868). Enzyme supplementation improved (P<0.05) ileal fat and energy digestibility by 4.5% and 5.8%, respectively. DE was 3.9% higher in enzyme supplemented diet than the control. Enzyme treatment improved crude protein (CP) digestibility by 7.3%. The protease increased (P<0.05) ileal AA digestibility for Met, Cys, Val and Ala by 8% or more, and for all other AA analyzed the increases in digestibility were not significant (P>0.05). In this floor pen trial protease supplementation improved BW and FCR by 1.9 and 2.2%, respectively. Consequently, enzyme supplementation should allow a cost saving through a reduction in CP and AA in feed formulation.

Key Words: enzyme, protease, amino acid, digestibility, performance

T103  Effect of processing temperature, nutrient provision and enzyme supplementation (Avizyme 1500) on performance and digestibility of broiler chickens fed corn/soy-based diets.  A. Péron3, A. J. Cowieson1, C. E. Gilbert*,1, and V. Ravindran2, 1Danisco Animal Nutrition, Marlborough, United Kingdom, 2Massey University, Palmerston North, New Zealand.

An experiment was performed to determine the effects of Avizyme 1500 (XAP), a combination of amylase, protease and xylanase, on broiler performance and digestibility coefficients. The study followed a 2x2x3 factorial design, using two control corn/soy diets (Positive Control PC and Negative Control NC), three processing conditions (mash, pellet 80°C and pellet 90°C) and two supplementation programs (no additive or XAP). 480 day-old male Ross 308 chicks were randomly allocated to 60 cages, giving 5 replicates per treatment. The PC contained 3000 kcal ME/kg. The NC diets contained 100 kcal ME/kg less ME with similar levels of other nutrients. The XAP enzyme combination was added at 0.05% in the feed, using a liquid application system. The additive supplied a guaranteed minimum of 300 U xylanase, 400 U amylase and 4000 U protease/kg diet. All diets were formulated using 0.3% titanium dioxide as an indigestible marker. Individual BW, feed consumption and FCR were determined between 0 and 21 d of age. At 21 days, birds were killed by intracardial injection of sodium pentobarbital. Contents of the distal ileum were collected, pooled per cage, and analyzed in order to determine ileal digestibility coefficients of dry matter (DM), nitrogen (N) and gross energy (GE), and to calculate ileal digestible energy (IDE). As compared with mash, pelleted feeds resulted in an average improvement (P<0.05) of 17.0% BW and 15.5% feed intake. However, pelleting was also associated with a 1.4% reduction for nitrogen digestibility coefficient. Chicks fed PC exhibited (P<0.05) lower feed intake (2.2%) and FCR (3.4%) values than those fed NC. Addition of XAP improved (P<0.05) performance and digestibility coefficients in PC and NC-fed birds by an average of 3.1% BW, 2.5% FCR, 1.2% N digestibility, 1.7% GE digestibility and 1.7% IDE (or +60 kcal/kg). The effect of XAP was greater in NC than in PC diets.

Key Words: enzymes, broilers, amylose, protease, xylanase
Key Words: breeder age, broiler feed, enzyme supplement, nutrient availability, carcass quality

T105 Evaluation of the effects of dietary enzymes on ileal amino acid digestibility in 18-day-old broilers during live coccidia oocyst vaccination. C. L. Walk,*1 C. Novak4, A. Cowieson2, J. Remus3, J. Escobar1, and A. P. McElroy1, 1Virginia Tech, Blacksburg, 2Danisco Animal Nutrition, Marlborough, Wiltshire, United Kingdom, 3Danisco Animal Nutrition, St. Louis, MO, 4Land O’Lakes, Inc., Kansas City, MO.

An experiment was conducted to evaluate the effects of various dietary enzymes on amino acid digestibility in broilers when using a live coccidia oocyst vaccine. One-day-old, Cobb 500 straight run broilers were obtained from a commercial hatchery and half were sprayed with a live coccidia oocyst vaccine. All chicks were weighed and placed in battery brooders according to eight dietary treatments (n = 108). Dietary treatments were positive control (PC; 0.90% Ca and 0.45% nPP), negative control (NC; 0.80% Ca and 0.35% nPP), NC + phytase (NC+P), NC + protease (NC+Pr), NC + xylanase (NC+X), NC+P+Pr, NC+P+X, and NC+P+Pr+X. Chicks were weighed and feed intake measured at days 7 and 18, and ileal amino acid digestibility was measured on days 7 and 18. As reported previously, enzyme supplementation did not significantly affect feed intake (FI) or body weight gain (BWG). Phytase supplementation improved (P < 0.05) feed conversion (FC) compared to protease supplementation at day 7. Phytase and xylanase supplementation improved FC compared to the NC and NC+Pr at day 18. Feed conversion was not different among any other dietary treatments. Coccidia vaccination reduced FI and BWG but did not affect FC. There were no diet by vaccine affects on FI, BWG, or FC. Ileal amino acid digestibility was not affected by diet or vaccination at day 7. Arginine, Glu, Pro, Tyr, Leu, and Phe ileal digestibility tended to improve in vaccinated broilers fed diets supplemented with phytase or xylanase and unvaccinated broilers fed NC+P+Pr. Ileal amino acid digestibility was affected by dietary treatments at day 18 for almost every amino acid analyzed, except Thr. Coccidia vaccination or diet and vaccine interactions did not affect ileal amino acid digestibility at day 18. These data suggest that selected dietary enzymes may improve broiler performance during live coccidia oocyst vaccination by improving nutrient utilization.

Key Words: phytase, protease, xylanase, broilers, coccidia

T106 Intermittent lighting affects efficacy of phytases differently. W. W. Saylor1, N. E. Ward2, and R. Angel*, 1University of Delaware, Newark, 2DSM Nutritional Products, Parsippany, NJ, 3University of Maryland, College Park.

The objective of this study was to determine if phytase efficacy could be improved by increasing crop residence time with an intermittent lighting program (LP). One-day-old straight-run Ross 708 broilers were fed a nutritionally-adequate diet and reared on a 23hr light:1hr dark photoperiod for 7d. On d7, 5 birds were assigned to each of 64 pens (n=320) in 4 brooder batteries. Each battery was housed in a separate environmentally-controlled room to which one of 2 LP was assigned: 1) 20:00hr light:0:00hr dark (CON) or 2) 2:30hr light:0:30hr dark (INT) throughout the 24-hr period (2 rooms per LP). Four pens of chicks per room were assigned to one of 4 diets (16 pens per diet) in a RCB design: 1) Positive Control (PC) formulated to meet or exceed NRC requirements for 0-3 wk broilers using Agristats, 2007 averages for Ca (0.95%), and non-phytate P (nP<0.45%); 2) Negative Control (NC), as PC except for Ca (0.85%) and nP (0.30%); 3) NC + Phytase A (PhA); and 4) NC + Phytase B (PhB). Phytase products were added to diets to replace 0.1% nPP per the manufacturer’s recommendation. At 20d, weight gain (WG), feed efficiency (F/G), and percent tibia ash (TA) were determined. LP had no effect on WG (mean = 558g), but CON chicks had poorer F/G and higher TA than INT chicks (1.51 vs 1.49, SEM=.01; 49.87% vs. 48.92%, SEM=.13; P<0.001). WG was higher (P<.001) for PC-fed chicks than NC-, PhA- or PhB-fed chicks (590, 530, 560, 554, respectively; SEM=9), but there was no difference (P>0.05) between Ph treatments. F/G was improved (P<.001) in PC-fed chicks compared to those fed all other diets (1.42 vs. 1.49, SEM=.02). Across both LP, NC+P+Pr had poorer F/G and higher TA than INT chicks (1.51 vs 1.44, SEM=.01; 49.87% vs. 48.92%, SEM=.13; P<0.001). WG was higher (P<.001) for PC-fed chicks than NC-, PhA- or PhB-fed chicks (590, 530, 560, 554, respectively; SEM=.9), but there was no difference (P>0.05) between Ph treatments. F/G was improved (P<.001) in PC-fed chicks compared to those fed all other diets (1.42 vs. 1.49, SEM=.02). Across both LP, TA was highest in PC-fed chicks compared to those fed NC, PhA or PhB diets (51.64%, 46.12%, 50.17%, 49.37%, respectively; SEM=.19) with PhA being higher (P<.001) than PhB. Although there was no LP X diet interaction (P>0.05), suggesting that LP did not improve phytase efficacy in 7- to 20d broilers, TA for PhA was higher (P<.001) than for PhB under the INT but not CON LP.

Key Words: phytase, intermittent lighting, broiler

The potential increased P replacement of the new RONOZYME® P phytase with the Coated Thermostable (CT) formulation was evaluated for broiler chicks with live performance, P and Ca retention and in tibia as the response variables. Four hundred Cobb x Cobb 500 broiler males were placed in 40 steel battery cages, 10 in each (0.80 x 0.90 m²). Corn-soybean meal diets were formulated using Brazilian standard levels of nutrients and energy. Experimental diets AvP levels were as follows: 0.37; 0.32; 0.27; 0.22% w/o phytase, or 0.22% supplemented with 100, 200, 300 or 400 g phytase/MT feed. Each of the eight treatments had 5 replicates. Performance was evaluated weekly to 24 d. On day 25, tibia was taken from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance, and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05). Quadratic adjustments were obtained in all performance parameters in response to phytase supplementation. The derivation of response curves allowed estimations of phytase levels or 400 g phytase/MT feed. Each of the five treatments had five replicates. Performance was evaluated weekly to 25 d. On day 25, tibia was collected from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance, and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05). Quadratic adjustments were obtained in all performance parameters in response to phytase supplementation. The derivation of response curves allowed estimations of phytase levels or 400 g phytase/MT feed. Each of the five treatments had five replicates. Performance was evaluated weekly to 25 d. On day 25, tibia was collected from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance, and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05).

Key Words: enzyme, phytase, digestibility, performance


Sources of phosphorus has been scarce and the potential increased P replacement of the new Ronozyme P phytase developed for mash feed was evaluated for broiler chicks with live performance, P and Ca retention and in tibia as the response parameters. Two hundred and twenty five Cobb x Cobb 500 broiler males were placed in 25 steel battery cages, nine in each (0.80 x 0.90m²). Corn-soybean meal diets were formulated using Brazilian standard levels of nutrient and energy. Experimental diets AvP levels were as follows: 0.37 and 0.23% w/o phytase, or 0.23% supplemented with 37, 74, 111 g phytase/MT feed. Each of the five treatments had five replicates. Performance was evaluated weekly to 25 d. On day 25, tibia was collected from 3 birds/cage for Ca and P determination. Total excreta collection was performed from 26 to 28 d in order to evaluate Ca and P retention. A gradual decline in performance and reduction in tibia Ash, Ca and P, as well as Ca and P retention were observed as AvP was reduced in the diets (P≤0.05).

Key Words: poultry, phytase, net energy

T109  The effect of exogenous phytase on dietary net energy for chickens.  V. Pirgolziev*, T. Acamovic1, and M. R. Bedford2, 1SAC, Ayr, Scotland, United Kingdom, 2AB Vista, Marlborough, England, United Kingdom.

Poultry diets are routinely supplemented with phytase to increase both mineral availability and growth of the birds and to reduce environmental pollution. Although it has been hypothesised that exogenous phytase may also increase dietary net energy, data supporting this hypothesis is limited. The aim of this experiment was to determine the effect of dietary phytase on performance, dietary apparent metabolisable energy (AME) and dietary net energy retained in the carcass (NEc; MJ/kg diet DM). Forty-eight male Ross 308 broilers (from 7 to 17d age) were used and four soya-maize based diets (positive control (PC), negative control (NC), NC + 500, + 12500 FTU (phytase units/kg feed)). All diets were formulated to be adequate in protein and energy however the NC was lower in available P compared to the PC, i.e. 2.5 vs 4.7 g/kg diet. The enzyme used was derived from an evolved E. coli phytase (Quantum®). There were six replicates of each diet in a randomised block design. Feed intake, weight gain and feed conversion efficiency increased (P<0.05) in a dose dependent manner in response to dietary phytase activity, with an average response of approximately 17, 27 and 7.6%, respectively, compared to birds fed the negative control diet. Overall, the NEc of the phytase supplemented diets improved (P<0.001) by approximately 15.6% compared to the negative control, i.e. 6.15 vs 5.32 MJ/kg DM, while dietary AME was not affected. The NEc of the 12500 FTU diet was 7.8% higher than that of the 500 FTU diet (6.38 vs 5.92 MJ/kg DM). The data presented supports the view that phytase may not influence AME so much as dietary NEc. Use of AME techniques to evaluate the energy sparing effect of the use of a phytase would thus appear to be inappropriate.

Key Words: enzyme, phytase, net energy

T110  An investigation of phytic acid and its various degradation products prepared by phytases for the inhibitions of pepsin-catalyzed protein hydrolysis.  S. Yu* and S. Dalsgaard, Genencor Enzyme R&D, Aarhus, Denmark.

The purposes of the experiments are: 1) to establish simpler and more sensitive methods for the monitoring of phytate inhibition on pepsin-
catalyzed protein hydrolysis; 2) to understand the inhibition extent in relation to the phosphorus esterification degree of myo-inositol; 3) to examine if phytate that inhibits protein hydrolysis by pepsin at acidic pH also inhibits the hydrolysis of peptides under such conditions; and 4) to develop a HPIC method for quantifying phytate degradation products by phytases.

Results: In this study simpler and more sensitive methods were employed to monitor the inhibition of phytate and its enzymatic degradation products by using caseins labeled either with chromophores or fluorophores, and by using peptides as the substrates for pepsin. The results showed that the reaction volume can be reduced to 0.05 ml and the assay can be done in one single step by using one reagent. Kinetic assay, which was impossible before, was possible using these methods in stead of endpoint method. The results further showed that phytate inhibited not only pepsin-catalyzed protein hydrolysis as reported before using these methods but furthermore it showed the hydrolysis of peptides was also inhibited. The inhibition extents of various degradation products of phytate (i.e., IP2-IP5), generated by bacterial and fungal phytases, respectively, were found decreased with the decreased phosphorylation of phytate (i.e., IP2-IP5), generated by bacterial and fungal phytases, also inhibited. The inhibition extents of various degradation products of phytate (i.e., IP2-IP5), generated by bacterial and fungal phytases, respectively, were found decreased with the decreased phosphorylation degree of myo-inositol. For the quantification of phytase degradation products of phytate, which was needed in these experiments, it was found that it was essential that the samples of IP1-IP6 be prepared in the solvent that has a HCl molar concentration the same as where it was eluted in the chromatogram.

Key Words: phytase, phytate, pepsin, protein hydrolysis, antinutritional factor

T111 Phytase and cocktail of carbohydrases and protease selectively improved nutrient utilization in corn-soybean meal broiler diets containing DDGS. O. A. Olukosi*1, A. J. Cowieson2, and O. Adeola1, 1Purdue University, West Lafayette, IN, 2Danisco Animal Nutrition, Marlborough, Wilshire, United Kingdom.

Two hundred eighty-eight 1-d old broilers were used in a 21-d trial to study effect of supplementation of phytase or cocktail of carbohydrases and protease (XAP) in a corn-based diets or diets in which DDGS replaced part of corn and soybean meal. The basal corn-soybean meal diets were supplemented with 0 or 100 g/kg DDGS and within each level of DDGS, phytase or XAP individually or in combination were added to provide per kg diet 1,000, 650, 1,650, and 4,000 units of phytase, xylanase, amylase, and protease, respectively. The experiment was a randomized complete block design with a 2×2×2 factorial arrangement. Each treatment had six replicate cages with six birds per replicate cage. Ileal digesta was collected on d 21 and excreta were collected on the last 3 d of the study. Ileal N digestibility was greater (P < 0.01) in diets without DDGS compared to diets that contained DDGS. Also ME was greater (P < 0.05) in the diets containing DDGS than in the diets without DDGS. There were no phytase × DDGS, XAP × DDGS nor a 3-way interaction. At both ileal and total tract levels, phytase improved (P < 0.05) DM, N, P, Ca and energy utilization whereas XAP showed no effect. Total tract DM retention was improved (P < 0.05) by phytase supplementation whether the diets containing 0 or 100 g/kg DDGS. Nitrogen, P and Ca retention, and ME were improved (P < 0.05) by phytase supplementation in diets without DDGS whereas phytase only showed a trend (P < 0.10) toward improving ME in diets with DDGS. In addition, XAP alone or combined with phytase improved Ca retention in diet without DDGS but had no effect in diet with DDGS. In conclusion, the absence of enzyme by DDGS interaction suggests that the influence of specific enzymes used did not depend on whether DDGS was in the diet or not and also that only phytase appeared to have a more consistent effect on nutrient utilization at both the ileal and total tract levels.

Key Words: broiler, nutrient utilization, phytase, carbohydrases, DDGS

T112 Effects of Avizyme 1500, Phyzyme XP and distillers dried grains with solubles (DDGS) on nutrient digestibility by broilers. D. R. Ledoux*1, R. E. Kutz1, R. Murraroli1, and P. Plumstead2, 1University of Missouri, Columbia, 2Danisco Animal Nutrition, Marlborough, United Kingdom.

An experiment evaluated the effects of Avizyme 1500 and Phyzyme XP on nutrient utilization by broilers fed diets containing graded levels of distillers dried grains with solubles (DDGS). The 12 dietary treatments fed from day 8 to 21 included a 4 × 3 factorial arrangement of 4 levels of DDGS (0, 6, 12 and 18%) and 3 enzyme treatments (No enzymes, Phyzyme XP, Phyzyme XP plus Avizyme 1500). Phyzyme XP phytase was added at 500 FTU/kg diet and replaced 0.12% Available P and 0.1% Ca from dicalcium phosphate. Avizyme 1500 was added at 0.1% and supplied 300 U xylanase, 400 U amylase and 4000 U protease/kg diet. Six pen replicates of five Cobb 500 broiler chicks were assigned to each dietary treatment. Compared with controls, ileal Ca digestibility, Ca and P retention were higher (P < 0.05) in chicks fed enzymes and were not affected (P > 0.05) by DDGS. Compared with controls, ileal P digestibility was higher (P < 0.05) in chicks fed Phyzyme and was even higher (P < 0.05) in chicks fed both Phyzyme and Avizyme. Ileal P digestibility was also higher (P < 0.05) when chicks were fed diets with 18% DDGS versus 0 or 6% DDGS. Ileal digestibility of all amino acids (AA) (including tryptophan) were lower (P < 0.05) in chicks fed DDGS compared with those not fed DDGS. In contrast, ileal digestibility of lysine, methionine, cysteine, threonine, arginine, glycine, histidine, isoleucine, leucine, phenylalanine, valine, alanine, tyrosine, aspartate, serine, glutamine and proline were higher (P < 0.05) in chicks fed enzymes compared with those fed no enzymes. Combining Phyzyme and Avizyme also consistently resulted in a higher AA digestibility versus Phyzyme added on its own. Significant enzyme by DDGS interactions (P < 0.05) were only observed for arginine and tryptophan. The data indicate that a combination of Phyzyme and Avizyme was most effective in improving nutrient utilization in chicks fed diets containing variable concentrations of DDGS.

Key Words: enzymes, phytase, broilers, amino acid digestibility

T113 Water-extractable (WE-AX) and water-unextractable arabinoxylans (WU-AX) as a prediction tool for AME-upgrading of raw materials with a bacterial endo-xylanase. R. Mombaerts and K. Van de Mierop*1, Nutrex nv, Lille, Belgium.

The level and characteristics of NSP in feed determine the antinutritional effect of a broiler diet, making these parameters crucial to estimate the energy value of NSP-enzymes.

AX, the most important NSP structure (w/w), are abundantly present in feed raw materials and can be split into WE-AX and WU-AX fractions, each contributing to the overall anti-nutritional effect in a different way. Nutrase Xyla proved to be effective in hydrolysing both types.
Broiler trials, using feeds with varying WE-AX and WU-AX levels (wheat and/or corn based) showed that the AME-uplift obtained by Nutrase Xyla is correlated with the level and type of AX. AX-dependant enzyme energy factors were calculated and put in the prediction model: \[ \text{AME}_{\text{EX}} = \text{AME} + 100\times\text{WE-AX} + 25\times\text{WU-AX} \]
To validate the model, diets with very low and high AX levels were made, using respectively sorghum or rye as main cereal sources. Four treatments were tested: sorghum control, sorghum +Nutrase Xyla, rye control and rye +Nutrase Xyla. Each treatment had 12 floor pens of 15 Ross 308 broilers (6 males and 6 females). Feed intake, body weight (BW) and mortality were measured at d42, weight adjusted feed conversion (WAFC) was calculated.

In the sorghum diet (0.1% WE-AX, 2.5% WU-AX) an enzyme effect on AME of 73 kcal/kg is predicted. Adding Nutrase Xyla improved BW gain by 6.7% and WAFC by 2.4% (P<0.05). This equals an energy liberation of 74 kcal/kg and confirms the estimation based on the prediction model.

In the rye diet (1.4% WE-AX, 3.2% WU-AX levels) an enzyme AME increase of 220 kcal/kg is expected. Zootecnical results improved by 19.6% for BW gain and by 9.7% for WAFC (P<0.05). Energy liberation corresponding to these zootecnical data is 301 kcal/kg. These results demonstrate that the energy uplift, calculated according to the prediction model, even underestimated the actual energy release by Nutrase Xyla. One may conclude that the model established from wheat and corn trials was also valid for estimating energy upgrading in diets with extreme AX levels.

**Key Words:** Nutrase Xyla, bacterial endoxylanase, arabinoxylan, AME-uplift model, broiler

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Back yard poultry production in México is a very important activity for low income producers in rural areas; poultry products are used as a source of animal protein, especially for children. However, broiler production is severely affected by gastro intestinal pathogens, among them is *Salmonella spp* that has a large negative effect on reproduction and production parameters. Antibiotics are not an option because of high cost, alternatives are under study to counteract this problem, medicinal plants could be an option for this kind of producers. A complete randomized experiment was performed to test the effect of the plant *Chrysactinia mexicana* extract. 50 day old Cobb chicks were assigned to following treatments: T1 control; T2 control with LPS challenge and no plant extract; T3 control with LPS challenge and plant extract and; T4 control no LPS challenge and plant extract. Plant extract was administered oral via 20 mg/ml during 14 days, on day 15 LPS thypimurium was injected intra abdominally, after five hours post injection blood samples were obtained by cardiac puncture and nitrate concentration and blood cell count was determined. There was a statistical difference (P<0.05) in nitrite concentration, with the highest level in T2 with 23.3 micromol than the one found for T3 with 9.8 micromol, T1 and T4 had lower levels as expected. There were statistical differences (P<0.05) in Erythrocyte count, T2 and T3 had the highest values versus T1 and T4, same occur in leukocyte count were T2 and T3 had the highest values. According with these results the use on the plant extract could be a toll for the backyard poultry producers by reducing the impact of bacteria in chick performance.

**Key Words:** chick, *Salmonella*, plant extract, nitric oxide, leukocyte

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**T116 Effects of fumonisins added to feed for broilers.** J. A. Fierro*, J. C. Medina1, R. Perez-Franco1, and E. Rodriguez2, 1NUTEK S.A. de C.V., Tehuacan, Puebla, Mexico, 2Investigacion Aplicada S.A. de C.V., Tehuacan, Puebla, Mexico.

Weight losses and liver lesions have been reported to occur in Brazil at levels under 50 ppm of FB1 on the diets of broilers. In order to verify the validity of this statement, an experiment was performed on broilers to demonstrate whether the concentration of 100 ppm of fumonisin B1 (FB1) produced any effects on weight gain and liver damage. 40 one day old Hubbard broilers were used, distributed into two groups of 4 birds, with 5 repetitions. The diets were identified as: Control Group (CG) and FB1 Group (FB1G). The fumonisins were collected from highly contaminated samples. The absence of other mycotoxins in the feeds was determined using analytical instruments: aflatoxins, zearalenone, T-2 toxin, ochratoxin A and deoxynivalenol. The concentration of FB1 in the contaminated feed was confirmed by HPLC.

The birds were weighed at day one of age and the individual weight was recorded on a weekly basis until the end of the experiment. The feed
intake was calculated weekly. At 21 days of age, 10 birds were bled and culled; the livers were removed and weighed individually. Samples were submitted to the laboratory for histopathology assays. The information generated was analyzed using SYSTAT, on Tukey test results. The significance value was based on a probability of 0.05.

No statistically significant differences were observed between both groups on weight gain ((CG: 782 ± 11.1 g a vs. FB1G: 797 ± 10.5 g a) and feed intake during the experimental period (CG: 1.36 ± 0.017 a vs. FB1G: 1.33 ± 0.018 a). No macroscopic lesions were observed on the group with Fumonins, and no effect on the histology was reported. There were no significant differences on the relative weight of the liver. The concentration of total proteins and gama-glutamil transferase was the same in both groups, except for the albumin (CG: 1.49 ± 0.024a vs. FB1G: 1.65 ± 0.051b).

It can be concluded that the FB1 at 100 ppm concentration has no toxic effect on the weight of the broilers. The concentration of other fumonins was not determined.

Key Words: fumonisins, fumonisin B1, mycotoxins, liver, broiler

T117  The effects of 1.5 ppm T-2 toxin on performance, lesions and general health of male broiler and the efficiency of a mycotoxin deactivator to counteract. V. H. Stark*1 and M. Forat2, Biomin GmbH, Herzogenburg, Austria, Instituto Internacional de Investigación Animal, Querétaro, Mexico.

T-2 toxin is a mycotoxin affecting broilers health and performance. Due to its chemical structure T-2 toxin cannot be adsorbed by mycotoxin binders. A trial was performed to evaluate the toxic effects of a low contamination of T-2 toxin and the efficacy of a mycotoxin deactivator based on biotransformation to destroy T-2 toxin during digestion. 90 Ross 308 male broiler were randomly allocated into 5 groups: group 1 - negative control, group 2 - 1.5ppm T-2 toxin, group 3 - 1.5 ppm T-2 toxin + mycotoxin deactivator 1, group 4 - 1.5 ppm + mycotoxin deactivator 2, group 5 - mycotoxin deactivator 2. Birds were fed respective diets from day 10 of life until day 39. Body weight was evaluated at the beginning (day 10) and at the end of the experiment. At day 39 consumption and weight gain, feed conversion and mortality were calculated. Lesions of the bucal cavity, feces and feathers were scored; general behavior was reported. Results showed that 1.5 ppm of T-2 toxin had a significant impact on overall feed consumption, weight gain, feed conversion and mortality. Contamination with T-2 toxin furthermore led to an increased number of birds with bucal lesions. All negative effects were completely overcome by the inclusion of mycotoxin deactivator containing a T-2 toxin degrading microorganism. None of the birds showed abnormalities in behavior or appearance. In conclusion it can be stated that T-2 toxin at low concentrations showed detrimental effects on broilers health and performance, and that the mycotoxin deactivator during digestion can be considered as an adequate approach to counteract the negative effect. The fact that lesions were reduced to a great extent in the treated groups confirms that lesions are not only caused by the skin-irritating effect of T-2 toxin but also by its systemic impact.

Key Words: T-2 toxin, broiler, biotransformation

T118 Bacillus licheniformis (GalliPro Tect) prevents necrotic enteritis and improves performance in broiler chickens. I. Knap* and B. Lund, Chr. Hansen, Hoersholm, Denmark.

Bacillus licheniformis can prevent necrotic enteritis in C. perfringens challenge studies. To understand both the mode of action of the NE preventing effect of Bacillus licheniformis and the performance under non-challenge condition, new studies were performed. Three C. perfringens challenge studies were carried out at Southern Poultry Research, Inc.; two cage studies and one floor pen study. In the studies different doses of Bacillus spores were tested from 8E+5 CFU/G to 8E+7 CFU/G. All challenge studies included a non challenged control group, challenged group without additive and a positive control with Virginamycin 15 g/t. Unmedicated commercial chicken feeds commonly used in the United States were used in all studies. Feed and water were available ad libitum throughout all trials. The Clostridia challenge was made using fresh C. perfringens broth culture given to the birds in 2 or 3 days. Weight gain, feed consumption, feed conversion, lesion scores, intestinal Clostridia counts and mortality were reported. In the non challenged study weight gain and FCR were measured. In all challenged trials a significant effect was seen of using B. licheniformis with regards to lesion score, mortality, weight gain and FCR. There was no significant difference between the B. licheniformis treatments and the Virginamycin treatment with regards to mortality and lesion score. A dose of 1.6E+6 CFU/G feed seems to be optimal to prevent necrotic enteritis. In the non challenged trial a significant effect on feed conversion was seen. Bacillus licheniformis used as a DFM improves production performance and can prevent necrotic enteritis in challenged broiler chickens.

Key Words: B. licheniformis, necrotic enteritis, C. perfringens, DFM

T119 Bone biomechanical properties in four strains of turkeys. E. O. Oviedo-Rondon*1, P. E. Eusebio-Balcázar1, P. L. Mente2, B. D. X. Lascelles1, J. Grimes1, and A. Mitchell4, 1Poultry Science Department, North Carolina State University, Raleigh, 2Department of Biomedical Engineering, COE, North Carolina State University, Raleigh, 3Department of Clinical Sciences, CVM, North Carolina State University, Raleigh, 4USDA-ARS, BARC, Beltsville, MD.

Genetic selection can be used to reduce incidence of leg problems in poultry. However, it is important to identify the appropriate bone architecture and biomechanical parameters that correlate with less leg problems and stronger bones. The objective of this experiment was to establish differences on bone biomechanical properties among four strains of turkeys at 20 wks of age. These strains were identified as A, B, C and D. Strain D had significantly less leg problems than the other strains and higher bone mineral density (BMD) at 20 wks. Ten healthy tom turkeys of each strain were selected from flocks that were incubated, fed, and raised under the same conditions in floor pens in an experimental house. All turkeys were sacrificed, legs collected and frozen for analyses. Weights and morphologic measurements of femur, tibia and shanks were recorded. Tibia strength was evaluated by four point bending test and femur strength was evaluated in torsion test. The strain C had shorter (P<0.05) femurs than A, but the femur length of these two strains were not different from those of the other two strains. Strain D had the smallest diaphysal angle (P<0.05), indicating more...
curvature in their femurs. Turkeys of strain D had also the smallest (P<0.05) tibia perimeters of all four strains, but the thickest cortical thickness (P<0.05). This strain had the highest (P<0.05) applied bending moment and maximum bending stress values, indicative of stronger bone material. The lowest value (P<0.05) of applied moment in four point bending test for tibias, and the lowest maximum shear stress at failure in torsion test for femurs were observed in tons of the C strain. Differences in the parameters of right and left leg bones from the same tons were observed. Genetic differences on bone biomechanical properties were corroborated and these correlate with the incidence of leg problems in each strain. Higher BMD, tibial cortical thickness, and smaller femur diaphyseal angle are correlated with stronger bones.

**Key Words:** turkeys, bone biomechanics, bone strength, genetics, leg problems

**T120** *Bacillus subtilis* (GalliPro) reduces the level of campylobacter in broiler chickens. M. Raun, M. Bennedsen, N. Milora, and I. Knap*, Chr. Hansen, Hoersholm, Denmark.

To evaluate if *B. subtilis* can improve the food safety of broiler chickens by reducing the level of Campylobacter in the GI track, a study was carried out at Southern Poultry Research, Inc on male broiler chickens (Cobb X Cobb) in a battery trial. There were two groups, one control group fed with standard, non medicated commercial broiler feed and one group fed the same feed with the addition of *B. subtilis* at 08E+5 CFU/g feed. At day 22 the ileum and caecal sacs were removed. DNA was extracted from the samples with QIAmp DNA Stool Mini Kit (Qiagen). A standard curve was prepared by spiking ileum samples with a serial dilution containing a known concentration of *Campylobacter jejuni*, followed by DNA-extraction. Real-Time PCR on the samples was run using Taqman C. jejuni Detection Kit. With this kit a simple, reliable and rapid procedure for detecting the presence of a specific bacterial pathogen was provided. The assay utilizes the PCR to amplify a target unique to the microorganism. A TaqMan probes containing FAM dye signal for the target DNA and VIC dye signal for the internal positive control were used to detect the presence of the C. jejuni in the samples. The results on caecum samples showed a significant reduction of 52% in Campylobacter in the *B. subtilis* treated group (CFU/g 2.13E+07) compared to the control group (CFU/g 4.08E+07) In the ileum samples there was a 40% reduction. The number of Campylobacter in the *B. subtilis* treated group was 5.64E+03 and 9.25E+03 in the control group. Use of probiotic *B. subtilis* can reduce the level of Campylobacter in broiler chickens and improve food safety.

**Key Words:** campylobacter, probiotic, food safety, chicken

**T121** Comparative efficacy of citrex liquid (drinking water acidifier) or citrexPowder (feed acidifier) for the control of necrotic enteritis caused by clostridium perfringens in broiler chickens. G. F. Mathis*1, C. Hofacre2, and M. Contreras1, 1Southern Poultry Research, Inc., Athens, GA, 2University of Georgia, Athens, 3Citrex, Inc., Miami, FL.

The objective of the study was to evaluate the anticostralidial efficacy of acidifiers administered in the drinking water or feed or Virginiamycin. A randomized block design with 7 replications of 8 birds per cage was used. The treatments were nonmedicated, non-challenged (NMNC), nonmedicated, challenged (NMC), Citrex Liquid 200 ppm or 300 ppm, Citrex Powder 400 ppm or 600 ppm, and Virginiamycin (VIR) 22 ppm. Birds (12 days of age) were placed into cages and issued treatment water or feed (DOT 0). Treatment water or feed was available ad libitum throughout the test period (DOT 0-16). On DOT 2, birds were challenged with E. maxima and on DOTs 7, 8, and 9 with Clostridium perfringens. On DOT 10, three birds per cage were NE lesion scored (scoring range 0-3). The parameters measured were feed conversion and weight gain (DOT 0 to 10 and DOT 0 to 16), Necrotic Enteritis (NE) mortality and NE lesion scores. Using tukey (HSD) comparison of means test, the results showed that there was a significant improvement in performance (feed conversion and weight gain) at both weigh periods for all treatments compared to the NMC treatment birds. The percent NE mortality for NMC was 12.5% was significantly higher than with all other treatments. The percent NE mortality for all treatments was not significantly different (range 0 to 3.6%). The average NE lesion score for NMC was significantly higher than observed with all other treatments. This study demonstrated the benefits using an acidifier either in the drinking water or feed of broiler chickens exposed to Clostridium perfringens.

**Key Words:** clostridium perfringens, citrex Liquid, citrex Powder, Virginiamycin, necrotic Enteritis

**T122** Feeding low crude protein levels and the effect on broiler breeder hatching egg fertility and hatchability. R. K. Bramwell*1, J. R. Moyle1, D. E. Yoho1, S. M. Whipple1, R. S. Harper1, C. N. Coon1, and K. J. Wilson1, 1University of Arkansas, Fayetteville, 2Georges, Inc., Springdale, AR.

Most feed management programs for Broiler Breeders are designed to maximize egg production more than targeting hatchability, with fertility typically associated with male conditioning and mating activity. In the past, crude protein levels in Broiler Breeder diets have been manipulated and decreased in an effort to improve egg production. In this study, varying crude protein levels were fed to both the hen and the rooster in the same manner the majority of the poultry industry utilizes. Therefore, the objective of this study was to feed a control diet (15.5% CP; T1) and two lower protein diets (14.5% and 13.5% CP; T2 and T3, respectively) at onset of egg production to both the males and females and measure fertility, hatchability, hatch of fertile and embryo mortality and sperm penetration values. 500 female and 100 male commercial strain broiler breeders were reared from eight weeks to 21 weeks of age on the same diet and were fed according to industry standards. At 21 weeks of age, all birds were randomly assigned to one of the three treatment groups with three males and 25 females randomly placed in pens with six replicate pens per group. Birds were fed an identical ration until egg production reached five percent for an entire treatment group, at which time the treatment group was placed on either a T1, T2, or T3 CP diet and fed daily allotments to meet industry recommendations. There was no significant difference in fertility at 35 weeks of age 96.26%, 96.16% and 96.69% respectively or hatchability 89.95%, 89.27, and 87.51 respectively. Through 60 weeks of age hatch of fertile remained insignificant at 86.03%, 86.65% and 86.24% respectively. In this study, results indicate that lowering dietary crude protein had little effect on fertility and hatchability while lowering overall feed costs.

**Key Words:** broiler breeder, crude protein, fertility, hatchability
T123 Comparative physiological capacity for fertility in broiler breeder hen lines with differing body weight characteristics. R. K. Bramwell, D. E. Yoho, J. R. Moyle, and S. M. Whipple, Department of Poultry Science, University of Arkansas, Fayetteville.

Evaluating fertility in commercial broiler breeder flocks has traditional been targeted at the male. However, previous research has shown variation in the ability of individual broiler breeder hens to become fertilized. This variability is consistent to specific hens throughout their reproductive life. This study was designed to evaluate the physiological capacity of different strains of Broiler Breeder hens (Cobb 500fed, 500sf, 700e, and Avian 48) to become fertilized under conditions of age and body weight. Two hundred pullets from each strain of broiler breeders were obtained from a commercial hatchery and reared into production according to industry standards. At 21 weeks of age, birds were light stimulated and separated into one of two groups; either at or below target weight (C), or heavy or above target weight (H) and housed in individual cages. H birds were maintained at +300 grams as compared to the C group. At 30 weeks of age hens were artificially inseminated with 100 million spermatozoa in a 0.05 cc volume from a pooled semen sample. Inseminations continued at five week intervals until 60 weeks of age. All eggs were collected daily to determine fertility and sperm penetration of the germinal disc by day post-insemination. Values were analyzed by breeder hen strain and body weight group until the cessation of sperm activity was determined with the effect of age determined from each group through the duration of the study. Results indicate that each C group had higher weekly egg production values as compared to the corresponding H groups. While fertility varied by age, the C groups had consistently better fertility and duration of fertility as compared to the H groups with the exception of the Cobb 700e, where values remained relatively constant regardless of body weight. Results indicate that body weight has a significantly detrimental effect on fertility and sperm penetration values in most breeder hen strains regardless of age.

Key Words: broiler breeders, fertility, body weight

T124 Inoculated broiler hatching eggs that remain in setter flats experience lower 18 day embryonic loss than their counterparts that are routinely transferred to hatcher trays. R. W. Keirs, E. D. Peebles, D. E. Rowe, and M. A. Dekich, Mississippi State University, Mississippi State, 2AviTech, LLC, Salisbury, MD.

Erradic late embryo losses (LEL) between trays of eggs following in ovo injection of broiler hatching eggs at approximately 18 d (432 h of incubation) stimulated field studies to uncover systematic variables other than in ovo injection itself that may be responsible for such results. Egg residue was examined in 36 trays across all 6 vertical hatchers columns and 6 horizontal rows of trays in a single hatchers machine. Inoculated eggs that remained in their respective setter flats were compared to those that were routinely transferred in a horizontal position to hatcher trays. Data analysis employed the Hatching Efficiency Analysis System (HEAS) methodology in conjunction with a latin square experimental design. Results showed that only 18 d embryonic loss was significantly (P<0.01) reduced (54%) by leaving eggs in their setter flats rather than subjecting them to routine transfer to hatcher trays. However, a numerical increase in hatching efficiency (2.13%) and numerical decreases in 18 d (1.45%), 19 d (0.99%), and 21 d (1.33%) LEL were also observed due to the elimination of routine transfer.

Key Words: broiler hatching eggs, embryonic loss, hatching efficiency, HEAS, latin square


Incubation parameters can influence metabolic heat production by the embryo and dissipation of metabolic heat from the egg. It can also influence initial body temperature at hatch. Eggs were divided into 4 groups and subjected to 4 different eggshell temperature profiles in a 2 x 2 factorial arrangement. The eggshell temperature during days 1-7 of incubation were either 37.5C(S) or 36.5C (L); days 8-14 all were 37.5C and from days 15-21 of incubation the eggshell temperatures were maintained at 37.5C(S) or 39C (H). The four groups were LH, LS, SH and SS. Hatchability was significantly lower when eggs were incubated at initially lower eggshell temperatures (76.4, 65.4, 84.7 and 82.6% respectively), also resulting in increased pips after 510 hours of incubation and slower hatch. Decreased relative heart weights were observed when embryos were subjected to H. Body temperature at placement into the broiler house pens were significantly less when eggs were subjected to L than S early during incubation (39.3c, 39.7b, 40.5ca and 40.3ca). Females also exhibited significantly elevated body temperatures compared to the males. Body temperatures were taken on days 1,2,3,4,5,6,7,9,11,13,15,21, and 29 during grow out. The body temperatures during this time were 41.6ca, 41.5c, 41.6a and 41.6b. Body weights at hatch were not significantly different and also at 28 days when the trial was terminated. Examined also was the potential influence of conductance of the eggshell upon the body temperature.

Key Words: eggshell temperature, incubation, body temperature

T126 In ovo technology: Commercial evaluations and trials at the hatchery. C. Williams, Pfizer Animal Health, Durham, NC.

Large scale in ovo application trials were conducted by an integrated poultry producer and customer of Pfizer Animal Health’s Poultry Health Division over the course of approximately 2 month period. The trials compared Pfizer’s Embrex® Inovoject® System and another commercially available egg injection system. The objective for the trial was to evaluate injection quality as measured by hatchability. The design of the test designated one half of the daily production to be injected with each system. Eggs were injected on day 18 of incubation for Monday and Tuesday hatch, and on day 19 of incubation for hatch on Thursday and Friday. Approximately 13 million total eggs were injected in the evaluation representing over 6 million eggs injected by each injection system.

Additionally, specific side by side pairing was conducted involving both day 18 and day 19 injections. These trials were designed to enable a more detailed and statistical analysis to the comparative evaluations. Necropsies of unhatched eggs from paired trials were utilized to detail specific post-injection embryonic mortality. Data from the necropsy (normal hatched live embryos) was analyzed by a generalized linear mixed model (binomial distribution) with fixed effects of breeder flock age, injection day and treatment and random effects of flock, flock*treatment and hatch basket within flock*treatment. Overall, hatchability as reported by the integrator during the 2 month test period was greater using the Inovoject system (83.44% vs 81.70%, AP=1.74%). Data comparing injections on both day 19 (83.69% vs 82.61%, AP=1.08%) and day 18 (84.05% vs 80.71%, AP=3.34%) of incubation also favored the Inovoject system. Detailed analysis from the necropsy data revealed that eggs vaccinated with the Inovoject system was found...
to have significantly higher overall hatch of normal live embryos than that of the other system (p<.05). In a direct correlation to the higher hatch of normal live embryos, data revealed that eggs vaccinated with the Inovovect had significantly less live chicks (in shell) than the other system regarding injections done on day 18, day 19, and overall.

Key Words: application trial, commercial hatchery, egg injection


This study determined the consumer preferences for egg shell and yolk colour in the study area. One hundred and eighty respondents that consume eggs were randomly selected in the study area. The result revealed that the respondents age range between 20 to 60 years and 160(88.9%) were males while 20(11.1%) were females. All the respondents had formal education with 10(5.6%) primary education, 50(27.8%) of the respondents agreed that brown eggs are more preferable to other birds. Among the respondents that rear birds 100(55.6%) rear layers, 140(77.8%) of the respondents rear birds while 40(22.2%) do not rear birds. Few (29.4%) of the respondents rear poultry while 120(70.6%) do not rear poultry. Also, the result revealed that 60 (35.3%) of the respondents prefer layer meat for consumption, 85(50%) preferred broiler meat and 25 (14.7%) preferred cock meat which indicates that majority of the consumers prefer broiler meat. Most of the respondents indicated that they consume chicken mostly in the festival period which could be due to the high cost of chicken meat. 25(14.7%) of the respondents consume chicken meat because it is tasty, 55(32.4%) tender while 35(20.6%) consume chicken meat for consumption, 85(50%) preferred broiler meat and 25 (14.7%) preferred cock meat which indicates that majority of the consumers prefer broiler meat. Most of the respondents indicated that they consume chicken mostly in the festival period which could be due to the high cost of chicken meat. 25(14.7%) of the respondents consume chicken meat because it is tasty, 55(32.4%) tender while 35(20.6%) consume chicken meat because it is soft and meaty. The responses to attitudinal statements revealed that most of the respondents consume chicken occasionally as 85(50%) agreed that chicken is too expensive. Chi-square result revealed that there is a significant relationship between consumers’ preferences for broiler to layers and cockerels (X2 =8.40, P≤0.05)

In conclusion, consumers of chicken meat consume chicken because of the tenderness and occasionally because it is too expensive. It is recommended that cost of rearing poultry should be reduced to enable consumers to afford it.

Key Words: consumers, preference, chicken, meat, university employees

T128 Consumer preference for different meats of chicken in Nigeria and University of Ibadan was purposively selected for the study.

One hundred and seventy employees that indicated interest were randomly selected and interviewed for this study. The results revealed that majority of the respondents were in their middle aged of 31 and 40 years and 155 (91.2%) were males while 15 (8.8%) were females. Few (29.4%) of the respondents rear poultry while 120 (70.6%) do not rear poultry. Also, the result revealed that 60 (35.3%) of the respondents preferred layer meat for consumption, 85(50%) preferred broiler meat and 25 (14.7%) preferred cock meat which indicates that majority of the consumers prefer broiler meat. Most of the respondents indicated that they consume chicken mostly in the festival period which could be due to the high cost of chicken meat. 25(14.7%) of the respondents consume chicken meat because it is tasty, 55(32.4%) tender while 35(20.6%) consume chicken meat because it is soft and meaty. The responses to attitudinal statements revealed that most of the respondents consume chicken occasionally as 85(50%) agreed that chicken is too expensive. Chi-square result revealed that there is a significant relationship between consumers’ preferences for broiler to layers and cockerels (X2 =8.40, P≤0.05)

In conclusion, consumers of chicken meat consume chicken because of the tenderness and occasionally because it is too expensive. It is recommended that cost of rearing poultry should be reduced to enable consumers to afford it.

Key Words: consumers, preference, chicken, meat, university employees

SCAD II

T129 Experimental reproduction of running and stunting syndrome in broilers. H. S. Sellers*, G. Zavala, and E. Mundt, Poultry Diagnostic and Research Center, University of Georgia, Athens.

Running-stunting syndrome (RSS) is a transmissible, infectious disease affecting young broilers between 1-2 weeks of age. Clinical features of RSS include severe weight suppression lack of flock uniformity, diarrhea, and a significant increase in the rate of feed conversion. Cystic enteropathy is consistently observed by histopathological examination of small intestine samples from affected flocks. Although descriptions of RSS date back to the 1970s, the etiologic agent(s) has yet to be identified. In previous studies, we isolated several viruses from RSS-affected birds, but no single virus, to date, has reproduced the clinical disease. All evidence suggests this is a multifactorial disease. To examine factors associated with disease, it is imperative to experimentally reproduce the clinical disease. In these studies, intestines from RSS positive broilers were collected, homogenized and stored at -80C. Numerous infection studies were performed in day-old commercial broilers in Horsfall Bauer isolation units. First, oral infection of day-old commercial broilers with homogenized RSS stock or a 0.2 micron filtrate of homogenized stock resulted in the reproduction of the clinical disease in a dose dependent response by 12 days post challenge as assessed by significant body weight suppression and cystic enteropathy in the intestinal villus. These results confirm that the disease can be reproduced from intestinal contents and that viruses are capable of reproducing RSS. In subsequent studies, day-old broilers were challenged with chloroform (CHC13)-treated filtrate to further characterize the viral populations that contribute to RSS. By 12 days post infection, body weights of the CHC13-treated group were significantly lower than the negative controls. In addition, cystic enteropathy was observed histologically in the CHC13-treated group implying that nonenveloped viruses can cause clinical RSS. The challenge model described can be reliably used to reproduce the clinical signs of RSS and is...
an important tool for evaluating treatments or vaccines used for control of the disease.

**Key Words:** running and stunting syndrome, viral enteric disease, infectious stunting syndrome, RSS, enteric disease of poultry

**T130** Development of a recombinant vaccine against running and stunting syndrome in chickens. H. Sellers, G. Zavala, and E. Mundt*, Poultry Diagnostic and Research Center, College of Veterinary Medicine, University of Georgia, Athens, GA.

Running and stunting syndrome (RSS) has been recognized since the late 1970s in broiler chickens. Although non-infectious factors may influence the severity of RSS, several viruses have been associated with this syndrome. Most of these viruses are not cultivable in vitro. To overcome this problem, a cloning approach was chosen to target small round viruses, Picornaviridae. The nucleotide sequence of the RNA dependent RNA polymerases (RdRp) is the most conserved sequence within this virus family. Using degenerated primers based on RdRp sequences, RT-PCR fragments were amplified and sequenced. However, the sequences were not present in the NCBI gene bank. Using several approaches, a 1.8 kbp fragment was amplified. While a genbank search did not result in any similar sequences, the in silico translated amino acid sequence showed a 34% similarity to a turkey astrovirus capsid protein. The open reading frame of the new capsid protein was cloned and a recombinant protein was expressed in a baculovirus system. Subsequently, the purified protein was used as an oil-emulsion vaccine in commercial broiler breeders along with a group of non-vaccinated broiler breeders. The development of antibody titer in the hens and the maternal derived antibodies in the offspring was monitored by an ELISA using the recombinant protein. A low ELISA titer was observed in the broiler breeders prior to vaccination, probably due to the fact that this or a similar astrovirus is circulating in the field. After the second vaccination, the vaccinated breeder breeders showed a significant increase in titer compared to the control birds. The same increase response was observed in the offspring. In challenge experiments using the offspring from hens receiving three vaccinations, a level of protection was observed against RSS. Progeny from vaccinated hens gained significantly more weight compared to offspring from the nonvaccinated/challenged controls. In addition, the number and size of enteropathic cystic lesions in the small intestine was significantly reduced in the offspring from vaccinated hens. Thus the recombinant vaccine may be a potential vaccine candidate in efforts to control RSS.

**Key Words:** chicken, RSS, vaccine

**T131** Survival of avian influenza virus in eggs during litter composting. T. V. Dormitorio*SC, J. J. Giambrone, and K. S. Macklin, Auburn University, Auburn, AL.

In-house composting of litter has been shown to be effective in eliminating avian pathogens. Infectious laryngotracheitis virus (ILT), avian influenza virus (AIV), and Newcastle disease virus (NDV) have been inactivated at composting temperatures of 40°C and above. Survival of AIV in embryonated eggs during an experimental in-house composting was determined. Ten-day old embryonated eggs were inoculated with a virus isolate (H10N7), and then buried into the compost pile. Eggs were withdrawn from the pile at various time intervals and allantoic fluids were tested for the presence of the virus by hemagglutination (HA) test. Results showed that 100% of the eggs inoculated with fluids from H10N7-inoculated and composted eggs contained residual live virus for up to 36 hours of composting, but at 54 hours and onwards, the virus was eliminated. On the other hand, H10N7 survived 72 hours at room temperature (27-30°C). The compost pile temperature (at the site where the eggs were buried) reached 60°C. Humidity (%RH) and dew point (°C) were 100% and 50°C, respectively. These results can be used to develop management strategies that can inactivate AIV in eggs laid by infected hens.

**Key Words:** avian influenza, composting, litter, virus inactivation, hemagglutination

**T132** Development of an H5 monoclonal antibody for establishment of an H5 species independent cELISA system. D. Dlugoleński*SC, R. Hauck, R. J. Hogan, and E. Mundt, University of Georgia, Athens.

Since the emergence of high pathogenic avian influenza virus (HPAIV) H5N1 in Asian countries, HPAIV H5N1 has become a major concern for human health. Waterfowl are the natural host reservoir for AIV, but cross species transmission can readily occur. The determination of the hemaglutinin (HA) subtype is restricted to inhibition and virus neutralization assays. Both assays are labor intensive and not suitable for automation. The presence of HA5 and HA7 antibodies are of major interest since these subtypes of AIV can develop a highly pathogenic phenotype. To develop a test which can be used in automatic settings the HA5 protein of a wild bird isolate [A/duck/NC/674964/07 (H5N2)] was cloned and subsequently expressed in a baculovirus system. In addition, a monoclonal antibody specific for the HA5 antigen (H5-mAb) was generated. Both reagents were used to establish a competitive ELISA (cELISA) system. The cELISA performed with influenza antibody free sera or sera of animals infected with AIV HA suptypes other than H5 showed no significant inhibition of H5-mAb binding, indicating a high specificity of the test. In contrast, sera of animals (chickens, turkeys, mallards, redheads, wood ducks, and cats) experimentally infected with H5-encoding AIV or vaccinated with inactivated vaccines were able to significantly inhibit the binding of the H5-mAb. The cELISA showed a significant inhibition (> 25%) of mAb binding in hemaglutination inhibition (HI) positive serum samples in chicken, duck, and turkey sera with a reproducibility of >95%. This test provides a platform for further development of this type of assay.

**Key Words:** avian influenza, cELISA, H5, recombinant protein, monoclonal antibody

**T133** Co-localization of the cellular protein p68 with a viral protein of infectious bursal disease virus. R. Stricker*SC and E. Mundt, University of Georgia, Department of Population Health, Athens.

A better understanding of viral replication is the basis for the discovery of new ways to interfere. Thus, there is an increasing interest in dissecting the molecular pathways of viral replication. It is known that cellular proteins operate as functional elements during viral replication. In our investigations we focused on the cellular dsRNA binding protein p68,
an established RNA helicase, which seems to have a regulatory function during replication of hepatitis C virus, HIV, and colon cancer. To examine a possible viral-host-interaction we investigated the role of p68 during replication of infectious bursal disease virus (IBDV). RT-PCR using chicken mRNA was performed and the p68 gene was cloned and sequenced. By using a recombinant baculovirus technology p68 was expressed and subsequently purified by affinity chromatography. The identity of the purified protein was confirmed by MALDI/TOF. An anti-p68 serum was generated in a rabbit and used for the determination of the localization of the protein in IBDV infected cells. Interestingly, in IBDV infected cells p68 was present in the cytoplasm. In non-infected cells the protein was observed in the cell nucleus. Double-labeling studies using monoclonal antibodies raised against IBDV proteins and the anti-p68 rabbit serum were performed using different anti-species conjugates. Surprisingly a co-localization of p68 was observed only with the viral protease VP4. This indicates that the investigated cellular protein p68 interacts with the viral protease. Subsequent experiments showed that this phenotype was independent from the used IBDV strain and independent from interferon alpha. Several transfection experiments in DF1 cells revealed that only the presence of the viral protein VP4 was necessary and sufficient for a presence of p68 in the cytoplasm. This phenotype was also observed when an inactive viral protease was expressed in the cytoplasm of transfected cells. Thus the proteolytic activity of VP4 was not necessary for the phenotype of p68. The interaction of VP4 with p68 might play an important role during the regulation of the translation process of the IBDV polyprotein.

**Key Words:** IBDV, replication, cellular protein, p68, VP4

**T134 Pathogenicity of infectious bursal disease virus variant AL2 in chickens.** H. Toro*, J. C. Effler, F. J. Hoerr, V. L. van Santen, and F. W. van Ginkel, Auburn University, Auburn, AL.

We evaluated the effects of infectious bursal disease virus (IBDV) variant AL2 in 4-day-old SPF chickens and in broiler chickens of commercial origin (with specific maternal immunity and vaccinated in ovo against IBDV). SPF chickens showed reduced weight gain compared to un inoculated controls and bursa lymphocytic depletion as determined by bursal index (BI) and bursa histomorphometry. Bursa histomorphometry and BI results differed during the early stages of the infection. Because bursa histomorphometry results were consistent with viral RNA detection, such values seem to be more appropriate for the assessment of AL2 viral infectivity in chickens. Infected SPF chickens showed a significant increase of splenic IgM+ cells at 5 and 8 days post-inoculation (PI). On day 8 PI the number of total IgM+ cells in the spleen was inversely related to the viral dose inoculated. Birds receiving higher virus concentrations showed a significant increase (P<0.05) of total spleen CD4+ cell counts on day 8 PI suggesting a role for these cells in protective immunity. Broiler chickens were exposed to IBDV AL2 via the drinking water on days 3 and 14 of age. No clinical signs were observed in these birds. Compared to uninfected controls, AL2 infected broilers showed significant bursa lymphocyte depletion on day 30 of age as assessed both by BI and histomorphometry. IBDV RNA detection in the bursae and seroconversion to IBDV after day 30 of age confirmed that bursal lymphocyte depletion was due to IBDV resuming replication.

**Key Words:** infectious bursal disease, AL2, pathogenicity

**T135 Detection of infectious laryngotracheitis virus in the water lines with real-time PCR and viral isolation.** S. C. Oua*SC, J. J. Giambrone, and K. S. Macklin, Auburn University, Auburn, AL.

Infectious laryngotracheitis virus (ILTV) causes respiratory disease in chickens and can result in severe economic loss to the poultry industry world-wide. Sources of ILTV transmission are clinically infected chickens, latent infected carrier chickens, and litter and fomites that are contaminated with ILTV. ILTV can persist for months in chicken carcasses, litter, and fomites. Rigorous biosecurity and vaccination are critical for ILT control. Biofilms in water lines are a source of pathogen transmission. Biofilms can protect microorganisms from environmental influences and sanitizers. In this study, a commercial CEO ILT was placed in isolation unit water lines and allowed to maintain overnight. The next day, the water lines were flushed with tap water three times. Three-week-old SPF chicks were then placed in these isolation units. At 7, 14 and 21 days later, swab samples were obtained from the nipple drinkers, the internal surface of the water lines, and chicken trachea. Swabs were checked with real-time PCR and then incubated in eggs for viral isolation. Results showed that all swabs were positive for ILTV DNA and contained live virus. Water lines in chicken houses may be an important source for ILTV transmission to subsequent flocks.

**Key Words:** infectious laryngotracheitis virus, ILTV, water line, real time PCR


Coronaviruses are positive sense RNA viruses that have a high mutation and evolution rate due to the lack of proofreading activity of the RNA-dependent RNA polymerase, its copy-choice replication mechanism and rapid generation time. Infectious bronchitis virus (IBV) was first identified in the 1930s and since then, many different serotypes have been identified and shown to persist in the field. We sequenced and analyzed the entire genome of eleven IBV field viruses of different serotypes, Mass and Conn, isolated over a 41, 25 and 8 year period respectively. Poultry producers routinely vaccinate for Mass and Conn whereas no vaccine exists for CAL. Our data showed that Mass and Conn did not accumulate changes while CAL accumulated changes and had a high rate of evolution. This indicates that the Mass and Conn viruses isolated from the field were possibly re-isolated vaccine viruses that were circulating in birds for only a short time while the CAL viruses were true field isolates that had been in circulation for years.

**Key Words:** coronavirus, evolution, vaccination

**T137 Full-length genomic comparisons of emerging coronaviruses.** S. W. Thor*SC, D. A. Hilt, C. Polizzi, and M. W. Jackwood, University of Georgia, Athens.

Viruses in the Family Coronaviridae are of global economic importance. Because coronaviruses have high rates of both mutation and recombination, it is not surprising that they have proven to be a major source of emerging zoonotic diseases. Although the spike region for many of the coronaviruses has been sequenced, there are very few full genomic
sequences available. This is especially true for the coronaviruses that infect animals that are in close contact with humans; including dogs, cats, rats, mice, chickens, and turkeys. Therefore, we were interested in examining the complete genomic sequence of selected animal coronaviruses from groups I, II, and III. Mutation rates, recombination events, and phylogenetic analysis will be presented.

**Key Words:** coronavirus, genomic sequencing, mutation rate, recombination, zoonoses


Infectious Bronchitis Virus (IBV) is a positive sense RNA virus that causes an upper respiratory disease in chickens. The disease is mostly controlled by vaccination with live attenuated viruses. Pathogenicity of IBV has traditionally been attributed to the spike glycoprotein, which is involved in attachment and entry into the host cell. However, evidence in literature indicates that other genes may also be involved. We were interested in examining the viral RNA-dependent RNA-polymerase genes because replication is critical to virus survivability and production of lesions in the host. In this study, the 1a and 1b genes of the attenuated Arkansas vaccine and pathogenic Ark-DPI parent strain of IBV were sequenced and compared. There were 344 nucleotide differences in the polymerase genes. Differences in individual proteins will be presented and the possible effects of the amino acid changes will be discussed. This work provides critical information needed to examine mutations individually and in combination to verify their role in coronavirus pathogenicity. With that knowledge, it is hoped that safer more efficacious vaccines can be produced.

**Key Words:** infectious bronchitis virus, coronavirusidae, antigenic variants, pathogenicity, polymerase

**T139 Uncommon tumor type associated with ALV-A infection in fancy breed chickens.** S. M. Williams*, G. Zavala, and T. Barbosa, University of Georgia, Athens.

Multiple sections of formalin fixed feathered skin, bones and heads were submitted to the Poultry Diagnostic and Research center for microscopic examination. Samples were taken from adult fancy breed chickens with a history of tumor formation over several months. Both roosters and hens were affected and submitted. Microscopically the tumors were consistent with sarcomas, both undifferentiated and myxomatous types. PCR on the fixed tissue determined that exogenous ALV was present and sequencing of the complete gp85 was consistent with subgroup A.

**Key Words:** chickens, ALV-A, myxosarcomas, sequencing, gp85

**T140 Testing of a new disinfectant process for poultry viruses.** L. A. Gay*SC and E. S. Mundt, University of Georgia, Athens.

The objective of this study was to investigate the application of a new chemical compound as a disinfectant against an enveloped as well as a non-enveloped virus. As model viruses a low pathogenic avian influenza virus (lpAIV, H5N2) and a vaccine strain of infectious bursal disease virus (IBDV, D78) were used. Unlike many disinfectants currently in use, the biocide used in this process forms a gas, and therefore has a strong penetrating capability in sealed poultry houses. After treatment, once properly ventilated, the poultry houses are safe for subsequent use without the risk of further infection or contamination. Rendering the poultry litter free of virus and pathogens would allow the reuse of some or all of the litter safely. This would reduce the cost of poultry production, as litter has been increasing in cost rapidly. The results show that lpAIV in contaminated chicken litter is inactivated in less than one hour when the disinfectant is used at the recommended dose. This result was also obtained at one third the recommended dose. The impact of the disinfectant on chicken litter contaminated with IBDV was comparable. IBDV was inactivated in less than one hour with full and half doses. These results indicate that routine treatment of the facilities and litter at Broiler, Egg and Turkey production companies would greatly control or eliminate the risk of transmission of virus between flocks which are raised on used litter. Use of this disinfectant after a disease outbreak to disinfect litter seems feasible.

**T141 Analysis of the host immune response during Mycoplasma gallisepticum vaccination or infection.** S. A. Leigh*, S. D. Collier, and S. L. Branton, USDA-ARS Poultry Research Unit, Mississippi State, MS.

Infection of layer chickens with Mycoplasma gallisepticum (MG) can result in decreased egg production compared to uninfected controls. Although multiple live MG vaccines are available, little is known about their induced immune response and how they protect the host from subsequent infection. The immune response from chickens vaccinated with either FVAX-MG® or Mycovac-L®, chickens infected with MG strain R-low, and control (unvaccinated/uninfected) chickens was compared. Results were obtained from FACS analysis of peripheral blood lymphocytes stained with fluorescently labeled antibodies against chicken CD8, CD4, and Bu-1. Based on preliminary studies, no major differences between chickens treated with MG versus control birds were observed. The results do suggest an increase in CD4 and Bu-1 expressing lymphocytes over the course of the experiment and a decrease in CD8 expressing lymphocytes, suggesting the importance of humoral immunity in response to MG infection. These results are consistent with the results of other researchers who noted the infiltration of B-lymphocytes into the tracheal mucosa along with a decrease in the detection of MG DNA. These results suggest that an antibody mediated immune response is important in controlling MG infection. Current results are ambiguous regarding the response of CD8 lymphocytes to MG infection.

**Key Words:** Mycoplasma gallisepticum, immune response, CD4, Bu-1

**T142 Effect of dosage and vaccination route on transmission of a live attenuated Mycoplasma gallisepticum vaccine: A broiler model.** J. D. Evans*, S. L. Branton, and S. A. Leigh, USDA-ARS Poultry Research Unit, Mississippi State, MS.

*Mycoplasma gallisepticum (MG) is an economically significant pathogen of poultry species and among the table egg sector of the poultry...
industry, live attenuated strains of MG are commonly utilized to limit production losses associated with MG-induced disease. The vaccine, however, may be problematic to broiler- and turkey-related industries due to associated virulence and therefore, understanding the transmissibility of the live MG vaccines is of particular importance. In the current study, a broiler model addresses the effect of vaccine application route and dosage on the transmission of the MG vaccine, FVAX-MG® to commingled unvaccinated subjects for 7 wks post-vaccination. Vaccinations occurred via eye-drop or spray application at 1X, 10⁻³X, or 10⁻⁶X of the manufacturer’s recommended dosage and transmission to unvaccinated subjects was measured. Serological response and presence of MG DNA indicate FVAX-MG® transmission only within the 1X FVAX-MG® eye-drop treatment and among no other treatment was transmission of FVAX-MG® detected. The results of the current study demonstrate that the dosage and vaccination route have direct implications on subsequent transmission of FVAX-MG®.

Key Words: Mycoplasma gallisepticum, mycoplasmosis, transmission, attenuated vaccine


*Salmonella* continues to cause significant cases of foodborne illnesses in the United States. With poultry recognized as an important vehicle in past outbreaks, pressure has been placed on the industry to reduce poultry and egg contamination with *Salmonella.* To effectively reduce or eliminate *Salmonella* from poultry operations will require identifying its source(s), and while serotyping has been helpful, it has been sufficient in identifying *Salmonella* to strain level. Pulsed-field gel electrophoresis (PFGE) has been a useful tool in typing most *S. enterica* serovars. However, *S. Enteritidis* (SE) is refractory to typing by PFGE, due to its clonal nature. We have been able to identify genetic differences in SE isolates using random amplified polymorphic DNA (RAPD) PCR. While we were able to discern some differences in SE isolates by RAPD, no single typing, PCR primer was sufficient to type SE by this method. However, when we collate the different RAPD DNA patterns for each typing primer into a single phylogenetic tree, we could identify sufficient genetic differences to discriminate SE isolates. From our analyses, we are able to identify geographical differences in the distribution of SE types, and discern source(s) of SE within a poultry integrator. This molecular approach to typing SE will prove to be a powerful epidemiological tool in determining the source of SE in poultry and layer operations.

Key Words: *Salmonella*, *Salmonella* Enteritidis, RAPD PCR, biosecurity, genetic differences
Two consecutive experiments were conducted to evaluate the influence of dietary composition, specifically protein and amino acid profile, on oocyst output and lesion development in male and female replacement broiler breeders of two different genetic lines. The first experiment was conducted on fresh pine shavings as the litter source while the second trial was conducted on the used litter following the first experiment. Dietary formulation was based on either breeder specific recommendations or formulations of a broiler integrator. Fecal material was collected on an every other day basis from 6 to 41 days of age to determine oocyst output. Lesion assessment was performed throughout the experiments to evaluate gross and microscopic intestinal lesions. In experiment 1, both genetic lines were associated with multiple peaks in oocyst output, with the first peak occurring at approximately 16 to 18 days post placement. This first peak tended to have the highest observed magnitude and corresponded with the highest level of intestinal lesions observed during the trial. Oocyst cycling in experiment 2 did not follow similar patterns. Peaks were delayed and at a lower magnitude. Dietary interactions were observed in both experiments where magnitude or duration of oocyst output and severity of lesion development was influenced by diet in both male and female genetic lines. These data indicate the dietary composition impacts oocyst cycling and lesion development during coccidiosis vaccination in replacement broiler breeders.

Key Words: broiler breeder, protein, oocyst, lesion, vaccination

Velogenic Newcastle disease virus has threatened the Mexican poultry industry since 1946. Nine strains of velogenic Newcastle disease virus were isolated in central and northern Mexico from 1998 to 2006 and subjected to phylogenetic analysis and biological characterization using standard pathogenicity tests. Phylogenetic analysis showed that all newly characterized velogenic strains belonged to genetic group V and are clearly divided in two lineages, since phylogenetic similarities between groups are of only 93-94%. isolates from 1998 to 2001 are closely related to the strain responsible for the 2000 year outbreak raised in La Laguna region (Toreon strain), and are phylogenetically distinct from viruses isolated between 2004 and 2006 that are genetically related to the Chimalhuacan strain isolated in 1973. All the viruses of both, the Chimalhuacan and the Torreon groups, contained a virulent fusion protein cleavage site represented by the motif "GGRQQKRF", revealing that evolutionary changes occurred at a different site. Fifty percent lethal dose in chicken embryo ranged from $10^{11}$ to $10^{8.5}$ LD$_{50}$/ml and does not seem to be related to the virus phylogenetic lineage. Chicken embryo mean death time values were shorter for the viruses isolated after 2001 (45.2 hours), when compared with the 1998-2001 average (51.8 hours). ICPI average value was higher (1.92) for viruses isolated during 2004-2006 than that for viruses isolated before 2001 (1.75). Along with the ICPI and MDT results, our findings suggest that some distinct selective pressure on the Chimalhuacan strain isolated in early 1970’s may have led to the appearance of the new group (Toreon-like) in the middle of 1990’s. The vaccination pressure raised after the 2000 outbreak may account for the reduction of Torreon-like isolates, then allowing the re-emerge of the more virulent Chimalhuacan-like isolates in the following years, once the vaccination programs went back to those used in central region of Mexico before the 2000 outbreak. Studies on tropism to lymphoid organs of broiler chickens are in progress, results will be also discussed.

Key Words: Newcastle disease virus, Mexico, genotype V, lineages, virulence

To evaluate a permanent anticoccidial program (nicarbazine – monenazine) on productive parameters in broilers for 49d, two hundred and forty one-day of hatch chicks were used. Chicks were randomly divided into 2 treatments (A: untreated diet and B: coccidiostat program on diet) with 4 replicates each one with 30 chicks per pen. Productive parameters were recorded weekly. Skin pigmentation and oocysts counting per gram of feces was evaluated after 21d. At 21d, chicks were orally gavaged individually with 60,400 sporulated oocysts of *Eimeria* spp. The productive parameters were evaluated with repetitive observation analysis and T-student test. No difference was observed (P>0.05) at day 49 in average body gain between groups (A: 2904g and B: 2963g); feed consumption (A: 6228g and B: 6033g); and feed conversion (A: 2.14 kg and B: 2.04kg). On skin yellow pigmentation, a statistic difference (P<0.05) was observed between groups (A: 11.23 and B: 9.22) with 15.4 respectively and it was related to a higher (P<0.05) number of oocysts per gram of feces in the untreated group (25,352) compared to the medicated group (9,227). Our results suggest that the anticoccidial program used in this trial improved numerically performance of chicks.
P147  Influence of experimental LPAI virus infection on susceptibility of wood ducks to H5N1 HPAI virus. T. P. Costa1,2,3, D. E. Stallknecht1, J. D. Brown1, E. W. Howarth1, and D. E. Swayne2, 1University of Georgia, Athens, 2USDA-ARS-Southeast Poultry Research Laboratory, Athens, GA.

In order to evaluate if a pre-exposure to a low pathogenic avian influenza (LPAI) virus provides protective immunity to wood ducks (Aix sponsa) challenged with a H5N1 highly pathogenic avian influenza (HPAI) virus, twenty-five 1-year old wood ducks, evenly divided into 5 groups, were intrachoanally inoculated with 106EID50 of the following LPAI viruses: A/mallard/Netherlands/2/05 (H5N2), A/blue-winged teal/LA/B228/86 (H1N1), A/mute swan/MI/451072-2/06 (H5N1), and A/mallard/MN/355779/00 (H5N2). The fifth group was not exposed to a LPAI virus. After 21 days, the birds were challenged with 106EID50 of the HPAI virus A/whooper swan/Mongolia/244/05 (H5N1). All four groups infected with a LPAI virus had reduced morbidity and mortality compared to the naïve group, suggesting pre-exposure to a LPAI virus provided some level of protective immunity. The level of protection, however, varied between LPAI isolates:

- No LPAI exposure - 100% morbidity, 100% mortality; Netherlands/05 (H5N2) - 80% morbidity, 80% mortality; LA/86 (H1N1) - 60% morbidity, 60% mortality; MI/06 (H5N1) - 20% morbidity, 20% mortality; MN/00 (H5N2) - 0% morbidity, 0% mortality.

The cause and mechanism for this protection and variation among isolates will be discussed herein. These results suggest that LPAI viruses naturally circulating in waterfowl populations can influence the susceptibility of these wild avian populations to H5N1 HPAI virus.

Key Words: avian influenza, LPAI, HPAI, susceptibility, wood duck

P148  Evaluation of management practices and Salmonella prevalence on broiler breeder farms in the southeastern United States. D. L. Mathis1, M. D. Lee1, J. J. Maurer1, J. L. Wilson1, R. K. Bramwell2, K. S. Macklin3, M. J. Wineland4, and R. D. Berghaus1, 1University of Georgia, Athens, 2Texas A&M University, College Station, 3University of Arkansas, Fayetteville, 4Auburn University, Auburn, AL, 5University of Carolina State University, Raleigh.

Salmonella is a leading cause of foodborne illness in the United States and poultry has been recognized as a common vehicle in past outbreaks. In this study, Extension agents are visiting 15 broiler breeder farms in each of four states (Alabama, Arkansas, Georgia, and North Carolina) to perform environmental sampling for the detection of Salmonella and to evaluate management practices thought to be important in Salmonella transmission. Farm-level, flock-level, and individual sample-level Salmonella prevalences for the first 43 farms enrolled were 91%, 86%, and 42% respectively. Within individual houses, the prevalence of Salmonella-positive samples ranged from 0-92%. Only 38% of the farms used disinfectant footbaths at house entryways and only 31% kept a record of visitors to the farm. Most producers (82%) indicated that they had an active rodent control program although the control was considered to be inadequate on 33% of farms. In the southeastern U.S., most broiler-breeder flocks are infected with Salmonella (~90%). Biosecurity and rodent control are common management deficiencies.

Key Words: Salmonella, management practices, broiler breeder, prevalence, biosecurity

P149  Probiotic administration during coccidiosis vaccination in broilers: Evaluation of protection against clinical Eimeria challenge. A. E. Klein1, J. Lee1, M. Farnell1, L. Oden1, M. Pohl1, M. Mohn2, R. Beltran2, G. Schatzmayr2, C. Broussard3, S. Fitz-Coy3, and D. Caldwell1, 1Texas A&M University, College Station, 2Biomin GmbH, Herzogenburg, Austria, 3Intervet-Schering Plough Animal Health, Millsboro, DE.

Recent reports from our laboratories have shown that probiotic administration during coccidiosis vaccination can increase immune responses and improve intestinal health during subclinical challenge by field strain Eimeria. The objective of this trial was evaluate live oocyst vaccination, with our without drinking water probiotic administration, for protection against clinical field strain Eimeria challenge. Experimental groups consisted of control, probiotic (Biomin® PoultryStar), vaccine (Coccivac-®B), and vaccine + probiotic, placed in four pens of 40 broilers each. All broilers were weighed then orally challenged with field strain Eimeria on day 35. All broilers were weighed and subjected to necropsy on day 42 for gross and microscopic intestinal lesions, as well as upper and lower intestinal weights. Body weight gain among vaccinated broilers was significantly increased (P<.05) during the seven day challenge period. Both probiotic and vaccine significantly decreased (P<.05) gross lesion scores in upper and mid-intestinal regions. A significant reduction (P<.05) in gross lower intestinal lesion score was also observed in the vaccine alone group. These findings were supported by microscopic lesion scores in vaccinated broilers where significantly reduced (P<.05) upper and mid-intestinal lesions were observed. Broilers receiving both vaccine and probiotic had reduced (P<.05) microscopic lower intestinal lesion scores. Vaccinated broilers had reduced (P<.07) relative lower intestinal weights at necropsy. These observations suggest that the administration of probiotic during coccidiosis vaccination can potentially stimulate immunity and improve intestinal health in broilers receiving clinical field strain Eimeria challenge.

Key Words: coccidiosis, vaccination, probiotic, challenge, broilers


Coccidiosis in chicken is caused by protozoan parasites of the genus Eimeria. Highly resistant environmental oocysts are ingested by the host animals, where sporozoites hatch, go through a complex life cycle with asexual and sexual stages, which are followed by formation and excretion of new oocysts. Complete in vitro development in primary cell culture is possible, but yields are too low for continuous production of relevant parasite
numbers. Development in permanent cell lines is known to be even more limited. Among chicken coccidia, *E. tenella* with MDBK (Madin Darby bovine kidney) cells as hosts are the most frequently used cell culture model for *in vitro* research. The parasites develop readily until first generation merozoites, but further development is poor. Therefore, also *in vitro* studies require regular passage of *Eimeria* by host animals. Improvement of parasite development would result in more efficient use of parasite material in bioassays and other research and require fewer experimental animals. Eventually it might even assist in achieving complete *in vitro* cultivation in the future.

In order to optimize parasite development for future *in vitro* bioassays, a series of experiments was performed in cell culture. Different cultivation conditions for *E. tenella* in MDBK cells and media supplements were tested and assessed by quantification of first generation merozoites. The amount of medium in culture dishes (96 well microplates) had most significant influence on parasite development. The reason is assumed to be less oxygen stress in cultures with higher medium supernatant. Increased levels of fetal bovine serum (FBS) and GlutaMAX™ (as a glutamine source) also positively influenced parasite numbers. These findings will be used for further *in vitro* experiments with *E. tenella*. This work was funded by the EU project SAFEWASTES.

**Key Words:** coccidiosis, *Eimeria*, *in vitro*, optimization, medium

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**P151** Onset and cessation of rigor mortis in layer hens. K. Y. Williamson*, E. Benson, R. Alphin, C. Ciaverelli, and M. Rankin, *University of Delaware, Newark*.

In the poultry industry, table egg laying hens are kept in cages with up to 75,000 to 125,000 or more birds per house. The primary steps in response to an outbreak of highly infectious diseases such as avian influenza is surveillance, quarantine, depopulation, disposal, and disinfection. When birds infected or suspected of infection with highly infectious disease such as avian influenza, the birds must be depopulated in order to prevent the spread of the disease. Depopulation methods have been developed for floor reared meat type birds, but caged layers remain a problem. One of the critical questions is whether to depopulate the birds inside the cages or to remove the birds prior to depopulation. This experiment was conducted to determine the time window under which birds could be removed from cages. Birds were euthanized using two potential depopulation treatments, carbon dioxide gassing and water based foam. Temperature was controlled and multiple carcass measurements were collected to determine the onset of rigor. The results showed that there was a 1.5 hr initial time period in which the birds were flexible followed by a 3 hr period of rigor under which the carcass would be too stiff to easily remove from layer cages. The onset of rigor mortis was independent of depopulation method.

**Key Words:** rigor mortis, layers, depopulation, euthanasia

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**P152** Meningoencephalitis in broilers associated to *Pseudomonas aeruginosa*. C. C. Rosario*, M. S. Gabilondo, and M. T. H. Casaubon. 1Departamento de Producción Animal: Aves, Universidad Nacional Autónoma de México, México, 2Avigrupo, Mexico.

Vaccination plays an important role in the poultry industry since it is the main strategy to prevent diseases within a flock. Several methods for the vaccination have been developed: drinking water, spray, eye drop, scarification and injection (intramuscular or subcutaneous). An automated machine that delivers high speed injections to chicken embryos was first used by manufacturers of human viral vaccine, and later, the design was adapted for use by the poultry industry. Administering live vaccines to a developing chick in the egg (in ovo) has proven to be a fast, effective, labor saving method, and, in some cases, a more rapid onset of immunity. However, the environmental conditions in poultry hatcheries that promote embryonic development also enhance proliferation of bacteria, which can cause disease in chicken flocks that could increase mortality. The aim of this abstract is to present a report case of meningoencephalitis in broilers. Ten twelve-day broilers showing severe nervous signs such as twisted necks, tremors or difficulty walking were submitted to the diagnostic area of the Poultry Department of the Veterinary School of UNAM (Mexico). At the time they arrived, two chicks had been died. All chicks were necropsied and no macroscopic lesions were observed, except several rounded granulomatous lesion (2mm to 7mm size) in the brain. Bacteriological isolation for aerobic and anaerobic bacteria and histopathological analysis using hematoxylin and eosin (H&E) stain were performed from the lesions of the brain. All samples were positive for the isolation of *Pseudomonas aeruginosa* in pure culture, which was confirm with the microscopic analysis of the lesions, where a supplicative meningoencephalitis was observed. These findings were important since the batch these chickens belong to were vaccinated *in ovo* at the hatchery. The high rate of diseased chicks suggests that a contamination could happen at the time they were vaccinated. Since no lesions were found in other organs, we hypothesize that intracranial inoculation with contaminated needles could be the origin of the problem.

**Key Words:** in ovo vaccination, broiler chickens, contamination, pseudomonas, hatchery

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**P153** Determination of *Salmonella* persistence in shell and outer and inner shell membranes of hatching eggs disinfected with hydrogen peroxide. J. Zamperio, I. Monroy-Beccerra, J. A. Quintana-Lopez, and O. Uruquia-Bravo*, Universidad Nacional Autonoma de Mexico, Mexico City, Mexico.

Due to *Salmonella* contamination continues occupying an important place in infectious diseases transmission and one of the way for hatchery eggs disinfection is by using innocuous chemical substances like hydrogen peroxide, the objective of the present study was to determine the persistence of *Salmonella* in shell and outer and inner shell membranes of hatching eggs disinfected with hydrogen peroxide. Three treatments (T) of 17 hatching eggs each one were carried out. The *Salmonella* Enteritidis PT 13A inoculum had 109 CFU per ml concentration and 50 µl were impregnated in the shell, in the opposition pole of the air chamber, close to the embryo localization. The hydrogen peroxide concentration was 30%. The T1 consisted in: hatching eggs without *Salmonella* inoculation and no disinfection; T2: hatching eggs inoculated with *Salmonella* without disinfection; T3: hatching eggs inoculated with *Salmonella* and disinfection with hydrogen peroxide by aspersion. Samples were taken from the shell surfaces in the 3 treatments by cotton swabs. Later the content of each egg drained to take inner and outer shell membranes. All eggs were analyzed individually by a qualitative bacteriological test (Mexican official standardization (NOM-005-ZOO-1993)), which consisted in culture samples in Tetrathionate broth and green brilliant agar. The results were: T1. 100% (17/17) negative to *Salmonella* as shells as shell membranes. T2. 100% (17/17) positive to *Salmonella* from shells...
and shell membranes. T3. 100% (17/17) negative to Salmonella isolation from the disinfected shells but 35% (6/17) of them were positive to the isolation of Salmonella from shell membranes, indicating that Salmonella was able to cross the pores of the shell in 2 hours postinoculation after disinfection with 30% concentration of hydrogen peroxide.

**Key Words:** hydrogen peroxide, Salmonella, disinfection, Salmonella contamination, egg shell contamination

**P154** Molecular detection and characterization of infectious bursal disease virus (IBDV) variant strains from Venezuela. F. Perozo*1, A. Oviedo2, P. Villegas1, and L. Purvis1, 1University of Georgia, Athens, 2Servicio Autonomo de Sanidad Animal, Maracaibo, Zulia Venezuela.

Molecular detection and characterization of infectious bursal disease virus (IBDV) field isolates is a useful tool in IBDV control. The technique has become available worldwide thanks to new handling techniques that allow molecular genotyping and classification of disease-causing viruses from countries lacking the necessary equipment and reagents to perform molecular technology. Classical IBDV is present in the Venezuelan poultry industry since the past century despite intensive vaccination programs are applied to control disease. The presence of variant strains has been reported lately in several Latin-American countries. This work reports the molecular identification of variant IBDV strains in poultry farms from Venezuela. Bursal imprints in FTA cards and tissues for histopathological analysis were collected from 4-week old broiler flocks. Reverse transcriptase polymerase chain reaction (RT-PCR) and direct nucleotide sequence were used for the molecular characterization. All the farms sampled were IBDV positive. Viruses from seven out of eight farms showed high similarity with the IBDV variant strains used for comparison (variants A and E). Histopathological findings were consistent with the RT-PCR results showing IBDV related bursal damage. These results indicate the presence of IBDV variant strains in Venezuela where no live vaccination against these strains is currently allowed, increasing the risk for vaccine failure and the susceptibility to endemic diseases.

**Key Words:** genotyping, IBDV, Venezuela, variant strains

**P155** Effects of time specific F-strain Mycoplasma gallisepticum inoculation overlays on prelay ts11-strain M. gallisepticum vaccination on blood characteristics of commercial laying hens. E. D. Peebles*1, A. M. Vance1, S. L. Branton1, S. D. Collier2, and P. D. Gerard1, 1Mississippi State University, Mississippi State, 2Poultry Research Unit, Agricultural Research Service, USDA, Mississippi State, MS, 3Clemson University, Clemson, SC.

Two trials were conducted to determine the effects of a prelay ts1-strain M. gallisepticum (ts11MG) vaccination alone or in conjunction with F-strain M. gallisepticum (FMG) inoculation overlays at 2 different age periods during lay on the digestive and reproductive organ characteristics of commercial egg-laying hens. In each trial, the following 4 treatments were utilized: sham vaccination at 10 wk of age; ts11MG vaccination at 10 wk of age; ts11MG at 10 wk of age overlaid by FMG inoculation at 22 wk of age; and ts11MG at 10 wk of age overlaid by FMG at 45 wk. Parameters measured in both trials were whole blood hematocrit, plasma protein, and serum cholesterol, triglycerides, and calcium. No significant age or treatment main effects or age by treatment interactions were observed for any of the blood parameters investigated, except for serum calcium. At wk 22, serum calcium levels were higher in birds vaccinated with ts11MG at 10 wk compared to sham controls, and birds vaccinated with ts11MG at 10 wk followed by an overlay of FMG at 22 wk were higher than controls and those vaccinated with ts11MG at 10 wk alone. These results suggest that ts11MG vaccination at 10 wk of age alone or combined with F-strain inoculum overlays at either 22 or 45 wk may be used without any consequential effects on hematocrit or the lipid and protein levels in the blood of commercial layers. Because elevations in serum calcium were not associated with changes in hen performance, as reported in a previous companion article, it is further suggested that prelay ts11MG vaccination before FMG inoculation overlays during lay may provide adequate protection against field strain MG infections while being innocuous to layer performance.

**Key Words:** blood, commercial layer, F-strain Mycoplasma gallisepticum, ts11-strain Mycoplasma gallisepticum, vaccination

**P156** Effects of time specific F-strain Mycoplasma gallisepticum inoculation overlays on prelay ts11-strain M. gallisepticum vaccination on digestive and reproductive organs of commercial egg-laying hens. A. M. Vance1, S. L. Branton1, S. D. Collier1, P. D. Gerard2, and E. D. Peebles*3, 1Poultry Research Unit, Agricultural Research Service, USDA, Mississippi State, MS, 2Clemson University, Clemson, SC, 3Mississippi State University, Mississippi State.

Two trials were conducted to determine the effects of a prelay ts1-strain M. gallisepticum (ts11MG) vaccination alone or in conjunction with F-strain M. gallisepticum (FMG) inoculation overlays at 2 different age periods during lay on the digestive and reproductive organ characteristics of commercial egg-laying hens. In each trial, the following 4 treatments were utilized: sham vaccination at 10 wk of age; ts11MG vaccination at 10 wk of age; ts11MG at 10 wk of age overlaid by FMG inoculation at 22 wk of age; and ts11MG at 10 wk of age overlaid by FMG at 45 wk of age. Necropsies were performed at the end of both trials (58 wk of age), using 2 birds per replication unit, to observe treatment effects on the following parameters: liver weight; liver lipid and moisture concentrations; incidence of fatty liver hemorrhagic syndrome; ovary weight; number of mature ovarian follicles; and the total and segmental weights, lengths, and histologies of the oviduct and small intestine. Treatments affected only vaginal length as a percentage of total oviduct length. Vaginas were relatively longer in hens that had only been vaccinated with ts11MG at 10 wk in comparison to all the other treatment groups, including controls. Except for relative vaginal length, the digestive and reproductive organs of layers were not influenced by the ts11MG and FMG treatment regimens imposed in this study. These results confirm that when coupled with FMG inoculations during lay, prelay ts11MG vaccinations may be a practical substitute for prelay FMG inoculations for providing continual protection against field-strain MG infections in layers.

**Key Words:** layer, liver, oviduct, small intestine, ts11-strain Mycoplasma gallisepticum
P157  The influence of in ovo inoculation with various nutrients and egg size on antibody levels of broiler chicks at 18 days of incubation, at hatch and 7 days of age.  T. T. Santos1, L. F. Araújo2,3,4, G. A. Gomes2,5, and L. C. G. Barcelos6,1, AB Vista Feed Ingredients, Curitiba, PR, Brazil, 2Universidade de São Paulo, Pirassununga, SP, Brazil, 3Mississippi State University, Starkville, 4Globoaves São Paulo Agroavícola Ltda, Cascavel, PR, Brazil, 5Tectron Saúde Animal, Toledo, PR, Brazil.

This trial was conducted to study the effects of in ovo inoculation at d 18 of incubation on eggs of different weights. Blood was collected from 10 embryos to determine antibody levels against reovirus and avian bronchitis at d 18. Eggs were collected from a breeder flock at 30 wk of age and separated into two groups, light and heavy eggs. These eggs were then incubated in the same machine. On d 18 of incubation the eggs were inoculated with solutions of Maltose, Vitamins, Zinc-Glicine, Glutamine, a mixture of all the solutions, and sodium chloride (control). The solutions were inoculated as Marek's vaccine diluter. After eclosion, 2460 male chicks were sent to the experimental farm and randomly allocated into 60 boxes. The chicks were then submitted to a factorial 2x6 (two egg weights and six solutions) design, totaling 12 treatments with 5 repetitions containing 40 chicks each. Blood samples of one bird per replication were collected and sent to a laboratory to determine antibody levels against reovirus and avian bronchitis at hatch and d 7 of age. Heavier eggs showed a trend (P=0.12 and P=0.11) of higher antibody levels for reovirus at d 18 of incubation and 7 d compared with lighter eggs (5.16 and 6.50; 5.14 and 5.81 for light and heavy eggs at 18 days and 7 days respectively on a logarithmic scale) but not at hatching (7.99 and 7.44 respectively). The inoculation of glutamine improved the antibody response for reovirus at d 7 (6.58) relative to the control (3.56) and zinc inoculation (4.19) levels. The antibody levels of birds inoculated with zinc were also lower than those inoculated with Maltose (6.16), vitamins (6.12), and a mix of all solutions (6.22). No significant differences were found in the antibody levels for avian bronchitis in all ages. The inoculation of solutions in ovo using the in ovo vaccination machine could possibly improve the antibody levels of young birds. Heavier eggs seem to produce birds with higher antibody levels.

Key Words: in ovo nutrition, antibody levels, reovirus, avian bronchitis


Coccidiosis is among the most economically important enteric diseases in turkeys as it has adverse effects on growth performance and resistance to other enteric pathogens. Moreover, the increasing public perception against the use of chemical anticoccidials requires the industry to consider more natural alternatives. Dietary supplementation of oregano oil may be one natural alternative to increase resistance to coccidiosis in turkeys by influencing mucosal barrier function. Two-hundred day-old Nicholas toms were assigned to 20 cages with two levels of coccidia (challenged vs unchallenged) and two levels of oregano essential oils (0 vs 300mg Regano®/kg). The four treatments were as follows: control (CC), Eimeria challenged (EE), oregano essential oils (OEO) and Eimeria challenged plus oregano essential oils (E-OEO). Regano® (Ralco Nutrition, Inc., Marshall, MN) contains oregano oil in a soluble hemicellulose emulsifier. A stock solution of Regano® at 4.7mL/L was given at 1:128 to drinking water for the first week. Each poult was gavaged at 3d with either a 1mL solution containing E. adenoeides and E. meleagrisim (total of 2500 oocysts/bird) or 1mL water. On 8d, proximal ileum samples were taken for scanning electron microscopy (SEM) and histomorphometrical analysis on 8 and 15d. Intestinal weight (rIW) between the gizzard and the cloaca relative to body weight (BW) was determined on 8 and 15d for one bird/cage. There were no significant EExOEO interaction effects on BW or rIW. Eimeria challenge significantly reduced 14d BW (366.4 vs 410.6g, P<0.0001) and increased 15d rIW (0.0836 vs 0.0941, P<0.05). Regano® supplementation significantly reduced 7d BW (152.5 vs 161.7g, P<0.001) but had no significant effect on 14d BW (384.5 vs 392.5g, P>0.05). Relative to SEM images from CC, E-OEO exacerbated villi tip erosion. Growth performance coincided with SEM observations and histomorphometrical analysis. Regano® supplementation did not improve poult response to Eimeria challenge perhaps due to excessive dose level.

Key Words: Eimeria, oregano essential oils, growth performance, intestinal morphology, poult

P159  Chicken selenoprotein P response to viral infection as influenced by dietary selenium source.  J. Read-Snyder*SC3, F. W. Edens1, C. M. Ashwell1, A. Cantor2, and A. Pescatore2, 1Department of Poultry Science, North Carolina State University, Raleigh, 2University of Kentucky, Lexington.

Selenium (Se), an essential trace element, functions in the form of selenoproteins, and selenoprotein P (SelP) plays a role in Se transport, detoxification and antioxidant defense. Avian reovirus (ARV) infection can induce inflammatory responses in which oxidative activity is elevated. Se has an antiviral property against RNA viruses such as ARV. Thus, it is important to know how Se sources influence the expression of SelP in different tissues. Cobb 500 broiler breeder eggs were hatched and chicks were placed into two isolation rooms in brooder batteries and were given parental diets [isocaloric Torula yeast diets consisting either 1) no selenium (less than 0.02 ppm), 2) Sel-Plex (organic selenium {Alltech, Nicholasville, KY} 0.3 ppm) or 3) sodium selenite (0.3 ppm)]. Hatchlings were placed in three dietary treatments in either Control or ARV-Infected groups (30 per group). ARV-Infected groups were given orally ARV-CU98 (10^4 2.6 pfu/chick) and Control chicks were given sterile water. At 7, 14, and 21 days of age, five chicks per treatment group were killed and 500 mg of brain, thymus, pancreas, bursa of Fabricius, and liver were dissected and stored in RNALater at -20°C. Total RNA was extracted and subjected to real-time PCR assays developed for chicken SelP and 18s rRNA. Changes in gene expression were determined by the delta-delta-Ct method. The effects of treatment were determined by ANOVA. The individual differences in Ct ratio among different ages/diets/virus were significantly different (p<0.05). Overall, Se increased SelP expression regardless of source. In liver and brain, SelP expression decreased with age. SelP peaked at 14d in the pancreas, but the bursa SelP expression was lowest at 14d. Generally, there was a transitory increase in SelP expression at 7d in ARV-infected birds followed by decreasing SelP expression. Expression of SelP can be modified by viral infection regardless of Se source.

Key Words: selenium., selenoprotein P, broiler
P160 Degradation of dietary flavonoids by chicken cecal microbiota and biotransformation potential of different carbon sources. M. F. Iqbal*SC and W.-Y. Zhu, Nanjing Agricultural University, China.

In vitro and animal studies have demonstrated that flavonoids have antioxidant and antimutagenic activities. Flavonoid classes vary in their absorption and colonic bacteria can degrade the flavonoids to bioactive form. The aim of the present study was to investigate the potential of chicken microbiota in flavonoids breakdown and the influence of different carbon sources on their degradation into bioactive form. Using an in vitro fermentation system, metabolism of rutin, hesperidin, naringin, genistin and aglycones daidzein and formononetin were investigated. Culture medium was anaerobically incubated at 37°C for 72 h and substrate degradation and metabolite formation were determined by high-performance liquid chromatography. Cecal microflora was found to be active in the conversion of hesperidin and genistin into their aglyconic forms which were further degraded. No metabolites were detected after the fermentation tests with the diglucosidic compounds rutin and naringin and aglycones daidzein and formononetin. A new facultative anaerobic Lactobacillus delbrueckii like bacterial strain, capable of deglycosylation of the flavonoids, was brought into pure culture. To verify the effective bioavailability of flavonoid aglycones, the degradation rates of hesperidin and genistin, following incubation with selected strain, were monitored. Differences in the degradation patterns were observed for the tested flavonoids and considerable amounts of aglycones were accumulated within the first 12 h fermentation. The experiment was repeated with the addition of (1% (w/v) fructo-oligosaccharide (FOS) or organic acids as a carbon source to the fermentation medium. Fructooligosaccharide resulted in further rapid degradation of aglycone hesperitin. However, when organic acids (lactate, acetate or butyrate) were added, flavonoids degradation was suppressed indicating that the metabolic fate of flavonoids may be related to gut organic acids metabolism. The selected strain could also use flavonoid glycosides as external carbon source.

Key Words: carbon source, chicken cecal bacterium, aglycone production, flavonoid transformation

P161 Evaluation of mucosal development of the small intestine in perinatal turkeys by light and electron microscopy. D. V. Bohórquez*1, A. A. Santos Jr.2, and P. R. Ferket1, 1North Carolina State University, Raleigh, 2Florida Hospital College of Health Sciences, Orlando.

The morphology of the intestinal mucosa changes dramatically in the perinatal turkey as it shifts from a lipid-rich in ovo nutrient supply to a carbohydrate- and protein-rich diet after hatch. These changes in mucosal morphology and the associated gut function can be modified by dietary or microbial factors. To our knowledge, this is the first study that evaluates the ultrastructural changes that occurs in the small intestinal mucosa of perinatal turkeys. Scanning electron microscopy (SEM), transmission electron microscopy (TEM) and light microscopy (LM) observations were conducted to study the morphological development of the duodenum, jejunum, and ileum mucosa from embryos at 22E, 24E, 26E, and poult at hatch, 4, 8 and 11 d. SEM and TEM observations were corroborated by histomorphometrical analysis made by LM. Villi topography and size profoundly changed between 22E and 24E, which coincided with the imbibing of amniotic fluid by the embryo. At 22E, the epithelial cell lining was not well-defined and microvilli were scattered, but by 24E the cell lining was well-attached and microvilli were uniformly distributed. SEM micrographs at 26E also revealed that the colonization of protozoa and bacteria in the ileum begins prior to hatch, although well-established colonies were only observed by 11d. Some of the bacteria identified at 11d were segmented filamentous bacteria, which are autochthonous organisms known to facilitate the mucosal development as well as the establishment of other non-pathogenic bacteria including lactobacilli. There was a dramatic 6-fold increase in villi surface area from 22E to 24E. Subsequently, villi surface area continued to double at each time point (26E, Hatch, 4d) until plateau at 8d. Villi morphology changed from finger-like projections before hatch to leaf-like projections after hatch. The profound morphological changes that occur over time in the small intestinal mucosa of perinatal turkeys may favor nutrient supply and the establishment of gut microflora.

Key Words: small intestinal mucosa, villi morphology, gut microflora, electron microscopy, perinatal turkeys

P162 Effect of high fat diet on broiler chicken performance. V. Durairaj*SC1,2, N. B. Anthony1, F. D. Clark1, W. E. Huff2, G. R. Huff2, and N. C. Rath2, 1University of Arkansas, Fayetteville, 2USDA/ARS PPSRU, Fayetteville, AR.

A previous study showed a link between elevated lipid levels and femoral head separation in broiler chickens. Thus, a study was conducted to find the effect of high fat diet on femoral head problems along with other physiological parameters. Four replicate groups of 15 chickens were fed either control diet with 4% poultry fat or diets containing 15% tallow, 15% lard or 15% poultry fat respectively from day 1 through 43 days of age. The chickens were reared in floor pens and given ad libitum water. By the end of the trial, there were no significant treatment effects on body weight or incidences of femoral head separation. However, the bone breaking strength was decreased in all high fat fed groups compared with control diet fed group. Body mass index (Tobec value) showed that the proportion of lean meat was significantly lower in all 15% fat fed groups. Serum chemistry analysis showed significantly elevated triglycerides levels in 15% lard fed groups, but there were no specific trends among other parameters in high fat fed chickens except an elevated level of alkaline phosphatase and decreased level of magnesium. The 15% fat fed chickens showed an accumulation of inflammatory cells such as heterophils in the liver. Body weight and incidence of femoral head separation were not altered in high fat fed chickens, but a decrease in bone strength and a tendency for hepatic inflammation was observed.

Key Words: high fat diet, femoral head separation, body mass index, bone strength, liver inflammation

P163 Response and resistance of several exotic pure chicken lines to heat stress by monitoring rectal temperature. A. Testik*, Cukurova University, Adana, Turkey.

The objective of this study was to determine the response, reaction and resistance of several chicken lines to heat stress by rectal temperature. The experiment was done at Experimental Poultry Farm of Cukurova University in Adana, Turkey. Animal materials of this experiment were 10 exotic chicken lines which are under improvement. These lines are; 2 brown sire, 4 brown dam, 2 white sire and 2 white dam lines.

Poult. Sci. 88 (Suppl. 1)
Rectal temperature of the chicken lines were measured at different environmental temperatures of the poultry house. Test temperatures were between 27-39 oC with step size 1oC. The results indicated that there are statistically significant rectal temperature differences among some lines at various environmental temperatures in the poultry house.

In conclusion; response and resistance of these poultry lines to heat stress were different and it can be possible to obtain resistant hybrid types to heat stress from the convenient lines.

Key Words: hens, lines, stress, rectal, temperature

P164  Assessment of fertility and hatchability of Mexican wild turkey melagris gallopavo intermedia eggs and artificially incubated.  S. G. López*1, J Yañez2, F Cortez2, and J. A. Quintana1, 1FMVZ, Universidad Nacional Autonoma de México, México D.F. México, 2CIVS, SEMARNAT, México, Estado de México, México.

Currently wild turkeys is in risk of extinction due to influences by climate conditions, vegetation growth is scarce and it is insufficient for nesting and there is not enough food for females with their turkey chicks, there is increased pillaging of nests and brood. The above makes artificial incubation of eggs of this species necessary to increase the population of wild turkeys.

The objective of this study was to artificially incubate wild turkey eggs and detect the moment in which embryo deaths occurs during artificial incubation. Wild turkey eggs were received each week for seven weeks from a Wildlife Research Center located in the State of Mexico at 1,830 mosl. All eggs produced during the week were artificially incubated in Brinsea® brand incubators, at 2240 mosl, from day 1 to 21 at a temperature of 37.5°C with 55% humidity. Incubators were modified into hatchers on day 24, with 37.2°C temperature and 75% humidity. On day 24, eggs were candled, infertility established, and embryo mortality phase detected; establishing cause of embryo mortality of non-pipped eggs.

Fertility and hatchability during the seven weeks were: first week 81.25 and 11.54, second 44.33 and 16.28, third 73.8 and 11.29, fourth 65.08 and 26.83, fifth 79.63 and 16.67, sixth 71.11 and 3.3 and the seventh week 64.71 and 18.18% respectively. With the exception of low fertility during the second week due to an animal handling factor the tendency is towards reduction as the seven weeks go by. Average fertility and hatchability during the seven weeks was: 67.43 and 12.72% respectively. In general high mortality during the eighth week. Average fertility and hatchability phase detected; establishing cause of embryo mortality of non-pipped eggs.

Key Words: Cairina moschata, ducks, eggs, disinfection, contamination

P166  The identification of fungi collected from a commercial laying pullets using an automated rep-PCR system.  J. A. Byrd*1, J. L. McReynolds1, C. R. Wanneck2, K. J. Genovese1, and D. J. Nisbet1, 1USDA-ARS-Food and Feed Safety Research Unit, College Station, TX, 2Department of Poultry Science, Texas A&M University, College Station.

In commercial layer houses, the type and number of fungi are normally ignored unless disease/syndrome clinical signs are reported, while the role of fungi in the laying house environment is largely unknown. Numerous preharvest interventions have demonstrated that beneficial bacteria can play a role in improving productions parameters, however, most researchers have ignored the impact that fungi may have on production parameters. The goal of the present study was to monitor any changes in the fungi ecology in a commercial layer house from placement to the onset of egg production. Commercial laying pullets were evaluated for fungi and yeast recovered from cecae at day-of-hatch, 3, 7, 14, 25, and 27 weeks-of-age. Over 200 fungal samples were isolated from the cecae and over 50 fungal samples were further characterized using an automated repetitive sequence based PCR (rep-PCR) methodology to track fungal genera changes during production. Over 10 different fungi and yeast genera were identified using rep-PCR including: Aspergillus spp., Penicillium spp., and Fusarium spp. The relationship between these fungi and production parameters are presented for each sampling point throughout production. The results from the present study will provide a better understanding of the microbial ecology of fungi and yeast in commercial laying hen facilities.

Key Words: laying hen, fungi, rep-PCR
P167 Effects of acidic calcium sulfate + clay or diatomaceous earth litter formulations on broiler growth characteristics and against Salmonella in broilers. E. L. LarrisonSC1, M. A. Davis1, J. A. Byrd2, J. B. Carey1, and D. J. Caldwell1, 1Texas A&M University, College Station, 2USDA/SPARC, College Station, TX.

Research has shown that Salmonella can be prevalent in poultry litter, which can be a source of contamination for newly arrived chicks at the poultry house. Since this organism is a pathogen of concern to the poultry industry, two types of litter amendments were created and tested to determine effects on broiler growth, litter moisture and efficacy against Salmonella colonization. Litter amendments consisted of the combination of Acidic Calcium Sulfate (ACS) with either diatomaceous earth (DE) or hydrated sodium calcium aluminoisolate (HSCAS). Experimental conditions for broiler growth characteristics without the addition of Salmonella consisted of 9 pens in a growout house with each pen containing 15 broiler chicks per pen. Each litter amendment was applied to 3 pens for replicates of experimental groups. One set of 3 pens did not have a litter amendment applied for control. Experimental conditions for testing the efficacy against Salmonella consisted of 12 pens in 4 isolation rooms with 15 broiler chicks in each pen. Each litter amendment was applied to 3 pens for replicates of experimental groups. There were two control groups of 3 pens each consisting of Negative Control (no Salmonella or litter amendment) and Positive Control (Salmonella, no litter amendment). After litter amendment application, 150 ml of Salmonella solution at concentration 3.8 × 10⁶ cfu/ml was applied to the litter for the two treatments and the positive control. Chicks were placed and growout time was 5.5 weeks. Litter samples were taken weekly from 5 areas in each pen and combined for determination of Salmonella counts. At 3 and 6 weeks post placement, 6 birds from each pen were euthanized by CO₂ asphyxiation. The crop and ceca from these birds were tested for counts and/or presence/absence of Salmonella. Further research is planned to fully determine efficacy on Salmonella colonization and if this method is cost effective at the commercial level.

Key Words: broilers, Salmonella, feed conversion, litter, growth


The management pre-slaughter of broilers is probably one of the stages of the production chain which exerts greater influence on qualitative and quantitative indices of the proceeds from slaughterhouse. Thus, the objective of this research was to evaluate the effects of four periods (4, 8, 13 and 17 hours) of pre-slaughter fasting on the carcass yield and commercial cuts of broilers type Griller. On day 35, ten birds per treatment were slaughtered and were considered the variables: income from hot carcass (IHC) and cold (ICC), rate of absorption of water by the carcass and income from commercial cut. The body weight and hot carcass of broilers undergoing four hours of fasting was higher than that of birds subjected to other times of fasting. However there was no difference for the IHC between treatments. For cold carcass weight of only the periods of 4 and 17 hours of fasting differed significantly between them, but is now also for the ICC difference between the four periods of restriction. The carcasses of birds undergoing the greatest time of fasting showed a higher rate of absorption of water after cooling. There were no significant differences in income from parts of carcasses of broilers. The loss of weight and weight of the carcass of broilers is proportional to the period of fasting. The duration of fasting has influence on the absorption of water by the carcass, but not on income, housing and commercial cuts.

Key Words: management, fasting, pre-slaughter, carcass yield, broiler performance

P169 Comparison of commercially available media in recovering Clostridium perfringens from poultry litter. J. T. Krehling* and K. S. Macklin, Auburn University, Auburn, AL.

In times of disease outbreak, it is important to obtain an accurate count of litter bacterial numbers. One of the more important pathogenic bacteria found in litter is Clostridium perfringens. Several commercial media are available for the isolation and cultivation of C. perfringens. To date, studies aimed at determining the effectiveness of these media in recovering C. perfringens have been primarily targeted towards recovery from food products. In this experiment, we tested four differential media (OPSP, SFP, SPS, TSC) for their effectiveness in recovery of C. perfringens from poultry litter. Twelve litter samples taken from built up pens were collected and analyzed for recovery of C. perfringens. While recovery from pure culture comparisons yielded little difference, recovery from litter samples showed a trend towards TSC as a useful medium for enumeration. TSC gave the most consistent counts in nine out of twelve litter samples tested. We feel with it’s ability to keep background bacteria suppressed more so than the other media tested and it’s consistency in this study, TSC is the best medium for enumerating C. perfringens from poultry litter.

Key Words: litter, media, Clostridium perfringens


Protein source for poultry in rural areas in México is a large problem, since commercial protein sources are not available for low income producers, so alternatives are under study to counteract this problem. In order to analyze the nutritional content of seeds of some legumes such as wild mezquite (Prosopis laevigata), huizache (Acacia schaffneri) and algarrobo (Ceratonia siliqua) and a performance trial with broilers, using this seeds as protein sources. Proximal analysis was performed to determine: dry matter (DM), moisture, ash, crude protein (CP) and fatty acid profile. 64 day old Cobb chicks were assigned to a complete randomize design to the following treatments: Control (T1), mezquite (T2), huizache (T3) and algarrobo (T4), four replicates and four chicks per replicate. Performance was evaluated with weight gain, feed intake and feed conversion. The nutritional content of seeds was: mezquite, DM 92.46%, CP 39.0%, ash 5.09%; huizache DM 92.51%, CP 22.94%, ash 4.65%; and algarrobo DM 91.82%, CP 18.39%, ash 4.11%. The fatty acid profile for the mezquite was: 12.73% palmitic acid, stearic
Agricultural experiments for scientific writing. Scientific writing should include statistical analyses as important methods for interpreting results of experiments with poultry. Several ANOVA and regression models were computed with or without a Class statement that signifies classification variables. With the Class statement, SAS computes the SS (sums of squares) with n-1 degree of freedom where n is the levels of each independent variable. Without the Class statement, SAS computes the SS with only 1 degree of freedom, the regression model. Two independent variables (x1 and x2) and one dependent variable (y) were analyzed. There were 6 levels of x1 and 2 levels of x2. Using either one-way ANOVA with Duncan's New Multiple Range Test or two-way ANOVA, no differences between treatments were detected. Using a linear regression model, x2 and the x1 × x2 interaction term had significant p-values (0.0222 and 0.0103, respectively). For a second order polynomial regression model, only x2 had a significant p-value (0.0279). When an ANOVA with components including linear and quadratic terms was computed, the interaction term between linear x1 and x2 had a significant p-value (0.0281). The choice of design is important because conclusions from the subsequent analyses depend on the particular design used.

Key Words: ANOVA, regression, interaction, Duncan, SAS

**P172**  

Statistical analyses are important methods for interpreting results of agricultural experiments for scientific writing. Scientific writing should clearly communicate the particulars of the research being described in a way that it can be precisely repeated. Comparing differences between several treatments by the probabilities (p-values) that differences in means are due to chance is often described in articles in Poultry Science and related journals. Most data were subjected to ANOVA (analysis of variances) or regression models using the GLM (general linear models) procedure of SAS (statistical analysis software) program in articles to determine the p-values. There are several ways to program the SAS GLM procedure depending on the desired comparisons leading to quite different conclusions.

Data from a recent experiment was analyzed by several SAS GLM procedures to show how different SAS programming models can lead to different interpretations of the same data. Several ANOVA and regression models were computed with or without a *Class* statement that signifies classification variables. With the Class statement, SAS computes the SS (sums of squares) with n-1 degree of freedom where n is the levels of each independent variable. Without the Class statement, SAS computes the SS with only 1 degree of freedom, the regression model.

Two independent variables (x1 and x2) and one dependent variable (y) were analyzed. There were 6 levels of x1 and 2 levels of x2. Using either one-way ANOVA with Duncan's New Multiple Range Test or two-way ANOVA, no differences between treatments were detected. Using a linear regression model, x2 and the x1 × x2 interaction term had significant p-values (0.0222 and 0.0103, respectively). For a second order polynomial regression model, only x2 had a significant p-value (0.0279). When an ANOVA with components including linear and quadratic terms was computed, the interaction term between linear x1 and x2 had a significant p-value (0.0281). The choice of design is important because conclusions from the subsequent analyses depend on the particular design used.

Key Words: chick, legume, seeds, fatty acid, protein

**P173**  
House characteristics and energy utilization in poultry houses raising small broilers. D. G. Overhults¹, A. J. Pescatore*¹, R. S. Gates², J. P. Jacob¹, M. Miller³, and J. Earnest Jr.¹, ¹University of Kentucky, Lexington, ²University of Illinois, Urbana, ³Kentucky Poultry Federation, Winchester, KY

An energy efficiency assessment was conducted on seven farms growing 1.8-kg broilers on a 36-d growout schedule. All houses were approximately 12-m x 157-m, with insulated dropped ceilings and tunnel ventilation. Houses on three farms had 60-cm sidewall curtain openings. On four farms, the sidewall curtain openings had been insulated and covered. All farms used propane-fired, forced-air heating systems with no radiant brooders. Total installed heating capacity was approximately 440 kW (1.5 million BTU/hr). All houses had either 8-9 120-cm or 130-cm tunnel ventilation fans. For each farm, propane and electricity use were obtained for the calendar years 2006-07. Production records for the same time period were provided by the integrator. Annual propane use averaged 21,119 L/house with a range of 12,270 to 25,877 L/house. The average yearly electricity usage was 30,263 kWh/house with a range of 21,277 to 39,968 kWh/house. On a live weight basis, propane use was 32.0 to 66.4 L/1000 kg with an average of 53.7 L/1000 kg. Electricity use was 1.0 to 100.1 kWh/1000 kg with an average of 77.0 kWh/1000 kg. Airspeeds during full tunnel ventilation were measured at bird level in 14 houses about 23 m upstream from the tunnel fans at four equally spaced locations. Mean airspeeds were 1.98 to 3.15 m/s with an average of 2.46 m/s for all farms. At each farm, a closed-house static pressure test was conducted.

Key Words: ANOVA, regression, interaction, Duncan, SAS
conducted in one house. Fans for which in-situ performance data had been obtained were selected for this test, thus providing an estimate of the actual air leakage rate at the various static pressures recorded during the test. Sufficient data were available from five farms to estimate the air leakage rate. At a static pressure of 0.1 inches of water, estimated air leakage rates ranged from 27,558 to 47,739 m³/h.

Key Words: broiler houses, energy efficiency

P174 The Kentucky Poultry House Evaluation Service. D. G. Overhults¹, A. J. Pescatore*¹, R. S. Gates², J. P. Jacob¹, M. Miller¹, and J. Earnest Jr.¹. ¹University of Kentucky, Lexington, ²University of Illinois, Urbana, ³Kentucky Poultry Federation, Winchester, KY.

The Kentucky Poultry House Evaluation Service (KPHES) is an ongoing project involving on-farm energy assessments for broilers raised in Kentucky. Objectives are to improve production efficiency by properly operating and maintaining equipment; to reduce energy costs by adopting energy-saving practices and installing cost-effective upgrades; to evaluate the cost effectiveness of potential house improvements; and to share with all growers of each integrator complex the information obtained from the evaluations. Approximately 60 sites, 6-12 associated with each complex, will be selected for on-farm assessments. The assessment team examines the building envelope, heating system, lighting, ventilation system, static pressure inlet system, cooling and tunnel ventilation, environmental controls, and electrical service. Each producer receives a written report outlining potential improvements, energy savings potential, and estimated payback periods for possible upgrades. After completing the on-farm assessments within an integrator complex, results are presented to all complex growers focusing on typical problems found, energy efficiency practices recommended, and cost effective upgrades that could be implemented for producers with similar housing characteristics. Work has been completed on 20 farms at two complexes and is underway at others. Some potential energy saving opportunities common to several farms already evaluated include adding attic insulation, closing and insulating sidewall curtains, installing attic air ventilation inlets, installing mixing fans, and changing from incandescent to compact fluorescent or cold cathode lighting. In most cases, estimated energy savings associated with these improvements provide simple payback periods of less than five years. Additional potential improvements were also identified but generally have longer projected payback periods.

Key Words: broiler houses, energy efficiency, energy audit

P175 Administration of Bacillus subtilis C-3102 (CALSPORIN®) spores plus glucose via drinking water of broiler chickens prior to slaughter to minimize weight loss during feed withdrawal and to reduce pathogen load. H. Horikawa¹, K. Iwasaki¹, K. Miyazaki¹, T. Marubashi¹, and D. M. Hooge*². ¹Calpis Co. Ltd, Tokyo, Japan, ²Hooge Consulting Service, Inc., Eagle Mountain, UT.

In Exp. 1, male broiler chickens (10/treatment x 3 treatments) from 48 to 51 d of age were given tap water or water plus an additive containing either Bacillus subtilis C-3102 (Bs C-3102) spores (CALSPORIN®; 6 x 10⁷ cfu/mL water) and glucose (4% by weight) or glucose alone during the last 2 d of feeding and 1 d of feed withdrawal to determine BW change. The BW gain in the 2 d before feed withdrawal and the total BW gain over 3 d were both greatest in the group receiving the combination additive (Bs C-3102 plus glucose), with the glucose fed group’s BW gains being intermediate, and the tap water group’s BW gains being lowest. Birds given water plus Bs C-3102 and glucose had larger BW gain while being fed solid feed for 2 d than the birds given water plus glucose. A field study (Exp. 2) was conducted on broilers in paired houses beginning at 54 d of age. From each house during the pretrial period (i.e., before 54 d), 30 fresh fecal samples were collected, and the 2 flocks were shown to have no remarkable difference in the amount of Salmonella detected initially. On d 1 (54 d), birds had access to solid feed and either tap water or water plus Bs C-3102 and glucose (5% by weight). On d 2 (55 d), birds had access to tap water or treated water but no feed. Birds were caught for slaughter on d 3 (56 d), and 30 fresh fecal samples per house were collected. The combination treatment in water had 7/30 Salmonella positives and 3.98 ± 0.40 log 10 cfu/g excreta whereas those given the tap water treatment had 18/30 Salmonella positives and 4.55 ± 0.66 log 10 cfu/g excreta (positive sample means; P < 0.05). The mixture of Bs C-3102 and glucose (4% or 5% by weight) in water was effective at increasing BW gain during feeding, reducing BW loss during feed withdrawal, and reducing the proportion of Salmonella positive birds and their salmonella counts versus results with tap water.

Key Words: Bacillus subtilis C-3102, broiler chicken, Calsporin, feed withdrawal, Salmonella


Previously, we have intensely screened for environmental Bacillus isolates capable of utilization of ammonia as the sole-source of nitrogen, with high sporation/spore stability characteristics. Two Bacillus isolates Bacillus subtilis/amyloliquefaciens (PHL-DW) and Bacillus cereus (PHL-CW) were presently evaluated for effects on BWG and Salmonella reduction in broiler chicks. Using a solid-state fermentation method we were able to produce spores greater than 10⁶ cfu/g. To test the ability of the probiotics to decrease Salmonella, the spores in the solid-state media were finely ground with a coffee grinder then mixed with feed using a Hobart-type mixer. Broiler chicks were fed feed containing either PHL-DW at concentrations of 10⁴, 10⁵, 10⁶, or PHL-CW at 10⁶ cfu/sps/g feed from day-of-hatch throughout the study. Chicks were challenged with Salmonella typhimurium (ST) at day-of-hatch (10⁶ cfu/chick by oral gavage). In experiment 1, the cecal tonsils were aseptically removed and cultured for the presence or absence of ST by enrichment 14 d post-challenge. There was a significant (p < 0.05) reduction in percent ST-positive cecal tonsils from birds that were treated with Bacillus; DW 10⁵ (43%), 10⁶ (67%), 10⁷ (33%), CW 10⁵ (40%), as compared to non-treated controls (87%). In exp 2, a significant (p < 0.05) reduction in ST-positive cecal tonsils from DW 10⁷ (27%) was noted as compared with non-treated controls (80%) at 12 d post-challenge. No consistent effect of Bacillus treatment on body weight was observed in these experiments. While no direct effect of these Bacillus isolates on Salmonella growth was observed in vitro during preliminary experiments, results from the present study suggest that stable Bacillus spores capable of ammonia fixation may have beneficial probiotic effects on Salmonella colonization when provided at sufficient concentrations with continuous feeding.

Key Words: Bacillus, Salmonella, probiotic
**P177** Interactions of probiotic administration and coccidiosis vaccine on avian mucosal immunity in broilers. J. T. Lee*1, D. I. Caldwell1, M. Mohr2, R. Beltran2, G. Schatzmayr2, S. Fitz-Coy1, C. Broussard1, and M. B. Farrell1, 1Department of Poultry Science, Agrilife Research, Texas A&M University, College Station, 2Biomin GmbH, Herzogenburg, Austria, 3Intervet-Schering-Plough Animal Health, Millsboro, DE.

The oral administration of probiotics has been demonstrated to improve heterophil function, increase antibody titers, enhance cell mediated immunity and reduce the incidence of pathogenic bacteria. The objective of the present study was to determine if the immune-potentiation of the avian gut with probiotic (Biomin® PoultryStar, Biomin GmbH) has an effect on coccidiosis vaccine (Coccivac®-B, Schering-Plough Animal Health) efficacy. Broilers were fed a conventional starter diet in experiment 1, while a diet with a slightly higher protein and amino acid profile which has been shown to improve broiler performance during coccidiosis vaccination was fed in experiment 2. Four hundred chicks were randomly divided into four treatment groups consisting of a negative control, probiotic, vaccine, and a combination of probiotic and vaccine. Blood was collected on day 7, 14, and 21. Four pools of peripheral blood were taken per group and immune cells were isolated with mcelleulose and discontinuous density gradients. Heterophil and mononuclear cell fractions were each assayed for oxidative burst using DCFDA, a fluorescent substrate. Lymphocyte proliferation was quantitated using WST-1, a formazan based colorimetric indicator. In Experiment 1, increases (P<0.05) were observed in all groups during the sampling period compared to the negative control in heterophil oxidative burst and lymphocyte proliferation, while monocyte oxidative burst was increased (P<0.05) in the combination probiotic and vaccine group. In experiment 2, increases (P<0.05) were observed in heterophil oxidative burst in all treatment groups and monocyte oxidative burst was increased in the vaccine group compared to the negative control. In the course of the two trials, the combination probiotic and vaccine group yielded increased immune cell function at multiple time points demonstrating an additive effect of the probiotic and coccidiosis vaccine. These data indicate the ability of probiotic bacteria and live oocyst vaccine to stimulate immune function in the avian mucosa.

**Key Words:** broilers, cornflakes wastes, performance, nutrient retention

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**P178** Effect of dietary levels of cornflakes waste on the performance and nutrient retention of finishing broilers in humid tropical environment. S. O. Omoikhoje*1, E. T. E. Ehebha1, D. O. Obasoyo3, S. A. Atole1, and A. M. Bamgbose1, 1Department of Animal Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria, 2Department of Animal Nutrition, University of Agriculture, Abeokuta, Ogun State, Nigeria, 3Bendel Feed and Flour Mill Ltd., Ewu, Edo State, Nigeria.

One hundred and twenty Anak 2000 broiler chickens of twenty eight days old were used to assess the effect of replacing maize with cornflakes waste meal (CFWM) on their performance and nutrient retention. Five finisher diets (1, 2, 3, 4 and 5) were formulated and cornflakes waste meal was incorporated in the diets at concentrations of 0, 25, 50, 75 and 100% respectively. Each diet was fed to a triplicate group of twenty four broilers each ad libitum comprising eight chicks per replicate. From the results, daily weight gain was higher (P<0.05) in birds fed 75% CFWM than those, on other dietary treatments. In contrast, birds fed the control diet (0%CFWM) had higher (P<0.05) daily feed intake than those fed the CFWM based diets. Dietary inclusion of CFWM at 75% improved (P<0.05) the feed to gain ratio and protein efficiency ratio of birds compared to those on other dietary treatments. Apparent digestible dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract were increased (P<0.05) as the dietary inclusion of CFWM increased from 0 to 75%. This suggests that CFWM can successfully be used to substitute maize up to 75% as a satisfactory energy source in broiler finisher diets with significant improvement in growth and nutrient retention.

**Key Words:** broiler, probiotic, coccidiosis vaccination, immune function

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**P179** Performance comparison and lysine requirements of seven commercial brown egg layer strains during phase two. P. K. Gunawardana*SC, D. A. Roland, and M. M. Bryant, Auburn University, Auburn, AL.

This study was a 3 × 7 factorial arrangement with 3 lysine levels (0.828, 0.747, and 0.680) and seven commercial brown egg layer strains. The objective of this experiment was to determine the effect of increasing dietary lysine on performance, egg composition, egg solids, egg quality and profits in seven commercial brown egg layer strains and to determine the lysine requirement during phase two (from 39 to 52 wk of age). This experiment lasted 14 weeks. Seven strains of hens (n = 240 of each strain) at 39 week of age were randomly divided into 21 treatments (8 replicates of 10 birds/treatment). The results showed that there were no interactions between lysine and strain on any parameter. Lysine had significant effects on feed consumption, egg production, egg mass, feed conversion, egg weight, egg shell components, percent yolk and whole egg solids, albumen and yolk weight, egg specific gravity, yolk color, and haugh unit. There were significant strain effects on feed consumption, egg mass, feed conversion, egg weight, albumen and yolk components, whole egg solids, albumen and shell weight, egg specific gravity, body weight, shell color, and haugh unit. Strain 1 had the best overall performance. All strains were laying 89.5 to 92.5% at 52 weeks of age. Average egg weight (39wk to 52wk) was 63g, varying from 61.5 to 63.6 g between strains. Average feed intake was 112.1 g/hen/day varying from 108 to 114 g/hen/day between strains. Average egg weight of hens fed diets containing the highest lysine level was 3.38g heavier than hens fed the diets containing the lowest lysine level. Increasing dietary lysine from 0.680 to 0.828% significantly improved feed conversion from 2.03 to 1.91 g/food/g egg and increased egg mass from 54.0 to 59.30 g/hen/day. Average lysine intake of hens fed 0.828% level was 939 mg/hen/day varying from 907 to 964 mg/hen/day between strains. Because egg and ingredient prices often change, there can be no fixed dietary lysine level for optimal profits.

**Key Words:** brown layer strain, lysine requirement, shell color

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A study was conducted to test the effect of Dried Distillers Grains with Solubles (DDGS) dietary inclusion rates in SCWL pullet rations on feed intake, body weight and growth performance. Four hundred fifty
Hy-Line W-36 pullets were fed diets containing 0, 2.5, 5.0, 7.5, 10.0, or 12.5% DDGS from day-old to 16 weeks of age. The starter diet was formulated to provide, 2950 Kcal/kg ME (Metabolizable Energy), and 20.0% Protein, and fed from day-old to 6 wks of age. The grower diet was fed from 7 to 9 wks of age and formulated to provide, 3000 Kcal/kg ME, and 18.0% Protein. The developer diet was formulated to provide, 3050 Kcal/kg ME, and 16.0% Protein, and fed from 10 to 15 weeks of age. The pre-lay diet was fed for one week (16) and formulated to provide, 3050 Kcal/kg ME and 17.0% Protein. The DDGS BPX® used to formulate the diet was provided from Dakota Gold® contained 2798 Kcal/kg ME and 26.7% crude protein. Fifteen chicks were placed per cage with 5 replicate cages per dietary treatment in a randomized complete block design. Feed intake and body weight were measured every week. Average feed intake was similar (p > 0.05) between treatments with a comparable feed intake to the Hy-Line W-36 manual. The overall avg. pullet weights were similar (p > 0.05) between dietary levels of DDGS. Time by treatment interaction was approaching significance (p =0.07) for pullet weight. Pullets fed 12.5% DDGS had greater (p< 0.05) body weight compared to the other dietary treatments at 14, 15 and 16 weeks of age. There was no difference in overall pullet weight gain (p > 0.05) between treatments. Dietary treatments had no effect on the mortality rate with only 0.07% total mortality. In summary, feeding DDGS up to 12.5% had no negative affect on body weight, growth rate and feed intake. Body weight, growth rate, and feed intake are comparable to the Hy-Line breeding manuals.

Key Words: DDGS, dried distillers grains with solubles, pullets, hy-line


The experiment was conducted at the Agrarian Sciences Center of UFPRB, Brazil. The aim was to evaluate the effect of proteic reduction in diets with supplementation of valine and metabolizable energy (ME) levels on broiler chickens performance from 1 to 42 days. Seven hundred and twenty male broiler chicks, Cobb, were distributed in a completely randomized design, in a factorial scheme 2 x 3 (two CP levels x three ME levels). To the treatments 1, 2 and 3, only L-Lysine, DL-Methionine and L-Threonine were added, which allowed CP to attend digestible amino acids (DAA) ratio, and the ME varied, -50, 0 and +50 kcal • kg-1, respectively, according to the levels recommended by Rostagno et al. (2005). In treatments 4, 5 and 6, besides these amino acids, L-Valine was also added, resulting in a CP reduction until the level which attends the other DAA requirements, and ME was similar to that in the previous treatments. The evaluated variables were: feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). No interaction between CP and ME levels was observed for the evaluated variables. FI from 35 to 42 days was higher (P<0.05) for birds receiving diets with greater CP without L-Valine supplementation. Except for FI during this phase, there was no significant effect (P>0.05) of dietetic CP on broiler chickens performance in none of the phases. On the other hand, ME levels influenced FI during the phases of 1 to 7 and 1 to 21 days (P<0.05), given the birds fed 50 kcal • kg-1 short, presented greater FI. WG was also influenced (P<0.05) by dietetic ME levels, since birds fed 50 kcal • kg-1 above requirements presented higher WG, in comparison to those submitted to diets formulated according to requirements or with 50 kcal • kg-1 of ration below the requirements. Thus, one can affirm that it is possible to reduce diet CP with Valine supplementation without causing any harm to birds performance and that the increase in 50 kcal • kg-1 of ME improved broilers performance.

Key Words: amino acid, crude protein, ideal protein, nutrition, requirement

P182 The distribution of crude protein and amino acid content in corn and soybean meal. N. Sriperm*,1, G. M. Pesti1, and P. B. Tillman2, 1University of Georgia, Athens, 2Ajinomoto Heartland LLC, Chicago, IL.

This study examines the critical assumption of a normal distribution of crude protein and amino acid content in corn and soybean meal (SBM). Data were collected from the Ajinomoto Heartland LLC laboratory analysis database between 2002 and 2007. After outliers were removed, the numbers of crude protein and amino acid measurements were between 260 to 312 for corn and 442 to 533 for SBM. Tests of normality for crude protein (CP) and each amino acid were performed, for both feedstuffs, using the Shapiro-Wilk test. Histograms and correlation analysis between crude protein and amino acids were defined and investigated. Results indicated Methionine, Methionine plus Cysteine, Threonine, Valine, Arginine and Leucine were not normally distributed in corn (p < 0.05). In addition, crude protein and most of the amino acids (except Arginine and Leucine) were not normally distributed in SBM (p < 0.05). Linear relationships existed (p < 0.0001) between CP and most of the amino acid levels in corn and Leucine. The relationship between CP and Leucine for corn and CP and Isoleucine for SBM were found to be non-linear (significant quadratic terms at p < 0.05 and p < 0.0001, respectively). These results indicate a need for normality testing of ingredient nutrient compositions. Those nutrients which are not normally distributed may need to be represented in least-cost feed formulation by the median rather than the mean, especially for lysine in SBM. The data indicated a bi-phasic distribution of lysine in SBM suggesting perhaps some SBM samples may have been either under/over-processed or there are two distinct cultivars included in the dataset. It is suggested that mathematical formulation models may need to be adapted to incorporate distribution functions that better approximate nutrient levels in feedstuffs. The lack of normality in SBM data is of questionable importance for most amino acids as the means and medians were within 0.01%. However, the distribution of lysine in 442 SBM samples was obviously not normal with 277 samples between 2.69 and 3.00 and 165 samples between 3.10 and 3.48.

Key Words: amino acid, protein, corn, soybean meal, normal distribution

P183 Ileal digestibility of amino acids in feedstuffs for White Pekin ducks. C. Kong* and O. Adeola, Purdue University, West Lafayette, IN.

Two hundred eighty-eight White Pekin ducks were used in a 5-d trial to determine apparent ileal amino acid digestibility of various feed ingredients. Six feed ingredients including soybean meal (SBM), meat and bone meal (MBM), canola meal (CM), corn distillers' dried grains with solubles (DDGS), corn, and wheat were used for study. The feed ingredients served as the sole source of amino acid in semipurified diets
composed of dextrose, soy oil, solka floc, minerals and vitamins. The ducks received standard duck starter diet for 13 d from day 1 post-hatch and at day 14, were sorted by weight and allocated to 6 dietary treatments in a randomized complete block design. There were 8 replicate cages per treatment and 6 ducks per replicate cage. Beginning from day 14, ducks received the assay diet for 5 d and ileal digesta was collected on day 19. Ileal N digestibility was greatest (P < 0.01) in diet with SBM and the range was 72.4 (MBM) to 88.3% (SBM). Ileal amino acids digestibility was highest for SBM among the feed ingredients. Soybean meal had the greatest digestibility for lysine followed by corn, wheat and MBM with DDGS being least digestible (P < 0.01). Methionine digestibility in SBM was greater (P < 0.01) than in corn, wheat, DDGS or CM, whereas MBM was the least digestible. For threonine, SBM had the highest digestibility and corn was the least digestible (P < 0.01), but there were no differences among other feed ingredients. The ranges in ileal amino acid digestibility were 69.2 (DDGS) to 90.3% (SBM) for lysine, 78.4 (MBM) to 91.8% (SBM) for methionine, 61.6 (corn) to 84.0% (SBM) for threonine, and 78.9 (MBM) to 93.0% (SBM) for tryptophan. In conclusion, there are considerable differences among protein sources in their ability to supply amino acid in a form utilizable by the duck. Therefore, more accurate diet formulation may be attained if digestible amino acids in a feed ingredient are taken into account.

**Key Words:** White Pekin ducks, amino acid, nitrogen, ileal digestibility, feed ingredient

**P184 Effect of sex, protein and energy level on broiler carcass composition.** B. L. Schneider*, M. J. Zuidhof, R. A. Renema, M. Betti, and V. L. Carney, Poultry Research Centre, Edmonton, AB, Canada.

As feed prices continue to rise, least cost formulation is routinely used to minimize input costs for the broiler industry. These diets may limit energy or protein to reduce the cost of a diet. To determine the effect of sex, dietary protein and energy level on carcass composition, 288 Cobb-Avian 48 broilers were raised sex-separately on one of 9 diets with one of 85, 100, or 115% dietary balanced protein (DBP) and one of 94, 97 or 100% of breeder recommended metabolizable energy (ME) levels. Eviscerated carcass fat, protein and ash were measured at 2 ages (42 and 52 d).

Males had higher percentages of carcass protein and ash than females (19.9% and 2.5% vs 19.2 and 2.3%, respectively), whereas females had significantly more carcass fat than males (11.0 vs 9.0%, respectively). Dietary ME affected all carcass composition traits. Reducing dietary ME below recommended levels resulted in lower carcass ash. The relative amount of carcass protein was highest in the 100% ME treatment, with no difference between the 97 and 94% ME treatments (19.7 vs 19.5 and 19.4%, respectively). Reducing ME below recommended levels resulted in significantly fatter carcasses (11.0, 9.7, and 9.3% carcass fat for 94, 97 and 100% ME, respectively). DBP had an interesting effect on carcass fat, with the lowest level in the 100% DBP treatment (9.6%). Providing DBP above or below the recommended level resulted in a significantly higher proportion of carcass fat (10.0 and 10.4%, respectively). DBP did not affect carcass protein. Although least cost diet formulation minimizes input costs, the effects of limiting dietary ME and/or DBP on carcass fatness may reduce the profitability of the breiler production system.

**Key Words:** dietary energy, dietary balanced protein, carcass composition, broiler


It has been suggested that Vitamin D3 stimulates an independent phosphate transport mechanism in the intestine, and improved absorption of phosphorus. The objective of this study was to examine if supplemental phytase and Vitamin E affect growth performance of chickens and also reduce phosphorus requirements. A completely randomised design experiment was conducted to examine the effect of dietary supplementation of microbial phytase (Naphulos 5000) and vitamin D3 on the performance, nutrient utilisation and ash contents of toe and tibiae of broiler finisher chickens. Two hundred and eighty eight 288 straight-run 21 day old Arbor Acre broiler chicks were divided randomly into 9 dietary treatments with 4 replicates, each replicate consisting of 8 birds. The dietary treatments were: a basal diet containing 20% crude protein with 3100 Mcal/kg DM ME without dicalcium phosphate (DCP)(negative control), basal + DCP (positive control), basal+ phytase at the rate of 350, 700, 1050 or 1400 FTU/kg and basal + vitamin D3 at the rate of 250, 750 and 1500 IU/kg, respectively. At the end of the 12 weeks feeding trial, six birds from each treatment were slaughtered to determine the dressing percentage and meat yield. A digestibility trial was also conducted following the feeding trial to determine the apparent metabolisable energy (AME) and nutrient digestibility. Birds fed diets supplemented with either phytase or vitamin D3, showed similar performance to those fed diets adequate phosphorus. No difference was noted in the AME values and digestibility of DM, CP, Ca and P, among the dietary treatments. With the exception of the Shank weight, dressing percentages and weights of internal organs were not influenced by phytase or vitamin D3 supplementation. Phosphorus excretion was reduced in the diets supplemented with phytase or vitamin D3. Toe and tibiae ash were higher in birds fed phytase or vitamin D3 compared to those fed diets adequate in P.

**Key Words:** phytase, vitamin D3, broiler, phosphorus, calcium

**P186 Effect of Phyzyme® XP inclusion in low metabolizable energy, calcium and available phosphorous diets on broiler performance and markers of phosphorous utilization.** A. Diaz*, S. Soderstrom1, E. Pierson2, M. Hruby3, A. Mireles5, and B. D. Humphrey1, 1California Polytechnic State University, San Luis Obispo, 2Danisco Animal Nutrition, St. Louis, MO, 3Foster Poultry Farms, Modesto, CA.

The objective of this experiment was to determine the effect of Phyzyme® XP 5000G Feed Phytase on broiler performance and markers of phosphorous utilization when in broilers fed diets with reduced metabolizable energy (ME), available phosphorous (avP) and calcium (Ca). One-day old straight run Cobb broilers were randomly assigned to one of eight replicate floor pens and provided one of four experimental diets. The positive control diet was formulated to meet or exceed NRC recommendations for the growing broiler chick. For each phase, the negative control (NC) diet contained reductions of 40 kcal/lb, ~ 10%, and ~ 25% in ME, Ca and avP, respectively. Phyzyme® XP was added to the negative control diet at an inclusion rate of 0.5%. All diets were fed as a mash. Differences between dietary treatments were maintained through all feeding phases. Feed intake, body weight, gain and mortality over the 43 day experimental period did not differ between dietary treatments (P>0.05). Phyzyme® XP addition to the negative control diet improved feed conversion, increased hot carcass weight, reduced
visceral weight and increased carcass yield compared to chicks fed the negative control diet (P<0.05). Phosphorus utilization was assessed by measuring bone strength and the mRNA abundance of the type IIB sodium phosphate (Nptb2) cotransporter in duodenal, jejunal and ileal mucosal scrapings by quantitative real-time PCR. Chicks fed NC diets containing Phyzyme® XP required greater tibia break force (kg) compared to chicks fed comparable nonsupplemented NC diets. The mRNA abundance of Nptb2 was highest in the duodenum (P<0.05). The negative control diet tended to increase Nptb2 mRNA abundance in the jejunal and ileum (P<0.2) compared to positive control and Phyzyme® negative control diet. The addition of Phyzyme® XP to NC diets enhanced tibia break force and increased carcass yield compared to NC diets.

**Key Words:** energy, phosphorous, calcium, enzyme, gene expression

**P187** Risk constrained programming: A visual basic for applications (VBA) excel spreadsheet program with solver for diet formulation. W. B. Roush* and S. L. Branton, USDA-ARS Poultry Research Unit, Mississippi State, MS.

A diet formulation program was written to take advantage of the advanced techniques available to developers of Excel spreadsheet programs and to encourage software developers to incorporate nonlinear programming in their mathematical programming packages. A menu driven program was developed in an Excel spreadsheet using Visual Basic for Applications (VBA). Solver served as the algorithm for linear program (LP) and stochastic program (SP) calculations. The menu consists of buttons for price, choosing ingredients, ingredient specifications, nutrient specifications, formulation, printing and exiting. Prices Button updates price information. Choose Ingredients Button produces a form from which ingredients can be chosen for the diet. Once the ingredients are highlighted, the choose ingredients button on the form is activated and the ingredients chosen with the accompanying information are transferred (by a transfer macro) to the LP and SP menus for formulation. Ingredient Specifications Button indicates restriction to be placed on ingredients. That is, definition of the chosen ingredient level as a minimum, maximum or equality. Nutrient Specifications Button shows the nutrients of interest, the requested requirement and the requested level of probability for meeting the requested requirement. The Formulation Button activates the Solver algorithm to calculate the LP and SP formulations. The screen is transferred to a summary window that simultaneously shows the results of the formulation. The Print Button sends the results to the printer. The Exit Button terminates the program. SP has been shown to improve the accuracy and precision of diet formulation with variable ingredients (e.g., Distillers Dried Grains). The menu driven Excel program with VBA allows the nutritionist to formulate and compare results of diets formulated with LP and SP in an atmosphere that does not resemble the traditional spreadsheet program.

**Key Words:** visual basic for applications, diet formulation, linear programming, stochastic programming


An experiment was conducted to evaluate the effects of feeding reduced levels of trace mineral in proteinate form (Bioplex®, Alltech, Inc.) on white layer pullet development. Eight replicate groups of 16 replacement pullets, 1-day of age, were randomly assigned to each of five dietary treatments. Pullets were housed in cages and received ad libitum access to feed and water. Treatments consisted of feeding corn-soybean meal-based starter and grower diets alone (control), supplemented with Cu, Mn, Fe and Zn at 25, 50 or 100 per cent of the NRC (1994) requirements in the form of proteinsates or 100 per cent of the NRC requirements in the form of inorganic salts. The excreta samples were collected at week 15 of bird age. At 17 wk of age, the trial was ended. The birds were weighed individually for the measurement of uniformity. A total of 10 birds from each treatment were randomly selected for collection of liver and tibia samples. The concentration of Cu, Mn and Zn in the tissue and excreta samples was analyzed. There were no differences among all dietary treatments in body weight, feed intake, uniformity and liver mineral content. The tibias and excreta samples from birds fed control diet with no mineral supplementation had significantly lower (P<0.01) Zn and Mn concentration than those from birds fed other diets. The tibias from birds fed 100% NRC level of supplementation as Bioplex® had higher (P<0.01) Mn concentration than those from birds fed 25% NRC level of supplementation as Bioplex®. The excreta samples from birds fed 25% level of supplementation as Bioplex® had lower (P<0.01) Zn and Mn concentration than those from the birds fed other diets except control diet. The results indicate that 25% NRC levels of trace mineral supplementation did not significantly improve the performance of white layer pullets when compared to 100% NRC levels of trace mineral supplementation.

**Key Words:** organic minerals, white layer pullets, dietary trace mineral levels,

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**P188** Use of pecan fiber to enhance non-feed withdrawal molting programs. N. M. Dale*, University of Georgia, Athens, GA.

During the past 5 years there has been increasing interest in the use of high-fiber diets as an alternative to fasting in molting programs for laying hens. The objective of such diets is to reduce metabolizable energy (ME) intake, and by doing so achieve a reduction in body weight and a cessation of egg production without resorting to complete feed withdrawal. Pecan fiber (PF) (the red-brown layer immediately inside the pecan hull) has been suggested as an ingredient to amplify the reduction in energy intake achieved with high-fiber diets. Three studies were conducted as an initial assessment of this hypothesis.

In the first study 0, 3, 6 and 9% PF were added to a commercial layer ration for a period of 6 days. Feed intake was negatively correlated with degree of inclusion of PF, and returned to pre-treatment levels immediately after withdrawal of the ingredient. The second study consisted of four treatments: a commercial layer ration (2820 kcal/kg) as a positive control, a high-fiber, low ME ration (1760 kcal/kg) as negative control, and either 5 or 10% PF added to the negative control. Once feed consumption stabilized after 7 days, daily ME intakes were 290 kcal/bird in the positive controls, 215 kcal/bird for the high-fiber treatment, and 107 and 72 kcal/bird in the 5 and 10% PF treatments, respectively. In the third study 0, 3, 6, 9, 12, or 15% PF were added to the high-fiber ration, with daily ME intakes of 136, 125, 118, 86, 75, and 41 kcal/bird, respectively, after 7 days treatment. This led to body weight losses of 14.7, 15.2, 16.0, 19.3, 23.8 and 26.9% in the respective treatments. In the 9, 12, and 15% PF treatments, a cessation of egg production was observed after 6 days feeding. It is concluded that Pecan Fiber is an effective means of reducing caloric intake in laying hens, and has the potential to make a significant contribution to non-feed withdrawal molting programs. On the basis of these studies, testing under commercial conditions appears to be warranted.

**Key Words:** pecan fiber, non-feed withdrawal molting, laying hens
level of supplementation as Bioplex® in pellet diets can reduce the mineral excretion, but has no negative influence on performance and tissue mineral concentration in comparison with 100% NRC level of supplementation as inorganic salts.

**Key Words:** pullet, trace minerals, organic minerals, proteinate

**P190** Effect of enzyme supplementation on the nitrogen digestibility of laying and meat type cockerels fed tomato by-products. M. Radfar1, B. Mansoori 2, A. Sheikhlar 1, M. Modirsanei 2, and M. M. Kiaeri 2, 1University Putra Malaysia, Serdang, Selangor, Malaysia, 2University of Tehran, Iran.

This experiment was carried out to determine the influence of dietary enzymes, avizyme 1502 and grindazyme 15000 GP, on uric acid output and true nitrogen digestibility of dried tomato pomace (DTP) in laying and meat type cockerels, using force-feeding technique. Twenty eight 8-week-old meat type cockerels (Ross 308) and twenty-five 35-week-old laying type cockerels (Hy-line W-36) were distributed into four groups of seven and five birds, respectively. After 24h of fasting, each bird was force fed with one of the following test materials, 50ml glucose solution (0.6 g/ml, control group), DTP alone (30 g), DTP and avizyme (30 g+20 mg) and DTP and grindazyme (30 g+10 mg). The voided excreta were collected for 48 hours and dried. Nitrogen content of DTP and excreta samples as well as the uric acid content of excreta was measured. Feeding DTP increased (p<0.001) the total nitrogen and uric acid output of the experimental birds. Enzymes had no effect on the excretion or digestibility of DTP nitrogen in laying type cockerels. However, meat type cockerels showed a lower uric acid output and higher DTP nitrogen digestibility when both dietary enzymes were used.

In conclusion, the addition of dietary enzymes might benefit the meat type bird as well as the environment by enhancing the digestion and utilization of DTP by the bird and reducing the excretion of undigested nitrogen.

**Key Words:** feed enzyme, nitrogen digestibility, tomato by-products, uric acid

**P191** Efficacy of a novel feed protease on a variety of protein ingredients. M. Fischer1, V. Glitsoe1, D. Pettersson1, and F. Fru2, 1Novozymes A/S, Bagsvaerd, Denmark, 2DSM Nutritional Products, Basel, Switzerland.

A novel monocomponent feed protease (RONOZYME®ProAct) was evaluated in an in vitro digestion model simulating the gastrointestinal system of monogastric animals. The ability of the protease to increase protein solubilization and the proportion of free amino acids from broiler diets and protein rich feed ingredients was evaluated. The samples were incubated without (controls) and with protease supplementation in a stomach step (pH 3) followed by addition of pancreatic enzymes in an intestinal step (pH 6.8). The controls were used to correct the results for the effect brought about by the endogenous digestive enzymes. Each treatment had five replicates.

The efficacy of the feed protease was tested on two commercial broiler diets based on soybean meal, maize and meat and bone meal. Moreover, different feed ingredients (meat and bone meal, maize, sorghum, feather meal, full fat soybean meal and defatted soybean meal) with varying protein content were tested separately. From all ingredients, the solubilization of crude protein (N×6.25) was increased (range 1 to 15%) by the feed protease. Effects were highest for meat and bone meal, maize and grain sorghum (8, 10 and 15%, respectively). Furthermore, the proportion of free amino ends, as determined by the Degree of Protein Hydrolysis, was increased (range 3 to 27%) for all ingredients, compared to the controls.

In conclusion, the results demonstrated a strong ability of RONOZYME® ProAct to increase protein solubilization and the degree of protein hydrolysis in vitro for a range of feed ingredients. Thereby, this protease has the potential to improve the utilization of protein rich feed ingredients in animal production.

**Key Words:** protein, protease, monocomponent, utilization


Allzyme SSF® is a naturally fermented complex capable of increasing release of phytate-bound phosphorus, calcium, energy and amino acids from poultry feed. In order to investigate the effect of Allzyme SSF® on the performance of chicks fed low phosphorus diet, a total of 192 chicks was raised for three weeks by using the following treatment diets: 1) corn-soy positive control diet containing 0.45% available phosphorous; 2) corn-soy negative control diet containing 0.25% available phosphorous; 3) Diet 2 + 400 g Allzyme SSF®/Ton; 4) Diet 2 + 600 g Allzyme SSF®/Ton. Eight replicate cages of six chicks were randomly assigned to each of four dietary treatments. Chicks were housed in starter cages in an environmentally controlled room with an ad libitum access to feed and water. Chicks fed the low phosphorus negative control diet had lower (P<0.01) weight gain and feed intake compared with other dietary treatment groups and had lower (P<0.01) gain to feed ratio compared with chicks fed diet with supplementation of 600 g Allzyme SSF®/Ton in the entire experimental period. Dietary supplementation of Allzyme SSF® in the low phosphorus basal diet significantly increased (P<0.01) weight gain, feed intake and gain to feed ratio. Data from this trial indicate that supplementation of Allzyme SSF® in corn-soy based poultry diets can improve phosphorus utilization.

**Key Words:** chick, phosphorus, enzyme

**P193** Improvement in commercial pellet mill throughput with dietary AZOMITE® Micronized in turkey feeds or with dietary builders' sand or AZOMITE® Feed-Grit in broiler chicken feeds. W. W. Emerson1 and D. M. Hooge2, 1Peak Minerals - Azomite, Inc., Kansas City, MO, 2Hooge Consulting Service, Inc., Eagle Mountain, UT.

A hydrated sodium-calcium aluminosilicate or HSCAS (AZOMITE®, Peak Minerals - Azomite, Inc., Kansas City, MO) from a volcanic ash deposit in Utah may provide several benefits in broiler chicken feeds including mycotoxin binding and improved BW, feed conversion ratio, livability, carcass yield, and breast meat yield. The product typically contains 75% of 92 naturally occurring elements and is listed by OMRI® for use in organic feeds. As an HSCAS, it is FDA approved as an anticaking (flow) agent at levels up to 2% in feeds; however, recommended
practical levels of inclusion are about 0.5% to 0.3%, starter to finisher, in broiler and turkey feeds. In a pellet mill test (Trial 1) with 8 turkey feed formulations ranging from 15% to 28% protein, and using 0 or 1% (AZOMITE®) Micronized (-200 mesh), the supplement increased conditioned mash temperature (+3.4°C or +6.1°F; P = 0.006), decreased amps (-9.4 amps; P = 0.011), and increased % pellets (+3.6% actual; P = 0.030) with similar pellet durability indexes (+0.4% PDI; P = 0.489). Trials 2-4 were with broiler feeds. In Trial 2, either 0, 0.5, or 1.0% levels of AZOMITE® Feed-Grit (about 70% coarse -8 mesh, 30% fine -50 mesh) were used. Throughput increased (+3.0 and +2.8 tons/hr, respectively; P = 0.000) with 0.5 and 1.0% levels vs 0%. In Trial 3, there were 22 (3.5-ton) batches with 0%, 27 batches with 0.4% AZOMITE® Feed-Grit, and 14 batches with 0.4% builders’ sand, always keeping throughput constant at 28 tons/h. The % pellets increased (+4.6% actual; P = 0.000) but amps also increased with phosphate plus either AZOMITE® or sand supplement. In Trial 4, using phytase, phosphate was reduced (0 vs 0.20%), meat and bone meal increased (3.29 vs 2.02%), along with 0 or 0.5% AZOMITE® Feed-Grit (5 x 5-ton batches of each). Throughput increased (45 vs 30 tons/h) and electrical efficiency improved (8.7 vs 12.7 amps/ton-h) due to the supplement. AZOMITE® increased pellet mill throughput under commercial conditions.

**Key Words:** azomite, builders’ sand, hydrated aluminosilicate, pelleting, throughput

### P195 Effect of zinc and manganese supplementation from inorganic source on egg quality parameters in White Leghorn hens

The study was designed to determine the effect of Zn and Mn supplementation from Availa-Zn and Availa-Mn on egg quality parameters in white leghorn hens from 45-85 weeks of age. A Corn-soy based diet was formulated to be isocaloric (2790 kcal/kg) and isonitrogenous (18.6%) with four dietary treatments. Diet 1 was formulated to have 60 ppm of Zn from ZnO and 60 ppm Mn from MnSO4. Diet 2 received 20 ppm of Zn from ZnO and 40 ppm of Zn from Availa-Zn and 60 ppm Mn from MnSO4. Diet 3 was supplemented with 60 ppm Zn from ZnO and 40 ppm from Availa-Zn and 60 ppm Mn from MnSO4. Diet 4 was similar to the third with the addition of 40 ppm of Mn from Availa-Mn. Each treatment was replicated eight times and fed to four hens per cage. Feeding laying hen’s diet supplemented with Zn and Mn significantly increased feed intake at all levels compared to diet 1 (p<0.05) with no difference in body weight gain. Egg production did not show any significant difference with addition of Zn or Mn. There was a significant increase in egg wt. between diet 1 and diet 2 supplemental Zn at 20 ppm from ZnO and 40 ppm from Availa-Zn (p<0.05), however the overall treatment effect was not significant. Supplemental levels of Zn and Mn had no significant effect on percent dry shell, wet shell, albumen and haugh unit. There was a significant decrease (p<0.05) in yolk weight with Availa Zn at 40 ppm and 60 ppm of Zinc oxide (diet 3) compared to diet 1. The addition of Zn had a significant effect (p<0.05) on specific gravity with the estimates being higher at 40 ppm Zn from Availa-Zn and 60ppm of Zinc oxide (diet 3) compared to diet 1 in addition to the larger egg size without any effect of Mn supplementation. The inclusion of Zn or Mn in the basal diet did not reduce the incidence of cracked, dirty, undergrade eggs or improve feather score. Supplementation of Zn improved feed intake at all levels and yolk weight as well as specific gravity seems to be affected at higher levels. Similarly, inclusion of Mn also improved feed intake without any effect on egg quality parameters.

**Key Words:** zinc, manganese, egg quality, laying hens

### P196 Using biochemical characterisation to compare phytases

K. Pontoppidan*1, V. Gittoe1, P. Philipp2, and N. Ward3 1Novozymes A/S, Bagsvaerd, Denmark, 2DSM Nutritional Products, Saint-Louis Cedex, France, 3DSM Nutritional Products, Parsippany, NJ.

It is generally acknowledged that feeding trials are the only way to fully understand the potential of a feed enzyme. However, due to the lack of suitable alternatives biochemical characterizations are often used to predict the performance of phytases at an early point in the discovery phase, even though simple enzyme activity assays cannot be expected to fully depict the environment or processes of the gastro-intestinal tract. Phytase activity is normally assayed using purified Na-phytate as a substrate. In contrast, phytate in the digestive tract occurs as part of a
complex feed matrix, and due to the strong chelating ability of phytate, it is associated with proteins and minerals that affect the solubility of phytate. Phytate solubility and phytase activity of a fungal phytase (*P. lycii*) were assayed at pH 2-10 using either Na-phytate or feed phytate (in a soybean meal/corn diet) as substrate. Phytate solubility in the feed matrix was very pH dependent with increased solubility from pH 3 to pH 4.5, whereas at pH 6 feed phytate was largely insoluble. The *P. lycii* phytase activity profile was shifted towards lower pH when feed phytate was used as a substrate rather than Na-phytate, indicating the importance of phytate solubility.

Phytase stability and activity at very low stomach pH is sometimes claimed to be a prerequisite for phytate degradation in vivo. However, the conditions chosen to mimic stomach conditions largely determine the results. More over, the gastro-intestinal site of phytate degradation in poultry has not been sufficiently investigated and phytate degradation may occur in the crop, thereby decreasing the importance of phytase stability and activity at low pH. The degradation of phytate in broilers was monitored by sampling the digesta from crop, gizzard and small intestine. *P. lycii* phytase degraded considerably more phytate in the crop than an *E. coli* phytase did (80.1% vs 37.4% compared to control animals; p<0.05). Hence, depending on the enzyme activity profile, phytate degradation can occur at various parts of the digestive tract.

**Key Words:** phytase, phytate, broilers, intestine, characterization


The experiment was conducted at the Agrarian Sciences Center of UFPB, Brazil. The aim was to evaluate the effect of proteic reduction in diets with Valine and metabolizable energy (ME) supplementation on broiler chickens carcass yield at 42 days. Seven hundred and twenty male broiler chicks, Cobb, were distributed in a completely randomized design, in a factorial scheme 2 x 3 (two CP levels x three ME levels). To the treatments 1, 2 and 3, only L-Lysine, DL-Methionine and L-Threonine were added, which allowed CP to attend digestible amino acids (DAA) ratio, and the ME varied, -50, 0 and +50 kcal/kg, respectively, according to the levels recommended by Rostagno et al. (2005). In treatments 4, 5 and 6, besides these amino acids, L-Valine was also added, resulting in a CP reduction until the level which attends the other DAA requirements, and ME was similar to that in the previous treatments. At 42 days of age, 2 birds per experimental unit, with representative parcel weight, were selected and after 8 hours of fasting, were sacrificed by cervical dislocation. Bleeding, depilating, evisceration and cutting were performed. Cuts were weighed in digital balance. Evaluated variables were: carcass, breast, thigh, drumstick and wing weight (g) and yield (%), and heart, gizzard and liver absolute (g) and relative (%) weight. Carcass yield was calculated in relation to the live fast weight, and cuts yield, in relation to carcass weight. Relative organ weight was calculated in relation to live fast weight. There was no interaction (P>0.05) between CP and ME for any of the evaluated parameters. Similarly, weight and yield of carcass and cuts, and organ absolute and relative weight were not influenced (P>0.05) by CP and ME separately. Therefore, can conclude that diet CP reduction, with Valine supplementation, and decrease or increase of 50 kcal ME/kg to the requirements do not alter carcass and parts yield of broiler chickens.

**Key Words:** amino acids, crude protein, ideal protein, performance, requirement


The experiment was conducted at the Agrarian Sciences Center of UFPB, Areia, PB, Brazil. The aim was to evaluate the effect of crude protein (CP) levels and of diet essential:non essential amino acids ratio (EAA:NEAA) on broiler chickens performance from 8 to 21 days. Four hundred and eighty male broiler chicks, Cobb, were distributed in a completely randomized design, with four treatments and six replicates with 20 birds. An 18% CP diet was formulated, supplemented with lysine, methionine, threonine, arginine, valine, isoleucine, glycine and tryptophan, in order to attend digestible amino acids (AA) requirements. After formulation, the EAA supply in total AA (TAA) was verified and the ratio with the level of CP of the ration was calculated. It was considered as EAA: lysine, methionine + cystine, threonine, arginine, valine, tryptophan, isoleucine, leucine, phenylalanine, histidine and glycine. The other treatments were formed from glutamate supplementation in order to reach the levels of 19, 20 and 21% of CP. Starch, oil and inert were used in the diets to make them isenergetic. EAA:NEAA ratios of

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**P197 The effect of commercial enzymes and their dose on broiler performance.** J. C. C. Carvalho*1, V. A. Costa1, R. L. Darí2, M. S. Cunha1, and A. G. Bertečini1, 1Universidade Federal de Lavras, Minas Gerais, Brazil, 2Nutron Alimentos Ltda, Campinas, SP, Brazil, 3Danisco Animal Nutrition, Campinas, SP, Brazil.

A search for ways to better utilize nutrients and, in particular, energy in feedstuffs, provides opportunities for greater incorporation of exogenous (feed) enzymes in poultry feeds. A 42-day study was conducted to evaluate the effect of two different commercial enzymes at two doses on broiler performance. The dietary treatments used were: 1) positive control (PC) corn and soybean meal-based diet with meat and bone meal without enzymes; 2) negative control (NC) with ME reduction of 60 kcal/kg from 8 to 21 days of age and 120 kcal/kg reduction from 22 days till slaughter; 3) and 4) NC plus 0.05% and 0.03% of commercial enzyme A (600 units endo-xylanase/g, 8000 units subtilisin protease/g and 800 units α-amylase/g), respectively; 5) and 6) NC plus 0.05% and 0.03% of commercial enzyme B (200 kNU α-amylase/g and 350 FBG β-glucanase/g), respectively. The completely randomized experimental design contained six diets and eight replicates of 32 Cobb 500 male broilers. At 21 days of age, broilers fed the NC diets had significantly (P<0.05) poorer weight gain (WG) and feed conversion (FC) compared to birds fed the PC diet. Both enzyme products improved WG significantly. At 42 days of age, the PC and the enzyme products, regardless of dose, provided better WG and FC than the NC. Both WG and FC of broilers supplemented with 0.05% of the enzyme products were similar to those obtained with the PC. At the 0.03% level of inclusion neither of the enzyme products was able to give broiler performance equivalent to the PC level. The use of both enzyme products reduced production costs per kg of 42-day live weight. Both enzyme products improved response in broiler diets with reduced ME, however, their effect was dose-dependent.

**Key Words:** enzymes, broiler, corn-based diet, dose, performance

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**P197**  The effect of commercial enzymes and their dose on broiler performance. J. C. C. Carvalho*1, V. A. Costa1, R. L. Darí2, M. S. Cunha1, and A. G. Bertečini1, 1Universidade Federal de Lavras, Minas Gerais, Brazil, 2Nutron Alimentos Ltda, Campinas, SP, Brazil, 3Danisco Animal Nutrition, Campinas, SP, Brazil.
diets with 18, 19, 20 and 21% of CP were 55:45, 52:48, 49:51 and 47:53, respectively. Evaluated parameters were: feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). Data were submitted to polynomial regression analysis. Besides, Dunnett’s test was also performed, in which the diet with 21% of CP was considered as control. There was linear effect of CP levels on FI and FCR, and for each 1% of CP increase, it is estimated a reduction of 18.9 g in FI (y = 1510.8 – 18.882x, r² = 0.92) and an improvement of 0.034 g kg⁻¹ in FCR (y = 2.136 – 0.0336x, r² = 0.94). By Dunnett’s test, it was verified that CP reduction up to 19% did not harm broilers performance. It’s recommended, therefore, 19% of CP in the diet for broiler chickens from 8 to 21 days, with the EAA:NEAA of 52:48.

Key Words: glutamate, ideal protein, initial phase, requirement, supplementation


The experiment was conducted at the Agrarian Sciences Center of UFPA, Areia ãe PB, Brazil. The aim was to evaluate the effect of crude protein (CP) levels and of diet essential:non essential amino acids ratio (EAA:NEAA) on broiler chickens performance from 22 to 40 days. Four hundred and eighty male broiler chicks, Cobb, were distributed in a completely randomized design, with four treatments and six replicates with 20 birds. An 16.5% CP diet was formulated, supplemented with lysine, methionine, threonine, arginine, valine, isoleucine, glycine and tryptophan, in order to attend digestible amino acids (AA) requirements. After formulation, the EAA supply in total AA (TAA) was verified and the ratio with the level of CP of the ration was calculated. It was considered as EAA: lysine, methionine + cysteine, threonine, arginine, valine, tryptophan, isoleucine, leucine, phenylalanine and histidine. The other treatments were formed from glutamate supplementation in order to reach the levels of 17.5, 18.5 and 19.5% of CP. Starch, oil and inert were used in the diets to make them isenergetetic. EAA:NEAA ratios of diets with 16.5, 17.5, 18.5 and 19.5% of CP were 49:51, 46:54, 44:56 and 41:59, respectively. Evaluated parameters were: feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). Data were submitted to polynomial regression analysis. Besides, Dunnett’s test was also performed, in which the diet with 19.5% of CP was considered as control. There was linear effect of CP levels on FI and WG, and for each 1% of CP increase, it is estimated a reduction of 57 g in FI (y = 3961.3 – 57.288x, r² = 0.76) and of 30 g in WG (y = 2256.3 – 30.011x, r² = 0.91). By Dunnett’s test, it was verified significant difference only for FI with 16.5% of CP, and no other significant differences were found for the remainder parameters in any proteic level. Thus, it is possible to reduce diet CP for broiler chickens from 22 to 40 days up to 16.5%, with the EAA:NEAA ratio of 49:51.

Key Words: glutamate, ideal protein, initial phase, nutrition, requirement

P201 Nutrient digestibility of young broiler feed fed enzyme supplemented undecorticated sunflower seed meal based diets. A. O Fafioju*, O. O Oduguwa1, A. M Bamgbose*, A. O Fanimo1, A. V. Jegede1, and O. M. O Idowu1, 1University of Agriculture, Abeokuta, Ogun State, Nigeria, 2University of Agriculture, Abeokuta, Ogun State, Nigeria, 3University of Agriculture, Abeokuta, Ogun State, Nigeria, 4University of Agriculture, Abeokuta, Ogun State, Nigeria, 5University of Agriculture, Abeokuta, Ogun State, Nigeria, 6University of Agriculture, Abeokuta, Ogun State, Nigeria.

Nutrient digestibility of starting broiler feed containing different levels of enzyme supplemented undecorticated sunflower seed meal was determined. Six hundred and forty (640) unsexed Anak 2000 day old broiler chicks were used to conduct the study. The chicks were allocated to eight dietary feed prepared in a 2x4 factorial arrangement within a randomised complete block design with twenty bird per replicate in four replication per treatment. Digestibility coefficient for dry matter, crude protein, crude fibre, ether extract and ash were determined. Dry matter and crude protein digestibility reduced significantly while crude fibre showed no definite pattern though higher inclusion of undecorticated sunflower seed meal led to reduced crude fibre digestibility. Ether extract values also reduced significantly at 75% undecorticated sunflower seed meal inclusion. Enzyme supplementation of undecorticated sunflower seed meal diets showed that the various components of proximate constituents were better utilised.

Key Words: undecorticated, digestibility, enzyme, supplementation, sunflower

P202 Effects of mannanoligosaccharides on broiler live performance. N. A. A. Barbosa1,2, N. K. Sakomura1, M. A. Bonato1, E. O. Oviedo-Rondôn3, and F. Goldfluss1, 1Department of Zootecnia, UNESP, Jaboticabal, SP, Brazil, 2Department of Poultry Science, North Carolina State University, Raleigh, 3Biorigin, Brazil.

One experiment was conducted to evaluate the effects of two mannanoligosaccharide (MOS) sources on broiler performance. 1280 Cobb male broilers were distributed in 32 floor pens with used litter in a completely randomized design with four treatments and eight replicates of 40 birds in each. The following treatments were analyzed: control, antibiotic (virginiamycin, 20 ppm), MOS-1 (ActiveMOS), and MOS-2. A corn-soybean meal basal diet with meat and bone meal and free of anticoccidial drugs was used. Birds were vaccinated against coccidiosis. Feed additives were supplemented according to treatments replacing inert material. MOS were added at 1.5, 1.0 and 0.5 kg/ton in starter, grower and finisher diets, respectively. Drinkers were cleaned only twice a week to increase microbial challenge conditions. Body weight gain (BWG), feed intake, feed conversion ratio, viability, and production efficiency factor (PEF) were evaluated from 1 to 42 days of age. Significant differences (P<0.05) among treatments were observed on BWG, feed conversion and PEF. Broilers fed diets with both MOS products had similar BWG than the ones fed diets with antibiotic. However, the BWG of these treatments were not significantly different from the control group. Dietary inclusions of MOS-1 and antibiotic promoted significant positive effects on feed conversion and PEF compared to the control group. MOS could be used as an alternative to antibiotic growth promoters for broilers. Not all commercial sources of MOS are the same.

Key Words: mannanoligosaccharides, prebiotics, growth promoters, additives, broilers
P203  Influence of dietary crude protein and metabolizable energy on growth parameters of the French guinea fowl. S. N. Nahashon*,1, S. E. Aggrey2, N. Adefope1, A. Amenyenu1, and D. Wright1, 1Tennessee State University, Nashville, 2University of Georgia, Athens.

This study was conducted to assess the influence of dietary crude protein (CP) and metabolizable energy (ME) on growth parameters of the French Guinea fowl (FGF), a meat-type variety. In a 3 x 3 factorial arrangement, 297 day-old French guinea keets were randomly assigned to experimental diets comprising 3,050, 3,100 and 3,150 ME kcal/kg diet each containing 21, 23 and 25% CP from hatch to 9 weeks of age (WOA). Using BW and feed conversion ratios (FCR) data from hatch to 9 WOA, the Gompertz-Laird, a nonlinear mathematical (NLM) function, was employed to estimate growth patterns of the FGF. Mean differences in exponential growth rate, age of maximum growth and asymptotic BW among dietary CP and ME levels were not significant. However, instantaneous growth rate and weight at inflection point were significantly higher (P<0.05) in birds on 25% CP diet than those on 21% CP diet (1.12 kg/wk and 0.79 kg vs. 1.04 kg/wk and 0.74 kg, respectively). The exponential growth rate was also higher (P<0.05) in birds fed the 3,050 ME kcal/kg diet with either 23 or 25% CP than those fed diets containing 3,050 ME kcal/kg and 21% CP. Mean FCR was higher (P<0.05) in birds fed diets containing 3,050 ME kcal/kg and either 21 or 23% CP than those in other dietary treatments. Therefore, diets containing 3,100 to 3,150 ME kcal/kg in combination with either 23 or 25% CP were utilized more efficiently by the FGF and growth parameters of birds on these diets were higher than those of other dietary treatments.

Key Words: French guinea fowl, growth parameters, Gompertz-Laird model

P204  Use of sodium chloride in Japanese laying quails diet. F. B. Petrucci1, J. G. Vargas Jr1, F. G. P. Costa2, B. A. Scotta, W. A. Barbosa1, J. F. V. Marin1, F. S. Pittelkow1, and T. P. Bonaparte1, 1Federal University of Espirito Santo, Alegre, ES, Brazil, 2Federal University of Paraiba, Areia, PB, Brazil.

The research was developed to evaluate the effect of different dietetic sodium levels on Japanese laying quails performance. Three hundred animals were used, with initial age of 120 days, in completely randomized blocks design, with six treatments, five replicates and 10 birds per experimental unit. The experimental period was 84 days, divided into four periods of 21 days. An experimental corn-soybean meal-based diet was formulated with 2,900 kcal/kg, 0.95% digestible lysine, 0.720% of digestible methionine + cystine, 2.5% of calcium, 0.35% available phosphorous and 0.05% of sodium. To the basal diet was added 0.000%, 0.126%, 0.252%, 0.378%, 0.504% and 0.630% of salt (NaCl) in substitution to inert material in order to obtain experimental diets containing 0.05%, 0.10%, 0.15%, 0.20%, 0.25% and 0.30% of sodium. Significant effects were observed for feed intake, egg production, egg mass, egg weight, final weight, feed conversion and weight gain. Amongst the evaluated parameters, except for egg weight, all the remaining presented quadratic effect. This is probably due to the absorption of some nutrients, as glucose and some amino acids, are sodium-dependent. That is, birds submitted to the diets that did not had enough sodium presented smaller nutrients absorption. Counterbalancing, sodium excess might have caused an electrolytic imbalance in the animal body, due to the sodium excess in the plasma, rendering that part of the nutrients and energy that would be used in the production, were switched to the restoration of the normal physiologic condition. Therefore, by obtained results, it can be concluded that the level of 0.209% of sodium in the diet of Japanese laying quails is enough to guarantee maxim productive efficiency.

Key Words: poultry nutrition, Japanese quail, sodium chloride, egg mass, performance

P205  Supplementation of dietary hydrolyzed yeast on broiler chicks. R. Barbalho*1, L. Araujo1, C. Araujo1, A. Corzo1, L. C. G. S. Barbosa1, and M. T. Kidd, 1Mississippi State University, Mississippi State, 2I. C. C., Sao Paulo, Brazil.

Many broiler companies electing not to use certain growth promoters have undergone testing of feed additives in search of efficacious replacement effects. The objective of this study was to evaluate hydrolyzed yeast from nucleotides on growth performance of broilers supplemented with different dietary inclusion levels from 1 to 14 d of age. A total of five hundred seventy six Ross 708 chicks were allotted to 6 experimental treatments with 8 replications (12 broilers per pen). Birds were randomly distributed in following treatments: 0, 2, 4, 6, 8, and 10 kg hydrolyzed yeast/ton of feed. The hydrolyzed yeast was added to the test diet in place of an inert filler. Starter diets were fed in crumbled form and chicks were allowed access feed and water ad libitum. All diets were based on corn, soybean meal, and poultry fat, and were formulated to achieve practical nutrient levels (following Guide Recommendations for Ross x Ross 708 broilers). Mortality did not differ among treatments. Chicks fed 10 kg hydrolyzed yeast had improved (P<0.05) BW, BW gain, and feed conversion over birds fed all other treatments. These results indicate efficacy of hydrolyzed yeast in the starter period for live performance measurements given that birds consume 10 kg/ton.

Key Words: nucleotides, broiler chick, yeast

P206  Use of sodium and potassium carbonate for Japanese quails fed with diets containing 21% of crude protein. B. A. Scotta1, J. G. Vargas Jr*1, F. G. P. Costa2, F. B. Petrucci1, W. A. Barbosa1, F. S. Pittelkow1, J. F. V. Marin1, and L. F. Demuner1, 1Federal University of Espirito Santo, Alegre, ES, Brazil, 2Federal University of Paraiba, Areia, PB, Brazil.

An experiment was carried out aiming to evaluate the performance of Japanese laying quail. Birds were fed with rations containing 21% of CP and three different electrolytic balance (200, 275 and 350 mEq / ration kg) in two forms of attaining electrolytic balance increase (K2CO3 and K2CO3 + Na2CO3). Two hundred and forty birds were assigned to a completely randomized design, in a factorial arrangement 3 x 2, with four replicates and 10 birds per experimental unit. The experimental period lasted 84 days, divided into four periods of 21 days, in which posture rate (%), egg weight (g), egg mass (egg g/ quail/day), feed intake (g/ quail/ day) and feed conversion (g/ g) were evaluated. Amongst the evaluated parameters, no significant effect was observed for productive parameters between the different electrolytic balances. However, birds fed with diets containing K2CO3 had better eggs mass in comparison to those fed with the addition of K2CO3 + Na2CO3. At the 21% CP level, the Japanese quails presented active renal function in order to keep nitrogen excretion in normal level, which made the cells maintenance of the osmotic balance without adding any sodium. If there were
P207 Use of sodium and potassium carbonate in diets for Japanese quails fed with rations containing 24% of crude protein. B. A. Scotta¹, J. G. Vargas Jr.*¹, F. G. P. Costa², F. B. Petrucci², W. A. Barbosa³, J. F. V. Marin¹, F. S. Pittelkow¹, and D. V. G. Vieira¹, ¹Federal University Espirito Santo, Alegre, ES, Brazil, ²Federal University of Viçosa, MG, Brazil, ³Federal University de Juiz de Fora, MG, Brazil.

An experiment was conducted aiming to evaluate the effect of the electrolytic balance, obtained by using different ions sources on Japanese quail performance. Birds were fed with diets containing 24% of crude protein, three different electrolytic balance (200, 275 and 350 mEq/kg of ration) in two forms of increasing electrolytic balance (K2CO3 and K2CO3 + Na2CO3). Two hundred and forty Japanese laying quails were used, with initial age of 120 days, distributed in a factorial arrangement 3 x 2, with four replicates and 10 birds per experimental unit. The experimental period lasted 84 days, divided into four periods of 21 days, in which posture rate (%), egg weight (g), egg mass/ chicken day, feed intake (g/ chicken/ day) and feed conversion (g/ g) were evaluated. Amongst the evaluated parameters, significant differences between the different studied electrolytic balances were not observed. However, it was observed that birds fed with diets containing joint addition of K2CO3 +Na2CO3 for attainment of the electrolytic balance presented better egg weight. This probably occurred due to the crude protein level of diet provided a nitrogen excess for the birds, leading them to excrete the excess, and thus promoting a greater renal activity. This may have caused osmotic unbalance of cells, and decreased extracellular electrolyte level, rendering necessary the sodium addition, since this is the ion present in greater proportion in the extracellular liquid.

With the addition of only K2CO3, there was not enough sodium for the highest birds need in the nitrogen excretion, resulting in reduced animal production. In conclusion, for Japanese quails fed with diets with 24% of CP, the best electrolytic balance is 200 mEq/ kg and, this should be obtained with the joint of sodium and potassium carbonate.

Key Words: electrolyte balance, potassium carbonate, carbonate of sodium and potassium, Japanese quail, crude protein

P208 Impact of post hatch administration of oil sources to broiler chicks on subsequent performance. L. Araujo, C. Araujo, A. Corzo, L. C. G. S. Barbosa*, and M. T. Kidd, Mississippi State University, Mississippi State.

Per os administration of oil sources to chicks has received little attention. The present study was designed to investigate the supplementation of oil sources to chicks post hatch (after transportation from the hatchery (1 h) and prior to placement) on subsequent performance and processing traits. Four hundred twenty straight run broiler were allocated to 35 pens (12 birds per pen). Five per os treatments consisted of: no oil source; corn oil; soybean oil; fish oil, and conjugated linoleic acid (CLA). The oil was provided in a 1 mL syringe and all birds received oil at an iso caloric level (4.23 kcal ME). Each pen contained a tube feeder, a drinker line, and built up pine shavings. From 1 to 42 d of age birds were fed common diets in crumble/pellet form that met or exceeded Ross nutrient recommendations (1 to 14, 15 to 26, 27 to 35, and 36 to 41 d). All diets were primarily composed of corn, soybean meal, and poultry fat. Live performance was evaluated in the starter period (7 and 14 d) and overall. At 41 d of age, three broilers of each sex were weighed separately and processed to determine carcass yields. Birds that were provided CLA had lower (P < 0.05) BW at 7d of age than all other treatments. Regarding processing, supplementation of corn oil resulted in lower tender yield (P < 0.05) than broilers provided other oil sources. However, birds provided fish oil yielded 6.28% more breast meat and 11.23% less abdominal fat than birds not provided any oil (P < 0.05). This research indicates that supplementation of oil source can impact carcass characteristics in broilers.

Key Words: fish oil, broiler, carcass

P209 Effects of the addition of a mixture of cell wall components and a yeast culture on the energy released from the diet of broiler chickens. S. Gomez*¹,², M. L. Angeles¹, M. C. Mojica³, and J. Buenrostro⁴, ¹CENIDFyMA-INIFAP, Ajuchitlan, Qro, Mexico, ²FES-Cuautitlan-UNAM, Ajuchitlan, Qro, Mexico, ³SynBioSA de CV, Queretaro, Qro, Mexico, ⁴Vi-COR, Mason City, IA.

Three balance trials and a growth performance experiment were done to evaluate the energy released from low energy diets added with mannanoligosaccharide plus a yeast culture from Saccharomyces cerevisiae (MOS+CSc) in broiler chickens. In the balance trials, 216 starter from 8 to 21 days, 72 grower from 22 to 35 days and 72 finisher from 36 to 49 days of age B308 broiler chicken allocated in metabolic crates were use. Birds were assigned to four dietary treatments in a factorial arrangement of 2 energy levels (Normal and Low: 3000/2900, 3100/3000 and 3200/3100 kcal of ME/kg of feed in the starter, grower and finisher phases) and 2 levels of MOS+CSc (0 and 1 kg/ton). There were 18 replications per treatment and results were subjected to analysis of variance. In the growth performance experiment, 1170 male B308 broiler chickens were assigned to 5 dietary treatments: T1= Normal energy diet with 3000, 3100 and 3200 kcal of ME/kg of feed in the starter, grower and finisher phases; T2= 2% less energy than T1 in the starter and 4% less energy in the grower-finisher diets; T3= 3% less energy than T1 in the starter and 6% less energy in the grower-finisher diets; T4 and T5 as T2 and T3 plus 1 kg of MOS+CSc per ton of feed. There were 9 replications per treatment and results were subjected to analysis of variance. The addition of MOS+CSc to the Low energy diets increased the energy released in 58, 82 and 106 calories in the starter, grower and finisher balance trials but no statistic differences were observed. In the performance experiment, the ADG was similar for T1, T2, T4 and T5 and lower for T3 (P < 0.05). The feed conversion ratio was similar for T1, T4 and T5 and lower for T2 and T3 (P < 0.05). The addition of MOS+CSc to a low energy diet can increase the dietary energy available up to 60 kcal in the starter and from 128 to 192 kcal in the grower and finisher diets.

Key Words: mannanoligosaccharide, yeast culture, energy available, broiler chickens
P210  Early nutrition experiments in broilers chickens.  C. Araujo*, L. Araujo, C. D. Zumwalt, A. Corzo, L. C. G. S. Barbosa, and M. T. Kidd, Mississippi State University, Mississippi State.

Improvements in genetic selection of commercial broilers have deemed early nutrition as a very important aspect of production. Therefore, availability of feed and feed type after hatch has found advantages to reach the best economic return. Two experiments were conducted to evaluate performance and carcass characteristics of broilers fed at d 1. In experiment 1, one thousand eight hundred Ross 708 chicks were sexed and placed into 36 chick trays. Early treatments represented crumbled broiler starter feed and was administered in the center of the trays on paper. Chicks received 3 treatments (12 replications/treatment of 50 chicks each): no hatchery supplement; hatchery feed representing 454 g of a starter diet; or hatchery feed representing 454 g of a starter diet plus 0.125% of yeast. Chicks were allowed to receive treatments 5 h before placement. In experiment 2, one thousand four hundred Ross 708 chicks were randomly distributed across 7 treatments representing a control (no feed) or six treatments of 454 g starter feed in a hatchery tray (50 chicks per tray). The starter feed contained: 0.5 mL of water; 0.5 mL water plus 0.22 mg glycine-zinc (GlyZn); 0.5 mL water plus 0.24 mg glycine-manganese (GlyMn); 0.5 mL water plus 0.20 mg vitamin complex, and one treatment with all nutrients before described. Chicks were in trays 5 h before placement. Water and feed were provided ad libitum, and performance and carcass characteristics were measure in both experiments. No differences occurred in experiment 1. In experiment 2, birds that received vitamins and GlyZn solutions showed better BW at 49 d than birds fed the control group (P < 0.05). Birds that received water plus glycine-zinc had improved (P < 0.05) feed conversion at 49 d, but GlyZn alone resulted in better carcass and breast meat yield than birds in the control group (P < 0.05). These results point to possible improvements in broiler performance as affected by early feeding.

Key Words: hatchery feeding, chick, glycine, zinc

P211  Assessment of manganese needs of mature Ross hens. L. Araujo*, C. Araujo, C. D. McDaniel, H. M. Parker, S. Hubbard, S. L. Branton, and M. T. Kidd, 1Mississippi State University, Mississippi State, 2United States Department of Agriculture, Mississippi State, MS.

Recent studies at Mississippi State University Poultry Research Unit have demonstrated the importance of Mn supplementation for breeders and heightened effects of progeny. This experiment was conducted to evaluate supplementation levels of Mn to mature breeders from 52 to 65 wk to better assess its need for good hen production. One hundred twenty Ross 708 hens received a control diet (vitamin and mineral premix devoid of Mn) or the control diet supplemented with inorganic Mn in the form of Mn sulfate (30mg/kg; 60 mg/kg; 90 mg/kg; and 120 mg/kg). All five dietary treatments were supplied in mash form. Breeders were housed in a floor pen facility with 40 pens (8 replications/treatment). Each pen was equipped with 1 feeder, nipple drinkers, and 1 nest. Each pen contained 3 females which were inseminated before eggs were collected. A total of five hundred eggs (100 eggs per treatment) were obtained and set at 61 wk of age. Egg production, specific gravity, fertility (infertility, hatchability, mortality, pip, bacteria, culls), and chick quality (dehydrated, small navel, large navel, open navel condition, wet chicks, wicks, dried yolk, and red hocks) characteristics were measured. Linear or quadratic trends were not observed for any parameter. There were no differences in egg production. However, feeding broiler breeders 120 mg inorganic supplemental Mn/kg improved egg specific gravity, fertility, and hatchability (P < 0.05). Breeders receiving 30 mg inorganic supplemental Mn/kg resulted in biggest incidence of wet chicks (P < 0.05). Other chick quality characteristics were not influenced by dietary treatments.

Key Words: broiler breeder, manganese, hatchability, fertility

P212  Determination of minimum available phosphorus level needed to maximize growth performance in straight-run broilers through 28 days of age. S. K. Pohl*, J. R. Prukop, L. A. Oden, A. E Klein, and J. T. Lee, Department of Poultry Science, AgriLife Research, Texas A&M University, College Station.

Phosphorus is a vital nutrient in broiler diets due to effects in bone mineralization; however, due to the eutrophic effects of excess dietary phosphorus excretion in waste as well as the impending cost of phosphorus ingredients used in diet formulation, it is becoming increasingly important to limit excessive use of phosphorus. This experiment was conducted in order to determine the minimum level of available phosphorus required to maximize growth of straight run broilers through 28 days of age when reared in industry type floor pens or experimental type battery pens. Experimental design consisted of six dietary treatments including calculated available phosphorus levels of 0.30%, 0.35%, 0.40%, 0.45%, 0.50%, and 0.55% in the starter diet. On day 14, all treatments were switched to a grower diet with a 9% reduced available phosphorus concentration as compared to each treatment’s initial starter diet. Each treatment consisted of five replicates of 40 chicks in the industry type floor pens and 10 chicks in each experimental type battery pen at day of placement. Floor pen birds were raised on fresh pine shavings and all chicks were administered fresh water and appropriate feed treatment ad libitum. At the conclusion of the starter period, the minimum available phosphorus level needed to maximize broiler growth in floor pens was 0.45% however; the minimum level of available phosphorus needed to maximize growth in battery pens was 0.40%. At the conclusion of the study on day 28, floor reared broilers fed the initial available phosphorus concentration of 0.40% yielded similar performance characteristics compared to increased levels. On day 28, broilers reared in battery pens fed the starter diet with an initial concentration of 0.35% yielded similar body weights as those fed increased levels. These data indicate that the minimum available phosphorus concentration needed to maximize growth varies according to rearing environment.

Key Words: broiler, body weight, phosphorus, feed conversion, rearing environment


There is far less data available describing the effects of microbial phytases in the diets of laying hens compared with broilers. The aim of this experiment was to determine the effect of relatively low doses of Quantum™ phytase on dietary apparent metabolizable energy (AME) and nutrient digestibility when fed to layers. A total of 90 ISA Brown hens were fed three mash maize-soybean meal-based diets containing...
2.2 g/kg available P (negative control, NC), supplemented with 0, 125 or 250 FTU (phytase units/kg feed). The birds received the experimental diets from 35 to 39 weeks of age, and each diet was replicated ten times in a randomised block design. During the last 24h of the study the excreta were collected and prepared for further analysis. No differences (P>0.05) in dietary AME, N retention, dry matter (DMD) and mineral digestibility were found between the NC and NC+125 FTU. However, the diet supplemented with 250 FTU had higher (P<0.05) AME (13.51 vs 12.83 MJ/kg DM) and DMD (0.758 vs 0.720) than the NC. The digestibility coefficients for dietary Mg, P, Zn and K were 29.9, 31.8, 46 and 71.5%, respectively, higher (P<0.05) for the NC+250 FTU compared to the NC. Dietary feed intake was not (P>0.05) influenced by the phytase supplementation. These results indicate that even relatively low activities of QuantumA® A® phytase can improve the intake of available nutrients in maize-soybean meal-based mash diets when fed to layers. It also supports the view that the use of dietary phytases is an efficacious method of reducing the pollution.

Key Words: phytase, layers, AME, nutrients, digestibility

P214  Comparison of the characteristics of black skin broilers with commercial broilers and dark cornish.  R. K. Bramwell*, J. R. Moyiel, D. E. Yoho1, R. S. Harper1, A. D. Swaffar1, and T. Whiting2, 1Department of Poultry Science, University of Arkansas, Fayetteville, 2Whiting Farms, Delta, CO.

In the US, Commercial Broiler Production primarily consists of white feathered broilers with the ‘traditional’ light colored meat. However, in other parts of the world where markets vary and traditions linger, colored feathered birds and in some cases dark meat birds are preferred. The Japanese Silkie is a breed with black heavily pigmented skin and heavily pigmented meat but is typically very small (< 1.3 kg). This black skin bird is preferred in many parts of the Asian world as not only a delicacy, but a preferred meat. The black skin characteristics were bred into a commercial broiler type bird that expresses the hyper-melanistic characteristics and can obtain a body weight of more than 2.5 kg at market age. This study was designed to evaluate the broiler characteristics of the ‘black skin broiler (BS)’ as compared to the Cobb 500 (C5) and Cobb 700 (C7) commercial broilers, and a standard size Dark Cornish (DC). All birds were hatched and raised from day-old using common broiler management guidelines in the same facility. The C5 and C7 birds were grown to a six-week market age while the BS and DC birds were grown to a 10 week market age. Final body weight and feed conversion were obtained at the conclusion of the growth period with all birds reaching the market age on the same date. Birds were processed to determine percent yield for WOG, fillets, tenders, wings, and legs quarters. Product obtained from the C5 and BS birds were evaluated using a controlled sensory panel. As expected, results showed that the BS and DC birds had lower body weight, poorer feed conversion and smaller part weights than both C birds. However, leg quarters and wings as a percent of WOG were significantly higher in both the BS and DC birds. Sensory panel results showed the BS product scored lower than the C5 product for all criteria evaluated. However, sensory data was strongly influenced by the inability to completely disguise the meat color.

Key Words: black skin broilers, meat quality

P215  Effect of immersion chilling and air chilling on texture quality and cook yield of chicken breast tenderloins deboned four hours postmortem.  H. Zhuang*, E. Savage, D. Smith, and M. Berrang, ARS-USDA, Athens, GA.

Boneless chicken breast fillets (pectoralis major) and tenderloins (pectoralis minor) are common poultry products in retail markets and are used extensively by restaurants and food service. Texture quality of these products could be impacted by poultry processing methods and parameters. Effects of chilling methods on fillets are available in published literature; however, there is a lack of published information of chilling methods effects on tenders. The objective of this study was to evaluate the effect of carcass chilling methods, water immersion chilling (IC) and air chilling (AC), on sensory texture descriptive profiles, Warner-Bratzler (WB) shear and cook yield of broiler breast tenders deboned at 4h postmortem. Ready-to-cook carcasses (42 days of age) were hot-boned as a pre-chill control, or chilled either by IC (0.3oC, 50 min) or by AC (0.7oC, 150 min). The chilled tenders were removed from the bone at 4h postmortem. Tenders were cooked to an endpoint temperature of 78-80oC. The texture qualities were measured by trained sensory panelists using 0-15 point universal intensity scales and by a TA-XT Plus Texture Analyzer fitted with a Warner-Bratzler shear blade. Our study shows that the average intensity scores for the 12 sensory texture attributes ranged from 1.5 to 5.9, the WB shear averages ranged from 20 to 31 Newton, and the average cook yield was 87%. No differences were found in cook yield between the hot-boned and the chilled samples. The average intensity scores of the texture attributes, cohesiveness, hardness, cohesiveness of mass, rate of breakdown and chewiness, and the average WB shear force values were significantly higher in the hot-boned samples than either of the chilled samples. However, there were no significant differences in the sensory texture profiles, WB shear and cook yield between the immersion-chilled and air-chilled tenders. These results demonstrate that either of IC and AC methods can be used to reduce broiler carcass temperature without losses of chicken breast tender texture quality and cook yield.

Key Words: chicken, tenderloin, chilling method, texture, cook yield

P216  Process water usage and water quality in poultry processing equipment.  R. Holser* and A. Hinton, Jr., Richard Russell Research Center, Athens, GA.

The operation of poultry processing equipment was analyzed to determine the impact of water reduction strategies on process water quality. Mandates to reduce the consumption of process water in poultry processing facilities have created the need to critically examine water usage patterns and develop strategies to meet these new requirements. The case of a 1000 bird/hr facility was used to evaluate alternative process modifications such as the treatment of recycled process water and the installation of specialized bird washing equipment. These changes in process operations were simulated with the computer program Super-Pro Designer v7.5 (Intelligen, Inc.). The analysis assumed an average broiler weight of 1 kg. The results indicated that the introduction of a water treatment system with a recycle loop could reduce annual water consumption by 20%. In this study the treatment system was based on ultraviolet light to reduce the microbial activity of process water prior to recycle. The economic savings of the water reduction was offset by the capital and operating costs associated with this process modification. These analyses were useful to compare alternative water management strategies and identify how process changes influenced process econom-
ics through utility costs. While process modifications involving recycle streams offer the opportunity to reduce water consumption there is a direct influence on process water quality. Any proposed water reduction strategy requires thorough analysis prior to implementation to avoid undesirable decreases in water quality.

Key Words: bacteria, contamination, reduction, simulation, water quality

P217 Comparison of neck skin versus whole carcass rinse for incidence of *Salmonella* and level of *E. coli* recovered from broiler carcasses. N. A. Cox1, L. J. Richardson1, J. A. Cason1, R. J. Buhr1, D. P. Smith1, P. J. Fedorka-Cray1, and M. P. Doyle2. 1USDA, ARS, Russell Research Center, Athens, GA. 2Department of Food Science and Technology, University of Georgia, Center for Food Safety, Griffen.

In the U.S. individual broiler carcasses are rinsed with 400 mL of 1% buffered peptone water (BPW) for *Salmonella* incidence detection, while the European Union (EU) uses a 25 g compositcd neck skin sample from three carcasses. Therefore, the objectives of the study were to obtain carcasses from a commercial U.S. processing facility and compare the U.S. and E.U. sampling methods for *Salmonella* prevalence as well as evaluate levels of *E. coli*. Two replications of 30 broiler carcasses each were obtained from a commercial plant just prior to the inside-outside carcass washer. The neck skin was aseptically removed and bagged separately from the carcass and transported to the laboratory for microbiological analysis. Neck skin (8.3 g) was aseptically weighed, added to 83 mL BPW and stomached for 30 sec. The corresponding carcass was bagged along with 400 mL BPW and shaken for 1 min; 30 mL of the 400 mL of carcass rinsate were removed and added to an additional 30 mL of BPW. Aliquots were then removed from each sample and plated onto Petrifilm® for *E. coli*/coliform enumeration while the entire neck skin and carcass rinsates were incubated for 24 h at 37 C. After incubation, standard cultural procedures for *Salmonella* were used for both samples. In both repitions, the *E. coli* counts were significantly greater (P<0.05) for the carcass rinse procedure (log10 2.9 cfu/mL) compared to the stomached neck skin (log10 1.9 cfu/mL). However, for *Salmonella* incidence there was no significant difference between the two sampling methods in rep 1, neck skin detected *Salmonella* from 17/30 carcasses and 19/30 carcass rinsates. In Rep 2, the neck skin and carcass rinse were both positive for 13/30 carcasses. Additional research is needed to sample a larger number of carcasses and at various sites in the processing plant to determine if one sampling method has an advantage over the other in regards to detecting *Salmonella*.

Key Words: whole carcass rinse, neck skin, *Salmonella*, *E. coli*, poultry carcass

P218 Effect of stomaching on numbers of bacteria recovered from chicken skin. J. F. Hannah1, J. A. Cason2, J. R. Richardson2, N. A. Cox2, A. Hinton, Jr.2, R. J. Buhr2, and D. P. Smith2. 1University of Georgia, Athens. 2USDA, ARS, Russell Research Center, Athens, GA.

Compared to rinsing, stomaching releases only a few more bacteria from a skin sample, but successive rinses continue to remove almost as many bacteria as the first rinse. One hypothesis to explain this observation is that relatively violent treatment of skin generates smaller pieces of skin thus increasing surface area and effectively sequestering bacteria so that fewer are suspended in the rinsate. An experiment was conducted to determine whether inoculated marker bacteria disappear from rinse liquid as skin pieces are stomached and naturally occurring bacteria are released. In each of 4 replications, 5 pre-chill broiler carcasses were collected from a commercial processing plant. Two 5 g pieces (n=40) of breast skin were removed from each carcass and placed in a stomacher bag. Thirty mL of 0.85% saline solution containing 10^4 *Salmonella* Typhimurium per mL was added to each sample. Skin samples were hand massaged for 30 s to mix the inoculum, after which a 1 mL aliquot was removed for enumeration bacteria. A similar sample was taken after 4 min of vigorous stomaching of the skin sample. Bacterial counts recovered from the 30 second hand massage were 4.3, 2.7, 2.6, and 3.7 log10 cfu/mL of rinsate for APC, coliforms, *E. coli*, and *Salmonella*, respectively. After stomaching, counts were 4.3, 2.9, 2.8, and 3.8, respectively. There was no difference in APC, but mean coliform and *E. coli* counts were significantly higher (P<0.05) after stomaching. Numbers of inoculated *Salmonella* did not decrease. Breaking up skin into smaller pieces by stomaching did not reduce the number of inoculated bacteria suspended in the rinsate.

Key Words: *Salmonella*, *E. coli*, rinsing, skin, broiler


Breeder hens are large birds, weighting 3.0 to 4.0 kg, with broiler-like conformation, with high amount of leg and breast meats, although it presents large fat deposition, both subcutaneous and abdominal. This study aimed to evaluate the characteristics of spent breeder hens breast meat quality collected in a commercial processing plant in Itapetininga (SP) city. 120 debone breast meat (Pectoralis major), were collected, shared at six collect with 20 samples each. Each sample analyzed in all samples were performed at 1.5 (zero time) and 4 hours post mortem. Samples were sent to the laboratory of FMVZ/UNESP, where the following parameters were analyzed: pH, R value, color, drip loss, water retention capacity, water holding capacity, emulsifying capacity, cooking loss, shear force and sensorial analysis. Average values for pH, R and L* value were 5.70, 1.40 and 50.11, respectively. Drip loss, emulsifying capacity and water holding capacity were 2.00%, 70.22mg/0.5g and 57.75%, respectively. For water retention capacity, cooking loss and shear force the mean values were 76.67, 17.92% and 4.94kgf/cm² respectively. When the sensory analysis was performed, the breast meat presented adequate technological characteristics to possibly be used as meat for further-processed products. However, it presented lower conditions related to some sensorial attributes like tenderness and juiciness compared to broiler breast meat.

Key Words: broiler chicken, meat quality, sensory analysis, spent birds, tenderness

The preference for well-pigmented poultry products in some markets around the world makes producers to add colorants into broiler rations as a way of improving attractiveness of the final products. *R. gelatinosus* biomass is a natural, pathogens-free source of red oxycarotenoids produced in poultry abattoir wastewater. This experiment was conducted to evaluate the effects of diets containing different concentrations of *R. gelatinosus* biomass on broilers' cuts color. Cobb male broilers' rearing was in floor pens, with water and diets supply on an *ad libitum* basis. Broilers corn-soybean based basal diets were supplied as follows: starter ration (1 to 21 d), grower ration (22 to 35 d) and finisher ration supplemented with the biomass at 0 (control), 400 and 800 ppm (36 to 44 d), as the dietary treatments. Each treatment was randomly allocated to 4 replicate pens with 10 birds each. Birds and diets were weighed at the beginning and at the end of finisher period for performance analysis. Two birds of each pen were killed according to Brazilian legal procedures and cuts of breast and thigh were prepared with and without skin. Color attributes were measured colorimetrically with a MiniScan XE Plus (Hunter Lab). Treatments were subjected to ANOVA and performance means were compared by Duncan's test at 5% significance. The relationship between biomass concentration in the feed and each color attribute was determined by regression analysis by orthogonal polynomials. Dietary treatments caused significant linear increases (P <0.05) of redness at breast and thigh skin and at breast and thigh meat with coefficients of correlation of 0.61, 0.61, 0.68 and 0.69, respectively, and no significant changes in lightness and yellowness at none of the cuts analyzed (P >0.05). Broilers' performance did not change significantly (P >0.05) with the biomass supplementation. Results show that the biomass deposits into broilers' meat and skin, increasing redness of broiler cuts without causing deleterious effects on birds' performance.

Key Words: breast, thigh, skin, meat, *Rubrivivax gelatinosus*


In many consumer markets, egg yolk color is an important quality attribute and defines purchasing decision. This makes producers to add extra xanthophylls in hens' rations as a way of improving egg attractiveness. Following the present tendency on the use of natural products in human and animal nutrition, an experiment was conducted to evaluate the use of *R. gelatinosus* oxycarotenoids as colorant to egg yolks. Thirty six Dekalbe laying hens at 19 wks of age were individually housed in wire cages equipped with feeders and drinkers to receive *ad libitum* the experimental diets that consisted of red *R. gelatinosus* biomass (pathogens-free) at 0 (control), 1,500 and 3,000 ppm added into a corn-soybean based basal diet nutritionally balanced to laying hens. Treatments contained 3 replicates with 4 hens each and were supplied for 30 days, under a constant lighting program of 16 h of light/day. Yolk color attributes were objectively determined with a MiniScan XE Plus (Hunter Lab) during the last 5 days of the experiment. Data for performance analysis were recorded at the beginning and at the end of the experiment. Data on yolk colors and productive parameters were subjected to ANOVA and significant differences among treatment means were determined by Duncan's Test at 5% probability. The administration of increasing levels of the biomass caused a significant darkening of yolks (P = 0.0021) and a significant increase in redness (P <0.0001), showing the effective deposition of the red biomass oxycarotenoids in yolks. As yellowness did not increase significantly (P = 0.0844), a new orange color arose due to the increase in redness. Feed intake increased significantly with the increases in biomass addition (P <0.0001) probably due to an improvement in the feeds color and/or flavor and so did egg production (P = 0.0175). Feed conversion and egg weight did not change significantly (P = 0.6199 and 0.9351, respectively). *R. gelatinosus* increased yolks lightness and redness, contributing to an improvement in yolks color.

Key Words: yolk color, *Rubrivivax gelatinosus*, biomass, oxycarotenoids, redness


Consumers are wary about the impact food fats have on their health. So, some studies aim at improving the polyunsaturated fatty acids (PUFA) contents in broilers meat through dietary supplementation. However, higher contents of PUFA expose broiler meat to lipid oxidation. This study was conducted to evaluate the characteristics of meat lipid fraction of broilers fed soybean and linseed oil and the effect of dietary vitamin E on meat lipid oxidation. A total of 360 Cobb (males and females) broilers were raised until 49 d of age on a corn-soybean meal-based diet containing 6.5% vegetable oil. The experiment was a 3x3x2 factorial with three combinations soybean:linseed oil (6:1, 0.4, 5:4:1.1 and 3.4:3:1, %), three concentrations of vitamin E (0, 200 and 400 ppm) and 2 sexes. After slaughtering, total lipids (TL), fatty acids profile (FAP) and cholesterol content (CC) were determined in breast and thigh meat. Thiobarbituric acid (TBA) reaction was used to evaluate lipid oxidation in samples of thigh maintained at -25°C for 45 days. The composition of the dietary vegetable oil did not influence any of the meat traits evaluated (P >0.05). TL of meat was not altered by sex (P >0.05) whilst CC was significantly higher in male than in female meat (P <0.05). However, male broilers meat had significant lower contents of saturated fatty acids (SFA) and higher contents of PUFA than female meat (P <0.05) but this difference in FAP was not significantly associated to lipid oxidation. The administration of vitamin E at 200 or 400 ppm significantly decreased meat TBA (P <0.05), with no difference on lipid oxidation up to 200 ppm. The use of linseed as linolenic acid source in broilers feed was not able to influence the fatty acids composition of meat at the concentrations supplied. Male broilers meat had higher CC and PUFA and lower contents of SFA than female broilers meat. Dietary supplementation of vitamin E at 200 ppm was enough to prevent meat lipid oxidation.

Key Words: vitamin E, lipid oxidation, broilers meat, fatty acid, cholesterol


There is almost a common sense among food consumers about the benefic effects of polyunsaturated fatty acids (PUFA), particularly
omega-3 (n-3) on their cardiovascular system. Because of that, some studies have been trying to demonstrate the benefits of the inclusion of n-3 PUFA sources such as linseed oil directly in foods or in feeds, as in broilers diets, aiming at their increase in meat. This research investigated the effects caused on broilers performance due to the substitution of soybean oil for linseed oil in diets. Cobb-one-day chicks (192) were raised in floor pens until 42 d of age with a corn-soybean meal-based diet containing 6.5% soybean or linseed oil at an ad libitum basis. The experiment was a 2x2 factorial, with two sexes and two dietary oil sources as variables. Data for performance analyses were recorded at 21 and 42 d of rearing. Additionally, the effect of the dietary concentration of linseed oil on broilers’ immunological response was evaluated. Test birds were vaccinated against Newcastle virus at 7 and 21 d of age. At slaughter, blood samples were collected for antibody titration by ELISA. Feed consumption and weight gain were significantly lower (P <0.05) for birds that received linseed, probably due to the presence of linatin, an antinutritional factor that forms complexes with pyridoxine. The main symptom of pyridoxine deficiency is the growth delay due to decrease of hunger. Immunological response also was injured by dietary linseed. While soybean oil is rich in linoleic acid, the precursor of leukotriens involved in immune system, linseed oil contains substantial amounts of limoninic acid, precursor of other n-3 PUFA. Considering that the metabolism of these fatty acids require the same enzymes, an excess of limoninic acid may be harmful for the formation of important compounds involved in the immunological mechanism. In conclusion, it is necessary to make an appropriate balance of vegetable oils in broilers feed in order to avoid damages in performance.

Key Words: polyunsaturated fatty acid, cholesterol, performance, broiler meat, immune response

P224 Effect of irradiation on the microbiological quality of chicken breast stored for different periods. K. F. G. Cardoso, A. A. Mendes*, V. L. M. Rall, I. C. L. A. Paz, and C. M. Komiyama, Universidade Estadual Paulista, Botucatu, SP, Brazil.

The effect of irradiation on the reduction and/or destruction of microorganisms present in chicken breast stored under refrigeration and freezing was studied. Forty chicken breast filets were obtained from a slaughterhouse inspected by the SIF. The samples were placed in vacuum plastic packages and then they were refrigerated or submitted to slow freezing. The samples were irradiated with a dose of 3 kGy and then stored in cold room (4°C) for 21 days or freezer (-18°C) for 90 days, according to treatment. Microbiological analyses were performed to determine the number of mesophilic aerobic microorganisms, or optional anaerobic, psychrotrophic, determination of the number of total and thermotolerant coliforms and detection of the presence of Salmonella. The samples placed in modified atmosphere showed a better microbiological quality than the vacuum packed ones.

Key Words: modified atmosphere, chicken breast, microbiology, shelf life, Salmonella

P225 Effect of modified atmosphere packaging on the microbiological quality of chicken stored for different periods. A. A. Mendes*, K. F. G. Cardoso, V. L. M. Rall, I. C. L. A. Paz, and C. M. Komiyama, Universidade Estadual Paulista, Botucatu, SP, Brazil.

In this work, the effect of modified atmosphere packaging on chicken breast stored under refrigeration and freezing was studied. Forty chicken breast filets were obtained from a slaughterhouse inspected by the SIF. The samples were placed in vacuum plastic packages and in modified atmosphere, for this, two different gas mixtures were used, called Gas I and Gas II (Gas I = 62% CO2 / 8% O2 / 30% N2 and Gas II = 20% CO2 / 80% N2 ) and then they were refrigerated or submitted to slow freezing. The samples were stored in cold room (4°C) for 21 days or freezer (-18°C) for 90 days, according to treatment. Microbiological analyses were performed to determine the number of mesophilic aerobic microorganisms, or optional anaerobic, psychrotrophic, determination of the number of total and thermotolerant coliforms and detection of the presence of Salmonella. The samples placed in modified atmosphere showed a better microbiological quality than the vacuum packed ones.

Key Words: modified atmosphere, chicken breast, microbiology, shelf life, Salmonella

P226 Comparison between the conventional microbiological method and the PCR method in the detection of Salmonella in naturally contaminated cuts of chicken. K. F. G. Cardoso, V. L. M. Rall, A. A. Mendes*, J. P. Araujo Jr, and J. M. G. Candeias, Universidade Estadual Paulista, Botucatu, SP, Brazil.

Demand for tests for detection of Salmonella in poultry has increased, especially for those most rapid, efficient and economical, due the requirements of quality control and market pressures, which appears eager for volume production and quality. The purpose of this study was to compare the conventional method and PCR to Salmonella detection in retail poultry naturally contaminated. The data were positive for Salmonella in the samples using PCR and conventional method were analyzed by test Mac Nemar with a significance level of 5%. We collected 50 samples, from nine different establishments in Botucatu city, Sao Paulo, from August 2007 to February 2008. Only 4 (8%) presented this pathogen using the traditional method and 23 (46%) by PCR, a statistically significant difference (S = 14.0 p = 0.0002). The results show the speed and high sensitivity are great advantages, been an important tool for the food industry. Then, it can be used in all productive chain, including the final product, ensuring the industry and the consumer product quality.

Key Words: Salmonella, PCR, microbiology, chicken, quality

P227 Evaluation of occurrence and quality characteristics of PSE meat in broiler chickens. R. G. Garcia*, A. M. A. Gabriel1, J. D. Graciano1, F. R. Calsara1, F. M. J. Vargas, L. W. Freitas1, A. W. Schwingel1, C. M. Komiyama2, and R. M. Farias1, 1UFGD - Universidade Federal da Grande Dourados; FCA - Faculdade de Ciências Agrárias, Dourados, Mato Grosso do Sul, Brazil, 2FMVZ/UNESP - Faculdade de Medicina Veterinária e Zootecnia de Botucatu-SP, Botucatu, São Paulo, Brazil.

It was undertaken a visit in commercial slaughter of Mato Grosso do Sul state, aiming to evaluate the occurrence of pale breast meat in broiler chickens, and was chosen a slaughter located in Dourados city. Incidence
of pale meats was realized using L* value (lightness), a* (redness) and b* (yellow) parameters in commercial plant of slaughter. The colorimeter used was Minolta CR-300, portable equipment and it was considered pale meat when samples presented L* value equal or higher 49. It was evaluated 600 samples with 50 normal-colour and 50 pale-colour were sent to the FCA/UFGD Laboratory and it was evaluated the remaining meat quality parameters (drip loss, water retention, cocking loss, texture and sensorial parameters). For breast fillets of broilers with pale coloration, the initial pH values was 6,54 and final pH values was 6,50, while normal colorations ones presented initial pH of 5,67 and final pH of 5,89. It was observed difference (p<.05) between pale and normal fillets for pH, L* value, redness, water retention and cocking loss. No difference was observed difference (p>.05) between pale and normal fillets for texture and sensorial parameters. This research revealed that the occurrence of pale meat in broiler breast was 10,20%.

**Key Words:** broiler meat, meat color, pH, water retention capacity, PSE meat


The pre-slaughter of broiler, which extends from the withdrawal of the diet in the farm to slaughter, is probably one of the stages of the production chain that exerts greater influence on the qualitative and quantitative indices of the proceeds from slaughterhouse. The objective was to evaluate the effect of different periods of fasting pre-slaughter (4, 8, 13 and 17 hours) on the attributes of quality of breast meat of broilers type Grille and microbiology of the gastrointestinal tract. 40 birds were used (females), Ross, randomly distributed in the treatments (10 birds / treatment). In 35 days the birds were slaughtered and the variables were analyzed: water holding capacity, loss of exudate, loss of water by cooking the brisket and the presence of microorganisms in the gastrointestinal tract. The results showed that the time of fasting pre-slaughter had no significant effect (P> 0.05) on any of the variables. The duration of fasting had no influence on the attributes of quality of breast meat of broilers type grill and microbiology of the gastrointestinal tract.

**Key Words:** water holding capacity, griller broiler, loss of exudate, loss by cooking, food restriction
Reis, R. N., T107, T108
Remus, J., M31, T105
Renema, R. A., P184
Rhyne, C. M., M14, M15
Richardson, J. R., P218
Richardson, L. J., M12, M13, M75, P217
Roberts, S. A., M63
Robeson, L., P180
Rocha, C., M28
Rodrigues, L., P219
Rodrigues, L. R., P198
Rodrigues, V. P., P181
Rodriguez, E., T116
Roland, D. A., P179
Romero, L. F., M69
Rosa, A. P., T101
Rosario, C. C., P152
Rottinghaus, G. E., T94
Roush, W. B., T97, P187
Rowe, D. E., T124
Ruiz-Feria, C. A., M4, M46
Russell, S. M., M54
Ruszler, P. L., T91
Sakomura, N. K., P202
Salmon, L., M74
Sanders, D., M26
Sanfelice, C., P219
Sansi, J. A. A., T95
Santana, M. H. M., P199
Santos, C. S., P200
Santos Jr., A. A., P161
Savage, E., P215
Saylor, W. W., T106
Schwingel, A. W., P227, P228
Scotta, B. A., P204, P206, P207
Sellers, H., T130
Sellers, H. S., T129
Shaw, A. L., M32
Sheikhlar, A., M29, P190
Shim, M. Y., P172
Shirley, R. B., M39, M67
Shivakumar, M. C., M16, M17
Shivaramaiah, S., M45
Silva, D. F., P199
Silva, J. H. V., P181, P198, P199, P200
Silva, N. V., P198
Singh, M., M52
Siragus, G. R., M83
Smith, D., P215
Smith, D. P., P217, P218
Smith, R., M20
Snyder, R. V., M25
Soderstrom, S., P186
Sogunle, O. M., M43
Sonubi, O. T., M43
Sorbara, J. O. B., M28, T101, T102, T107, T108, T114
Southern, L., M30, M42
Southern, L. L., M37
Souza, E. B., P168
Souza, J. G., P181
Stark, C., M36
Stark, C. R., T89
Starkl, V. H., T117
Stayer, P. A., M20
Stefanello, C., T101
Stephens, C. B., M13
Stevenson, L., M55
Stricker, R., T133
Stringfellow, K., M4
Stringfellow, K. D., M9, M81
Swaffar, A. D., P214
Swamy, H. V. L. N., M16, M17
Swayne, D. E., P147
Swingle, A. W., M168
Swestka, R. J., M63
T
Teichmann, K., M82, P150
Tejeda-Gil, R. V., P171
Tellez, G., M45, P176
Testik, A., P163
Thor, S. W., T137, T138
Tillman, P. B., M67, P182
Toro, H., T134
Troche, C., M19
U
Ukil, M. A., P185
Urquiza, O., P165
Urquiza-Bravo, O., P153
Usry, J., M67
Utterback, C. W., M2
Utterback, P. L., M2
Uwigboe, E. O., M27, T87, T127, T128
V
Van de Mierop, K., T113
Van den Brand, H., M72
Van Ginkel, F. W., T134
Van Santen, V. L., T134
Van Wyhe, R., M8
Vance, A. M., P155, P156
Vargas, F. M., P227, P228
Vargas, F. M. Jr, P168
Vargas Jr., J. G., P204, P206
Vargas Jr., J. G., P207
Vian, A. C., T114
Vieira, D. V. G., P207
Vieira, S. L., T107, T108, T114
Villas, P., P154
Vizzier-Thaxton, Y., T100
W
Waguespack, A., M42
Walk, C. L., M31, T105
Walter, K. A., M65
Waneck, C. R., M5, P166
Ward, N., P196
Ward, N. E., T106
Weber, P., P180, P195
Wells, J., M57
Whipple, S. M., M58, M60, M61, M73, T122, T123
Whiting, T., P214
Whitley, J., M14
Williams, C., T126
Williams, S. M., T139
Williams, Z., T100
Williamson, K. Y., P151
Wilson, J. L., M12, P148
Wilson, K. J., M60, M61, T122
Wineland, M., M47
Wineland, M. J., M11, M14, M15, T125, P148
Wolfenden, A. D., M45, P176
Wolfenden, R. E., P176
Womack, S. K., M48, M49
Wright, D., P203
X
Xavier, P. S., T114
Xin, H., M63
Xu, Y., M51
Y
Yañez, J, P164
Yersin, A. G., M25, M26
Yoho, D. E., M58, M60, M61, M73, T122, T123, P214
Young, S., M7, P144
Yu, S., T110
Z
Zamperio, J., P153
Zavala, G., T129, T130, T139
Zhu, W.-Y., P160
Zhuang, H., P215
Zuidhof, M. J., M69, P184
Zulkifli, I., P185
Zumwalt, C. D., M10, M24, P210