
Commercial feed phytases are industrial enzymes used to break down phytate in animal feed and release phosphorous (P) essential for growth. It is a cheaper alternative to mineral phosphates, such as MCP, which is a limited resource. A life cycle assessment (LCA) was done according to ISO 14040 and similar to Nielsen and Wenzel (2006; Environmental Assessment of RONOZYME P5000 CT Phytase as an alternative to Inorganic Phosphate in Pig Feed, Int. J. LCA) in which the environmental effects of P excretion. MCP, commonly used as a P source in broiler diets, contains 22.7% easily digestible P and is derived from rock phosphate, which is a limited resource. A life cycle assessment (LCA) was done according to ISO 14040 and similar to Nielsen and Wenzel (2006; Environmental Assessment of RONOZYME P5000 CT Phytase as an alternative to Inorganic Phosphate in Pig Feed, Int. J. LCA) in which the potential environmental impact measured as global warming, acidification, nutrient enrichment (algae bloom), energy consumption and, were estimated using CML 2000 characterization model in Simapro 7.2. In this study, a solid state form of a bacterial 6-phytase from Citrobacter braakii (RH) at 1000 U was benchmarked against 9 kg of MCP which will each provide of an equivalent of 1.5 kg of available P per ton of broiler feed. In all parameters analyzed RH was significantly better than MCP. Global warming potential (kg of CO2 eq.) was 0.20 vs. 10; Acidification potential (g of SO2 eq) was 0.60 vs. 180; Nutrients enrichment (g of PO4 eq.) was 0.40 vs. 460; Energy consumption (MJ) was 2.2 vs. 140. In conclusion not only is RH a cheaper alternative to mineral P such as MCP it is much better for the environment and can enable farmers to stock more animals in places where P output is limiting thus providing more meat per unit.

Key Words:  life cycle assessment, phytase, mineral phosphate, Citrobacter braakii
of 0.60 µg of 25(OH)D$_3$ is capable of increasing the bone strength of male Ross × Ross 708 broilers through d 28 poh.

**Key Words:** 25-hydroxycholecalciferol, broiler, density, mineral, tibia

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**P269 Effect of incubation temperature on body weight, oxidative stress, antioxidant status, and fatty acid profile of day old broiler chicks.** A. K. Panda* and G. Cherian, Department of Animal and Rangeland Sciences, Oregon State University, Corvallis.

Incubator temperature that is currently used (37.5°C) may promote oxidative stress and lipid peroxidation in the fast-growing broiler chick embryo with a high metabolic rate. The increase in oxidative stress may promote lipid peroxidation and may compromise antioxidant status of the embryo and hatching. The hypothesis tested is that reducing the incubation temperature will minimize lipid peroxidation, enhance tissue antioxidant status, and increase the retention of long chain polyunsaturated fatty acids (PUFA) in the hatched chicks. One hundred and forty-four fertile eggs were distributed into 2 groups with 12 replicates of 6 eggs each. The eggs were incubated at a constant temperature of 100°F (Control) or the incubation temperature was reduced to 2°F (98°F) (Low) from d 5 until hatch. No difference was observed in the body weight of hatched chicks (P > 0.05). Liver weight as percent of body weight was higher in Low than in Control chicks (P < 0.05). However, relative weight of the yolk sac was higher in Control than in Low groups (P < 0.05). There was no difference in the total lipid content of liver and yolk sac in Control and Low chicks. Lipid oxidation products measured as thiobarbituric acid reactive substances (TBARS) in the yolk sac were lower (P < 0.01) in Low chicks when compared with Control chicks. No effect of incubator temperature on liver TBARS was observed (P > 0.05). No effect of incubator temperature on α-, γ-, or total tocopherol content in the yolk sac was observed. The liver tissue of Low chicks was higher in docosahexaenoic (22:6 n-3), arachidonic (20:4 n-6), total n-3 and saturated fatty acids than in Control groups (P < 0.05). However, total n-3 fatty acids were lower in the yolk sac of Low than in Control groups (P < 0.03). No difference was observed in the total saturated or monounsaturated fatty acids in the yolk sac of chicks from Control and Low groups. The results of the present study revealed that temperature manipulation during incubation affects oxidative stress and fatty acid metabolism in broiler chicks.

**Key Words:** incubation temperature, polyunsaturated fatty acid, lipid oxidation product

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**P270 Effect of thermal stimulation during broiler embryogenesis on hatchability, chick quality, and chick performance under commercial conditions.** A. Elmehdawi*1, M. Hall1, P. Skewes1, D. Wicker2, and D. V. Maurice1, 1Clemson University, Clemson, SC, 2Fieldale Farms Corporation, Baldwin, GA.

The aim of this study was to investigate the effects of manipulating the incubation temperature during late incubation on hatchability, chick quality, secondary sex ratio, and growth out performance under commercial conditions. Two setters of 42,240 eggs capacity each were used. One served as the control and the other as the treatment which had the same physical environment as the control except that a thermal stimulus of 1°C above the optimal incubation temperature for 2 h was superimposed each day from d 18 to d 20. Temperatures were verified by the use of data loggers in each unit. Hatching eggs from hens aged 35–39 weeks were set and about 20,000 chicks from each group placed in the field weekly. The experiments were replicated over time with 5 replicates. Chicks were sampled at hatch and at one week of age and body weight,
feed conversion, and mortality measured at market age. Moisture loss, embryo temperature, hatchability, chick weight, chick rectal temperature, chick quality, and residual yolk sac weight were measured and sex determined after dissection. Thermal stimulation improved feed conversion by 1.82% or 3.6 points ($P < 0.0491$) in comparison to the control group. When adjusted to a 6-lb body weight, the improvement in feed conversion translated to 2.03% lower feed conversion and 2.23% lower caloric cost. The other responses measured at hatch or post-hatch were not influenced by thermal stimulation. The results demonstrated that low-intensity, short-duration thermal stimulation above the optimal incubation temperature during late incubation had positive long lasting effects on chick performance and feed conversion.

**Key Words:** broiler, incubation, thermal stimulation, feed conversion

P271  Effects of eggshell conductance and incubation temperatures on duck footpad development and dermatitis incidence. M. J. Da Costa*,1, E. O. Oviedo-Rondon1, M. J. Wineland1, and D. Jeffrey2, 1Department of Poultry Science, North Carolina State University, Raleigh, 2Maple Leaf Farms, Milford, IN.

Footpad dermatitis (FPD) is a major animal welfare concern. Paws are great source of revenues for poultry companies nowadays. One experiment was conducted to evaluate the effects of eggshell conductance (G) and temperature profiles during incubation on duck footpad histological structure and FPD incidence at 35 d of age. A total of 10,000 Pekin duck eggs from a commercial line of Maple Leaf Farms were randomly sorted, equally distributed into 4 groups, and placed in 2 single stage incubators. Treatments consisted of 2 G, reduced and normal, and 2 incubation temperature profiles (T), elevated and normal, after d 12. Eggshell G was reduced by dipping eggs in wax at 14 d of incubation. At hatch, ducklings were identified and placed in a commercial house. At market age, 5 drakes and 5 hens of each treatment combination were selected, weighed and classified for FPD using a 3 level scale. Additionally, 7 ducks per treatment combination were culled and footpad skin samples were collected for posterior histological processing. Histological analysis assessed thickness and total area of stratus corneum (SC), epidermis and dermis and total height and width of papillae present in footpad skin. FPD data were analyzed using cumulative logistic regression to model the log odds of the cumulative probabilities of lesions as a function of the factorial effects of treatments plus the additive sex effect. For the histological data a 2 × 2 factorial design with T and G as main factors was used. Results indicated ($P < 0.05$) that either elevated T or reduced G increased the probability of having FPD. No differences were observed between sexes. On the histological results, an effect of G was observed on epidermis area. Reduced G ducks had a bigger area of epidermis than normal G. Additionally, a trend ($P = 0.09$) of T effect was observed on papillae width. Elevated T increased the width of papillae in comparison with normal T. It was concluded that G and incubation profiles have an effect on FPD in ducks at market age, and this might be related with changes on footpad skin structure.

**Key Words:** footpad dermatitis, duck, welfare

P272  Salmonella typhimurium litter recovery during rearing of broiler breeder pullets on skip-a-day and every-day feeding programs. K. M. Wilson*1,2, B. L. McLendon2, D. V. Bourassa3, J. L. Wilson3, N. A. Cox1, and R. J. Buhr1, 1USDA-ARS, Athens, GA, 2University of Georgia, Athens.

The impact of restrictive feeding programs on Salmonella positive seeder chicks was investigated. Chicks (135/pen) were placed on litter into 3 feeding program rooms, each room containing duplicate pens. Feeding programs began at wk 4 and were as follows: 1) Skip-a-day in the trough feeder (SAD); 2) Every-day in the trough feeder (EDT); or 3) Every-day on the litter (EDL). At 5 wk, 5 Salmonella-seeder pullets (gavaged with 4.0 × 10^4 cells of a nalidixic acid-resistant Salmonella Typhimurium on d 1) were commingled in each pen and the litter surface sampled using stepped-on drag swabs at 7, 9, and 11 wk. At 7 wk, from one SAD and one EDT pen Salmonella was recovered from the litter with direct plating and after enriched all 6 pens were Salmonella-positive. At 9 and 11 wk, pen litter was sampled at the following times: 1) Before feeding, 2) 3 h after feeding, and 3) 6 h after feeding. At 9 wk there were 2 sampling days for SAD, EDT and EDL and at 11 wk SAD pens were sampled on both off-feed and on-feed days. At 9 wk: SAD had the highest Salmonella-positive litter with 11/12 direct plates positive and 100% following enrichment. EDT had only 2/12 direct plates positive and 100% following enrichment. EDL had the lowest Salmonella recovery, with no direct positive plates and only 58% positive following enrichment. At 11 wk: SAD again had the highest Salmonella-positives for both on-feed d 4/12 direct plates and 100% following enrichment and off-feed d 2/12 direct plates and 100% following enrichment. EDT had only 1/12 positive direct plates but 100% following enrichment. EDL had the lowest Salmonella litter recovery, with no direct positive plates and only 50% following enrichment. There were no obvious associations with the time after feeding of collected litter samples (presence of fresh feces) and Salmonella recovery. These results suggest that feeding broiler breeder pullets SAD may contribute to higher Salmonella litter contamination and persistence after an environmental challenge during rearing.

**Key Words:** restrictive feeding, broiler breeder pullet, Salmonella typhimurium, litter

P273  Effects of a commercial anticoccidial on broilers raised on litter seeded with potentially resistant oocysts. K. S. Macklin*1, M. A. Bailey1, J. T. Krehling1, J. B. Hess1, and J. D. French2, 1Auburn University, Auburn, AL, 2Elanco Animal Health, Greenfield, IN.

Coccidiosis in broilers can be a serious problem if prophylactic measures are not taken to control it. Prolonged usage of some prophylactics can lead to resistance. Resistance of *Eimeria* will lead to a decrease in live bird performance. The objective of this study to determine if there was any loss in live performance in birds fed a commercial anticoccidial (narasin/nicarb [NE]) that were reared on litter seeded with *Eimeria* from a farm that has used this anticoccidial for several flocks. In this study, 1600 females were randomly placed into 32 pens (50/pen), with 16 pens on each side of a pen house. One side of the house (16 pens), had litter seeded with *Eimeria* spp. from a producer that had not used narasin/nicarb (NE) for several years, while the other side of the house had litter seeded with *Eimeria* spp from a producer that has used narasin/ nicarb (EE) for several flocks. Each 16 pen group had 8 diets that contained the narasin/nicarb while the other 8 pens had diets that lacked any anticoccidial. A standard 3 fed diet was used, that depending on the diet included the anticoccidial at the manufacturer recommended level. Bird and feed weights was determined at 0, 14, 30 and 35. Data was then analyzed using ANOVA with any significant differences ($P < 0.05$) being further separated using Tukey’s HSD. The results at d 35 were significant ($P < 0.001$) and showed that there was an overall improvement in AFC in the birds fed narasin/nicarb (1.54EE, 1.55NE), versus those that had no anticoccidial in their diets (1.56EE, 1.58NE). When AFC between the birds fed anticoccidial and the source of *Eimeria* spp. were analyzed, there was no significant difference ($P > 0.05$; 1.54, 1.56).
Final BW was improved ($P < 0.05$) in the birds fed the anticoccidial (1.88kgEE, 1.92kgNE) over those that were not (1.85kgEE, 1.86kgNE). There was no difference ($P > 0.05$) in BW between anticoccidial fed birds (1.88kgEE, 1.92kgNE), regardless of the *Eimeria* spp source. These results show that the anticoccidial containing the combination of narasin and nicarbazin is less likely to develop resistance; however prudent use of this product should still be used.

**Key Words:** coccidiosis, broiler, resistance

P274  Use of PCR for the detection of the *netB* gene in strains of *Clostridium perfringens* isolated from cases of avian necrotic enteritis in Alabama.  M. A. Bailey*, K. S. Macklin, and J. T. Krehling, Department of Poultry Science, Auburn University, Auburn, AL.

The discovery of the *Clostridium perfringens* (CP) NetB toxin has introduced questions which challenge the traditional model describing the pathology of necrotic enteritis (NE) in chickens. Increase in the total population of CP in the gut, induced by dietary factors and prior intestinal damage, is the most widely accepted cause. With the discovery of NetB, the literature has shown not only that this toxin is crucial for the virulence of some strains, but also that the encoding gene, *netB*, is present in 51–91% of strains isolated from separate cases of NE. Additionally, few strains from healthy birds have this gene. Considering these observations, it has been proposed that NE is not induced by increases in the total gut population of CP, but by the increase in clonal populations which contain *netB*. Although previous data appears to support this proposal, isolates tested for *netB* have originated from limited geographical areas. To increase understanding in the widespread importance of the toxin, this study analyzed 49 isolates from separate cases of NE in Alabama for the presence of *netB* using PCR. Only 2 isolates (4%) tested positive for the gene. This appears to support the accepted model of pathogenesis and indicates that the NetB toxin may only be an important virulence factor for certain isolates or only in certain geographical areas.

**Key Words:** poultry, necrotic enteritis, *Clostridium perfringens*, *netB*

P275  Effect of natural extracts mixed with organic acids on broiler health and production.  G. Guzman*, A. Garcia1, 1Viator, Guadalajara, Jal, Mexico, 2Universidad de Guadalajara, Zapopan, Jal, Mexico.

The purpose of the present study was to evaluate 2 nutraceutical water additives on blood parameters and body weight. The study consisted of 7,000 Ross 308 female chicks that were placed in 3 experimental groups (A, B and C) with 3 replicates each, and provided 2 nutraceutical formulas in the drinking water. The nutraceutical composition for each Group was as follows: Group A 5% yeast extract, 10% Roselle hydro-alcohol extract, 10% of acetic acid, 10% of citric acid; Group B 10% Bloodroot hydro-alcohol extract, 10% of acetic acid, 10% citric acid; and Group C were provided water only. The nutraceutical dosage for A and B groups were 1 mL of nutraceutic formula per one liter of drinking water in each diet change for 3 d (starter, growth and finish). Blood samples were taken at 35 and 40 d old and were analyzed for hemoglobin, plasmatic protein, albumin, globulin, albumin/globulin ratio by spectrophotometry. At the termination of the study, final body weights were recorded. Poultry body weight group B was statistically different ($P < 0.05$) than the rest of the groups. Body weights at 43 d old in decreasing order were for group B 2.268 kg, group A 2.205 kg and group C 2.167 kg. Hemoglobin at 35 d old, group A was statistically different ($P < 0.05$) than the rest of the groups but at 40 d old there was not statistical difference among groups. Hemoglobin at 35 d old in decreased order were for group A 8.97 g/100 mL, group B 8.04 g/100 mL and group C 7.75 g/100mL. No statistical differences were observed among groups on plasmatic protein, albumin and globulin. There was statistical difference only on albumin/globulin ratio in both sampling periods. At 35 d old the albumin/globulin ratio in decreased order were for group B 1.217, group A 0.921 and group C 0.923. At 40 d old the albumin/globulin ratio in decreased order were for group B 1.90, group A 1.64 and group C 1.65. In conclusion the difference among groups was the kind of extracts. Further studies are needed to elucidate if Bloodroot extract influence directly on the intestines or indirectly by interaction with the enteric ecology, in particular with the microbes.

**Key Words:** broiler, natural extract, nutraceutic, final weight, globulin

P276  Effects of feeding diets naturally contaminated with deoxynivalenol (DON), aflatoxin B1 (AFB1), and/or fumonisin (FUM) in layers on internal egg quality measurements.  S. Iselt1, J. Lee1, M. Farnell1, R. Latham1, K. Naehrer2, U. Hofstetter2, R. Beltran2, G. Schatzmayr2, and D. Caldwell*1, 1Texas A&M University, College Station, 2Biomin, Herzogenburg, Austria.

The effect of feeding pre-peak production laying hens diets formulated using corn naturally contaminated with DON, AFB1, or FUM on albumen height, Haugh unit value, and relative egg weight components (albumen, yolk, and shell) was evaluated during a 10-wk trial. Two primary corn sources, one with predominant DON contamination and the other with predominant AFB1+FUM contamination, were used for challenge diets. The experimental design consisted of a 4 × 2 factorial with 4 mycotoxin diets with or without a commercially available deactivating compound (DC). Mycotoxin challenge diets with calculated target mycotoxin levels included: control, DON (9 ppm) challenge, AFB1 (2 ppm) + FUM (54 ppm) challenge, and a mixed challenge comprised DON (6 ppm) and AFB1 (1 ppm) + FUM (27 ppm). Assayed values of DON in challenge diets were close to targets. Assayed values of AFB1+FUM varied and were often below target, indicating inconsistent levels in source corn. Hens were randomized, placed into commercial type laying cages, and were fed respective diets for the duration of the trial. At wk 7, all mycotoxin challenge groups decreased ($P < 0.05$) albumen height, Haugh unit value, and relative egg weight components compared with controls. At wk 9, DC inclusion increased ($P < 0.05$) relative albumen weight and increased ($P < 0.05$) relative yolk weight compared with diets without DC. At wk 5 and 6, all mycotoxin challenge groups increased ($P < 0.05$) relative shell weight compared with controls. At wk 5, DC inclusion increased ($P < 0.05$) relative shell weight compared with diets without DC inclusion. The variable nature of some observed measurements suggests pre-peak production laying hens may be relatively resistant to DON, AFB1, and/ or FUM mycotoxin challenge at levels evaluated in the current trial.

**Key Words:** aflatoxin, deoxynivalenol, fumonisin, egg grading, egg weight component

P277  Effects of feeding diets naturally contaminated with deoxynivalenol (DON), aflatoxin B1 (AFB1), and/or fumonisin (FUM) in layers on external egg quality measurements.  S. Iselt1, J. Lee1, M. Farnell1, R. Latham1, K. Naehrer2, U. Hofstetter2, R. Beltran2, G. Schatzmayr2, and D. Caldwell*1, 1Texas A&M University, College Station, 2Biomin, Herzogenburg, Austria.

The effect of feeding pre-peak production laying hens diets formulated using corn naturally contaminated with DON, AFB1, or FUM on egg weight, shape index, specific gravity, and egg shell thickness was evaluated during a 10 week trial. Two primary corn sources, one with predomi-
nant DON contamination and the other with predominant AFB1+FUM contamination, were used for challenge diets. The experimental design consisted of a 4 × 2 factorial with 4 mycotoxin diets with or without a commercially available deactivating compound (DC). Mycotoxin challenge diets with calculated target mycotoxin levels included: control, DON (9 ppm) challenge, AFB1 (2 ppm) + FUM (54 ppm) challenge, and a mixed challenge comprised DON (6 ppm) and AFB1 (1 ppm) + FUM (27 ppm). Assayed values of DON in challenge diets were close to targets. Assayed values of AFB1+FUM varied and were often below target, indicating inconsistent levels in source corn. Hens were randomized, placed into commercial type laying cages, and were fed respective diets for the duration of the trial. At wk 6, 7, and 10, the AFB1+FUM diet decreased (P < 0.05) egg weight compared with mixed or DON diets. At wk 7, the AFB1+FUM and mixed diets decreased (P < 0.05) egg length compared with the DON diet. At wk 7, all mycotoxin diets increased (P < 0.05) specific gravity compared with controls. At wk 5, the DON diet decreased (P < 0.05) egg shell thickness compared with the AFB1+FUM diet. At wk 6 and 7, all mycotoxin diets increased (P < 0.05) egg shell thickness compared with controls. The variable nature of some observed measurements suggests pre-peak production laying hens may be relatively resistant to DON, AFB1, and/or FUM mycotoxin challenge at levels evaluated in the current trial.

Key Words: mycotoxin, egg weight, shape index, specific gravity, egg shell thickness

P278 Effects of housing system and hen strains on skeletal integrity and egg quality of laying hens at the end of the first laying cycle. R. Adhikari*1, J. H. Kim2, and W. K. Kim1,1University of Manitoba, Winnipeg, MB, Canada. 2National Institute of Animal Science, Chungnam, Republic of Korea.

The objective of this study was to evaluate differences in skeletal integrity and egg quality between 2 strains (Bovan White and Shaver White) of laying hens reared in 2 different cage systems (conventional and enriched). Two different strains of laying hens housed in a conventional cage system (CC) with 5 birds/cage providing 561.6 cm² of floor space per hen or enriched cage system (EC) with 24 birds/cage providing 642 cm² of floor space per hen were selected for the study in a 2 × 2 factorial design. The EC contained perch, curtained nesting area and scratch pad. A total of 40 cages (10 cages/strain/cage system) were used for the study. On 55 wks 2 eggs per cage were collected to measure egg quality parameters: egg weight (EW), specific gravity (SG), Breakage strength (BS), shell thickness (ST), and Haugh Unit (HU). At the end of 65 weeks one bird per pen was euthanized to collect left femur and tibia to measure bone mineral density (BMD), bone mineral content (BMC) and bone area using dual-energy x-ray absorptiometry. Tibia BMD and bone area of EC hens were higher (P < 0.05) than those of CC hens; however there was no difference in bone area. Femur bone area of EC hens was lower (P < 0.05) compared with those of CC hens; however there was no difference in BMD and BMC. Femur BMD and BMC of Shaver were higher than those of Bovan (P < 0.05). BMD and bone area of tibia were better in Shaver than in Bovan (P < 0.05). The result showed that Shaver in enriched cages achieved the best bone health; however, there was no significant cage and breed interaction. There was no difference in body weight, EW, SG, BS, ST, and HU between the 2 cage systems. Eggs from Shaver had higher SG than Bovan, whereas eggs from Bovan had higher BS (P < 0.05). This study indicates that laying hens housed in enriched cages may have better bone quality than in conventional cages at the end of the first laying cycle.

Key Words: laying hen, skeletal integrity, cage system