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Drought, debt and politics drive economic outlook  

Terry Barr  

CoBank

The global economy faces major headwinds entering 2013 as the drive for deficit and debt reduction in the advanced economies will limit the much needed job creation amid significant political turmoil. The major driver of global growth, China, will be undergoing a once-in-a-decade leadership transition. As a result consumer purchasing power and demand in the U.S. and world will grow modestly. At the same time drought-reduced grain production in the U.S., Russia and Europe has reduced supplies and pushed grain and oilseed prices to record levels. This combination will present a challenging market environment for the cattle, hog, poultry and dairy sectors. Output adjustments to restore profitability will be difficult and will place a heightened premium on strong balance sheets, liquidity and risk management strategies.

**Key Words:** Global economy, China, Market environment
M1 Lectin staining of chicken sperm storage tubule and uterovaginal junction epithelia M.R. Bakst1*, J. Eastridge, J. Dymond US-DA-ARS Beltsville, Beltsville, MD

Lectins are sugar-binding proteins that bind to terminal sugars associated with extracellular or intracellular cell membranes. Each lectin can be used to identify one or more specific glycoconjugates that may influence cell-to-cell recognition, composition of epithelial cell glycoalyx, and/or cell transport and absorption activities, cell functions relevant to SST function. In this study we examined the lectin binding activity of SSTS and uterovaginal junction (UVJ) epithelia isolated from laying broiler hens. UVJ mucosal folds containing SSTS were fixed, embedded, sectioned and stained with fluorescent-conjugated lectins. Our preliminary observations confirm that the epithelia lining the UVJ and SST are not only morphologically distinct but possess different lectin binding characteristics. Wheat-germ agglutinin (WGA; n-acetylglucosamine) was observed in both epithelia, specifically the apical and lateral plasma membranes. In contrast, Griffonia simplicifolia-II (GSII; n-acetylglucosamin) only was localized to the SST basement membrane and intermittently to the UVJ epithelial cells. Concanavalin A (Con A; alpha-linked mannosides and glucosides) localization was limited to the basement membrane of the SST epithelium but exhibited a strong affinity for the secretory epithelial cells lining the UVJ. Peanut agglutinin (PNA; galactosyl residues) only reacted with the UVJ epithelium and lymphocytes in the loose connective tissue and both epithelia. These baseline observations are being used in on-going studies to elucidate the possible role of glycoproteins in sperm:epithelial associations, sperm:epithelial binding, and differences within and between SST and UVJ epithelia at different stage of the daily ovulatory cycle.

Key Words: sperm, oviduct, sperm-storage

M2 Effect of thermal manipulations during pre-incubation and first 5 days of incubation on early vascular development of Ross 708 embryos. Yun Mei Lin1,*, John T Brake1, Shlomo Yahav2 'Department of Poultry Science, North Carolina State University, Raleigh, NC; 2Institute of Animal Science, ARO The Volcani Center, Bet Dagan, Israel.

Previous studies showed that elevated temperatures during pre-incubation and through E5 of incubation affected embryo growth pattern, hatched chick length, and breast muscle yield of broilers at market age. The present study investigated the effects of early thermal manipulations (TM) on the vasculature development of the yolk sac membrane (YSM) and chorioallantoic membrane (CAM). A total of 2880 broiler hatching eggs from 41-wk-old breeders were subjected to a 2 x 2 factorial design involving pre-incubation temperatures of either 23.9C or 29.4C for 12 h followed by incubation at either 37.5C or 38.1C to E5 of incubation. Incubation continued at 37.5C from E6 and was slightly reduced beyond E12 to maintain egg shell temperature near 37.5C. The RH was 53% from the start of incubation. The YSM and CAM blood vessels were photographed with Wild Photomakroskop M400 software on a Nikon DS-Fi1 Digital Camera and analyzed by Matlab to calculate the blood vascular area within each membrane. An initial incubation temperature of 38.1C increased YSM vasculature at E7. Significant two-way interactions were observed for the preheating temperature by incubation temperature, where the 23.9C + 38.1C combination increased YSM vasculature at E7 and E8 as compared to the other preheating temperature by incubation temperature combinations. As for the CAM vasculature, 38.1C increased CAM vasculature at E8 and E10. The 23.9C + 38.1C combination increased CAM vascular area at E8 and E10 when compared to the other preheating temperature by incubation temperature combinations. It was concluded that elevating temperature prior to and during the beginning of incubation positively affected angiogenesis in both YSM and CAM tissues.

Key Words: broilers, embryos, pre-heating, chorioallantoic membrane (CAM), yolk sac

M3 Blackhead Disease: Reduced sensitivity of Histomonas meleagridis to nitarsone. Mathew Abraham1,*, Larry McDougald, Robert Beckstead Department of Poultry Science, University of Georgia, Athens, GA

Histomonas meleagridis, a flagellated protozoan parasite, is the causative agent of blackhead disease in gallinaceous birds. Necrotic foci in the liver and ulcers in ceca are the pathognomonic lesions of blackhead disease. Currently, nitarsone (4-nitrophenylarsonic acid) is the only approved anti-histomonal drug available in the United States. However, recent histomoniasis outbreak in nitarsone-fed turkeys suggested that the product was not as effective as previously demonstrated. In the present study we tested the sensitivity of nitarsone in both in-vitro and in-vivo conditions. For the in-vitro study, 3 different strains collected from outbreaks in North Carolina (Strain MNC), Michigan (Strain ZM) and Georgia (strain BG) were used. Histomonas diluted to 40,000 cells per ml in fresh modified Dwayer's media were treated with purified nitarsone (Sigma-Aldrich, Inc. St. Louis, Missouri) at 0, 100, or 400 mcg/mL in 3 replicate cultures. Strain ZM and Strain BG at both 100 and 400 mcg/mL showed a diminished growth in comparison with their respective control groups. However, strain MNC treated with nitarsone at 100 mcg/mL did not show any effect and their growth pattern was almost similar to that of control group. In the in-vivo study, two week old turkey poults were individually weighed, banded and distributed into 9 groups of 10 birds each. Three groups were mucosalized clonally with histomonas (Strain MNC) at a dose of 35,000 cells/bird (IC), 3 groups infected with histomonas (35,000 cells/bird) were fed with nitarsone from the first day of life (INT) and other 3 groups were remained uninfected (UC). A commercial premix of nitarsone (Histostat-50Pfizer Animal Health, Inc., Fort Washington, New Jersey, USA) was used to mix turkey starter ration at 0.0187% (187 ppm). At 10 days post infection (dpi) birds were weighed, euthanized, necropsied and cecal and liver lesions were scored in a 0-4 scale. Nitarsone treated group (INT) did not show any significant improvement in the average weight gain compared to that of infected control group(IC). Average weight gains of the uninfected control (UC), infected control (IC) and infected nitarsone treated (INT) were 191.97g, 117.71g or 83.91, respectively. There were no significant difference in the liver and cecal lesions of IC and INT. But both showed significant difference from UC (P<0.0001).
Development of nitarsone resistance by certain strains is strengthening the necessity of alternative chemotherapeutics or immunophrophylaxis against the blackhead disease.

**Key Words:** Histomonas meleagridis, Blackhead, Nitarsone, Histos-tat-50

**M4 Effects of Actigen® Yeast Cell Wall Derivative, Dietary Antibiotics, or Both on Broiler Chicken Performance**

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Actigen® is a pre-biotic yeast cell wall derivative used to improve intestinal health. A floor pen trial was run on built-up litter topped with pine shavings. The trial used a randomized complete block designs (LSD ≤0.05). A total of 2,400 Cobb X Cobb 500 male broiler chicks were vaccinated for coccidia at hatch and then randomly assigned to 48 pens (8 blocks) of 50 chicks/pen providing 0.93 sq. ft per chick. A three phase dietary program was used based on commercial feed formulation standards; starter (ST) d0-17, grower (GR) d17-31, and finisher (FIN) d31-52. Chicks were assigned to treatments and fed one of the following diets: 1. negative control (CON); 2. AGP program (AGP); BMD® 50 g/t d0-31, Staface® 20g/t d31-52; 3. Actigen starter (ACT): Actigen® 800 g/t d0-17; 4. Combination Starter (ACT+AGP); 5. Actigen step down (ACT-SD): Actigen® 800 g/t d0-17, 200 g/t d17-31; 6. Combination Actigen® step down plus AGP (ACT-SD + AGP).

At each weighing, the adjusted FCR d17, d31, d42, and d52 and weight gain d42 and d52 for the feed additive fed birds were significantly better than the CON. The birds fed the combinations ACT+AGP, ACT-SD + AGP and the stand alone ACT-SD program had significantly better FCR at d42 and d52 compared to those fed the AGP and ACT (starter only) programs. The Actigen® at 800 g/t in the starter and the AGP program fed birds were significantly more beneficial to the birds. However, the combinations of Actigen® only starter and step down both in combination with AGP program were the most effective treatments for improving live performance.

**Key Words:** Actigen, prebiotic, antibiotic growth promoter, broiler, performance

**M5 Effect of Lasalocid or Salinomycin on Performance and Immunity Following Coccidia Vaccination in Commercial Broiler Chickens**

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**Introduction:** Coccidia vaccines and ionophores have each traditionally been used to control coccidiosis in broilers. More recently, programs. The Actigen® adjusted FCR at d42 and d52 compared to those fed the AGP and ACT + AGP and the stand alone ACT-SD program had significantly better FCR at d42 and d52 compared to those fed the AGP and ACT (starter only) programs. The Actigen® at 800 g/t in the starter and the AGP program fed birds were significantly more beneficial to the birds. However, the combinations of Actigen® only starter and step down both in combination with AGP program were the most effective treatments for improving live performance.

**Key Words:** Actigen, prebiotic, antibiotic growth promoter, broiler, performance

**M6 Pathological effects of feeding of cottonseed (broken), screw pressed cottonseed meal, isolated pigment glands and lysisne in adult broiler breeder males.**

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The aim of this study was to observe the pathological effects induced by cottonseed by product feeding and supplemented lysisine in diets of breeder males at adult age. 70 sexually active adult 40 weeks of age were randomly assigned different experimental feeds for 10 weeks and groups were identified by the experimental feeding being offered A (Basal feed), B (Broken cotton seed), C (Broken cottonseed +2%lysine), D (Screw press CSM), E (Screw press CSM + 2% lysine) F (Pigment glands) and G (Pigment glands+ 2% lysine) birds were offered weighed daily ration as recommended by the breeding company. The birds in groups A, D, E did not exhibit any behavioral alteration, Maximum intensity of clinical signs was observed in groups F and G (134 mg gossypol /kg bw/day). A significant reduction in body weight and lesser development of comb, vents and testicular size were observed in groups F and G compared to control group. Hematomatological and serum biochemical parameters were also decreased. Testes volume, semen and sperm count were also significantly reduced. No pathological lesions were observed in testes of males kept on ration containing up broken and screw pressed cottonseed with and without lysisine. However, Histologically testes of birds in group F and G exhibited marked reduction in the spermatogenic cell layers with degenerated and necrotic spermatids and multinucleated giant cells in lumen. Increased intertubular connec-tive tissue with punctuation of the chronic inflammatory cells. Massive cytoplasmatic vacuolation in hepatocytes and necrosis in the kidneys. It is concluded from present study that cottonseed byproducts are deleteri-ous to the male reproductive organs at adult age. However, addition lysisine in diets partially ameliorates these untoward effects of cottonseed.

**Key Words:** Cottonseed, pigment glands, Testes, Semen, Pathology

**M7 Ameliorative effects of L-carnitine and vitamin E upon toxicological alterations induced by ochratoxin A (OTA) in white Leghorn cockerels.**

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1 Veterinary Research Institute Lahore Cantt, Lahore, Pakistan; 2 Department of Pathology, 3 Department of Physiology and Pharmacology, University of Agriculture, Faisalabad, Pakistan

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Ochratoxins are the secondary fungal metabolites posing great damages to poultry, livestock and also in humans while L-carnitine is a quaternary ammonium compound biologically synthesized from amino acids methionine and lysine and vitamin E is an antioxidant.

Objective: The present study was aimed to investigate the ameliorative effects produced by L-carnitine and vitamin E against the toxicopathological alterations induced by ochratoxin A in white Leghorn cockerels.

Materials and Methods: A total of 240 cockerels were selected and divided to 12 groups containing 20 birds each. Each group was treated with different levels of OTA, L-carnitine or vitamin E or their combinations. Different parameters were studied like behavioral parameters, body weight gain, organ weights, hematological and serum biochemical parameters and histopathology of organs.

Results: Birds treated with OTA were depressed and less attractive to feed having ruffled feathers. Body weights and organ weights of the groups treated with OTA were also depressed. Hematology of OTA treated groups showed a decrease in PCV, Hb, TEC and TLC moving the birds in an anaemic state. Total proteins and albumin concentrations in the serum of OTA treated groups were significantly lower while serum urea and creatinine in OTA treated groups was significantly higher than control. Liver of control group showed normal hepatocytes and normal sinusoidal spaces. Nuclei were normal with exception of only few pyknotic nuclei. In kidneys, tubular epithelial cells had normal nuclei and urinary spaces were clear and dilated. In OTA treated groups, the sinusoidal spaces were congested and hepatocytes were pyknotic while in kidneys, there was pyknosis of nuclei of tubular epithelial cells and urine spaces were also congested. All these alterations and lesions were more severe at higher doses (2.0 mg/kg OTA) while less severity was observed at low levels (1.0 mg/kg OTA). Results confirmed that L-carnitine and vitamin E given alone or combination with 1.0 mg/kg OTA ameliorated OTA induced alterations in behavioural parameters, body weight gain, and organ weight, feed intake, haematological, serum biochemical and histopathological parameters. This amelioration, however, was not seen at 2.0 mg/kg OTA.

Conclusion: The present study suggested that the products like L-carnitine, vitamin given alone or combination had the ameliorative effects against the toxic effects of OTA present in commercial feed in a dose dependent manner. As the levels of OTA increased in feed, this amelioration became disappeared.

Key Words: ochratoxin A, vitamin E, L-carnitine, amelioration, leghorn

M8 EFFICACY OF NEWCASTLE VACCINES FORMULATED WITH GENOTYPE V VIRUS IN A BREEDER FLOCK Nancy Christy, Alejandro Bobadilla, Daniel Marrufo 1, 1Investigación Aplicada S.A. de C.V., Tehuacan, Mexico 2Nutritaix de México, Tehuacan, Mexico

Virulent Newcastle disease isolates in the latter years in Mexico are of the same serotype but a different genotype than current vaccine strains. In this case presented here breeders were vaccinated with genotype II vaccines before an outbreak. During and after the outbreak we applied genotype V vaccines for control. We evaluated the viral shedding during the outbreak and after vaccination with live Newcastle vaccine formulated with Genotype V. Published experiments (Miller 2009) with an homologous vaccine showed less virus shedding compared with heterologous vaccines.

All the breeders were vaccinated with 100 μl of a live vaccine into the eye after we detected an outbreak. All the flocks received a vaccine formulated with Genotype V strain (A representative isolate of the outbreak of Newcastle in Mexico in 2005). Oropharyngeal swabs were collected during the outbreak and after vaccination. Breeders were monitored daily for clinical signs and death.

Results indicated that the virus had a negative effect in egg production. On the other hand live vaccines with an homologous genotype were useful to protect against morbidity and mortality and significantly reduced the problem with the egg production and viral shedding.

The virus was isolated and phylogenetic analysis of the isolates demonstrated that this virus was most closely related to isolates from Mexico (Genotype V).

Genotype V virus continues to circulate in Mexico; homologous vaccines provide protection and are useful to decrease the virus shedding and egg drops in production.

Key Words: Newcastle disease, Newcastle vaccines, Genotype V.

M9 A possible equivalent to the cyanophil found in the turkey Paul Cotter1, Dave Pyle2 1Cotter Laboratory, Arlington, MA 2Pyle Veterinary, Zeeland, MI

A routine examination of peripheral blood from a 12 wk commercial tom in apparent good physical condition, revealed a hemogram inconsistent with a good health status. A Wright stained differential of 200 cells was completed at 40x magnification using an Olympus CX41 light microscope. In addition to enumerating the frequencies of leukocytes and granulocytes, the unusual features of this specimen were recorded. Photomicrographs of representative fields were taken at 10x and 40x magnification. Images of individual cells were captured by an Infinity-2 1.4 Megapixel CCD USB 2.0 camera at 100x (oil) magnification. The features of this sample included gross and microscopic abnormalities. The former was the lack of uniformity of the thin film, probably the result of a combination of clotting and agglutination. Microscopic abnormalities include an obvious inflammatory hemogram, with multiple reactive clusters (RC) composed of lymphocytes and immature heterophils. These RC’s contain groups of cells in close arrangement, resembling bone marrow. A typical RC contains early heterophils and lymphoid cells at a ratio of 3:1. RC heterophils stain faintly, but the lymphoid cells stain heavily. Other abnormalities were parasite gametocytes closely resembling Plasmodium. Both free and colonial bacteria were detected. The latter contain groups of cocci, bacilli, and other forms. In addition, 10 large granulocytes (~ 15 μM) with a lobed nucleus, large blue cytoplasmic granules, and smaller azurophilic cytoplasmic granules were documented. These cells, distinct from other granulocytes, and are the focus. Eosinophils were not present, surprising in the light of the complex hematology. We suggest that the novel cells are the turkey equivalent of the chicken cyanophil. Our purpose is to present this tom’s hematology, with reference to the novel cell. To our knowledge, these cells are not described elsewhere. We assume that their presence in the peripheral circulation is a consequence of a myriad of immunological stimuli of microbial origin.

Key Words: inflammatory hemogram, granulocyte, cyanophil, turkey

M10 Coccinocyte: A novel lymphocyte of commercial pullets, a possible precursor to NK cells. Paul Cotter1, Darrin Karcher2, Cara Robison2 1Cotter Laboratory, Arlington, MA 2Department of Animal Science, Michigan State University, East Lansing, MI

ABSTRACT OF PAPERS
Agranulocytes include various lymphocytes and monocytes. Some small lymphocytes lacking B or T cell surface markers are NK cells, a component of innate immunity. These contain azurophilic granules with a lytic capacity. A cell found during a study of heterophil lymphocyte ratios (H/L) of hens appears to be novel. Their characteristics suggest that they are early developmental forms of small (mature) NK cells. Novels were more frequent in pullets with frank bacteremia, possibly due to *Clostridia*. The objective here is to describe the novel’s morphology. Wright’s stained thin-films of peripheral blood came from 17 wk pullets housed in conventional cages (CC, n = 50), or in enriched cages (EN, n = 50). Differentials of 200 cells per slide were counted at 40x magnification. Photomicrography was at 100x (oil) magnification. Image capture was by an Infinity-2 1.4 Megapixel CCD USB 2.0 camera. The novel’s most distinguishing features are its scarlet cytoplasmic granules, and clear vacuoles. Large novels (> 10 μM) are irregular in shape, medium and small novels are circular. Size ranges from 8 to 4 μM. Larger novels contain more granules, and the number decreases with maturation. Their nucleus is large, round, and stains purple with coarse chromatin. The nuclear/cytoplasmic ratio decreases with cell size reduction from 0.6 in early developmental types to 0.9 in definitive types. The cytoplasm is violet and contains multiple sizes of granules, some clustered into grape-like bunches. Despite granules, they are not heterophils, basophils, or eosinophils. They are not phagocytic but they may indicate a lymphocytic “left-shift”. Several “toxic” forms accompanied bacteremia. These cells do not share morphological characteristics of cyanophils (Cotter, et al., 2012, Abs No. 19, 101st Annual Meeting Poultry Science Association, Athens, GA). Because of the scarlet granule color, the name “coccinocyte,” is given. The study is a part of the Coalition for a Sustainable Egg Supply (CSES) project.

**Key Words:** novel lymphocyte, azurophilic granule, coccinocyte, CSES

**M11 Effects of commercial in ovo coccidiosis vaccine on hatchability, chick quality, and post hatch broiler performance** Adebayo Sokale1**, E. D Peebles1, W. Zhai1, L. M Poten1, C. J Williams2 1Department of Poultry Science, Mississippi State University, Mississippi State, MS 2Pfizer Animal Health, Durham, NC

The effects of in ovo injection of commercial coccidiosis vaccine on hatchability of fertilized eggs (HF), and post hatch performance of Ross x Ross 708 broilers from a 48-wk-old breeder flock were determined through d 14 of age. Fertile hatching eggs were injected (50 μL of commercial vaccine containing oocysts of *E. acervulina, E. maxima, and E. tenella*) on d 18.5 of incubation using an automated multiple-egg injector. Three control groups (non-injected, diluent-injected and dry punch) were also included. The site of injection (SOI) of the vaccine, and embryo staging (ES) were evaluated by injecting dye into embryonated eggs on d 18.5 of incubation. The HF and yolk free BW of the chicks on day of hatch were determined. Body weight gain, feed conversion, and oocyst shedding through d 14 post hatch were also determined. A mean ES score of 2.09 indicated that embryos were at the early d 18 stage of development and that vaccine was delivered into the amnion in 84.7 % of injected embryos. There was no significant difference among treatments for HF on d 21.5 of incubation, however, there was a significant (P ≤ 0.001) difference in BW on d 14 post hatch. Body weight was higher in diluent- and vaccine-injected groups compared to the non-injected control group. There were significant treatment effects on BW gain (P ≤ 0.001 ± 0.01) and feed intake (P ≤ 0.005 ± 0.01) on d 0-14 post hatch. Feed intake and BW gain were decreased in the vaccine- and diluent-injected groups when compared to the non-injected and dry punch control groups. Mean BW gain in the non-injected control, dry punch control, diluent-injected control, and vaccine injected groups were 5.05, 5.05, 4.48, and 4.60 kg, respectively.

Chicks began shedding oocysts on d 4 post hatch, and oocyst per gram of feces reached a peak on d 10 post hatch. Therefore, based on oocyst detection, it was concluded that the birds received oocyst exposure and a subsequent coccidiosis infection from the vaccine. Furthermore, the qualitative evaluation of SOI and ES monitored by dye injection suggested that the injection of the commercial coccidiosis vaccine between d 18 and 18.5 of incubation ensured its delivery into the amnion without having any detrimental effects on broiler embryogenesis or on post hatch performance through d 14.

**Key Words:** body weight, broiler, in ovo injection, oocyst, vaccination

**M12 An intestinal health evaluation system that correlates with bird performance** Natalie Armour1**, Stephen Collett 2Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, GA

Evaluation of the intestinal tract during routine necropsies allows an assessment of the birds’ ability to digest and absorb nutrients, and thus to convert feed into animal protein. Many current intestinal evaluation systems score clinical disease, but disregard more subtle intestinal pathology, which may significantly affect flock performance. Our objectives were to develop a holistic scoring system to evaluate and compare the effect of different in-feed treatments on intestinal health, and to determine whether these results correlated with bird performance. The treatments evaluated included a mannanoligosaccharide (Actigen), alone or in combination with a standard antibiotic growth promoter (AGP) program (bacitracin methylene disalicylate (BMD) and virginiamycin). In two consecutive experiments, 2160 (Trial 1) and 2400 (Trial 2) broiler chicks were assigned to the following treatment groups: negative control (no treatment), AGP only (BMD d0-30; virginiamycin d31-52), Actigen only (Actigen d0-52) and Actigen/AGP (Actigen d0-52; BMD d0-30; virginiamycin d31-52). Two additional groups were incorporated into Trial 2: Actigen starter (Actigen 0-17d) and Actigen starter/AGP (Actigen 0-17d; BMD d0-30; virginiamycin d31-52). Necropsies were performed on randomly sampled birds from each treatment group by a veterinarian blinded to treatments when the experiments were terminated at 52 days. Intestinal health was evaluated with the FACET scoring system, which scores seven indicators of intestinal health: Footpad lesions; Area (villus height; measured histologically); Cecal content and Consumption (litter); Exudate (intestinal mucus); Tone and Thickness. For both experiments, Actigen/AGP treatment groups had the highest intestinal health scores, followed by Actigen and AGP treatments. The same trend was seen in performance, with feed conversion ratios in the Actigen/AGP groups significantly lower than in the Actigen (Trial 1), Actigen starter (Trial 2) and AGP only groups. These results demonstrate the application of an intestinal health scoring system incorporating parameters which correlate with bird performance.

**Key Words:** intestinal, evaluation, performance, mannanoligosaccharide, antibiotic

**M13 Characterization of Salmonella isolates from commercial layers of Colombia using an Intergenic Sequence Ribotyping (ISR) method** Martha Pulido - landinez1**, Roxana Sanchez-Ingunza2, Jean Guard2, Vladimir Pinheiro Do Nascimento1 1Federal University of Rio Grande do Sul, Bogota, Colombia 2USDA-ARS, Athens, GA

A severe outbreak of salmonellosis in commercial brown table egg layers occurred in Colombia in 2006. Affected flocks had severely depressed birds with moderate to severe diarrhea, severe drops in egg production and increased mortality. A preliminary diagnosis by the Laboratory of Avian Pathology of the National University of Colombia reported the isolation of *Salmonella* spp, group D (motile and non-

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motile bacteria). Between the years 2008 and 2012, 140 samples from commercial poultry farms were collected in order to assay for Salmonella. Thirty five Salmonella spp. (25%) were isolated from commercial layers farms. Bacteria were isolated mainly from samples of liver and spleen (71.42%), pools of organs (liver, spleen and ovarian follicles (25.71%) and a lower proportion (2.85%) from drag swabs. Serotype was assigned using Intergenic Sequence Ribotyping (ISR). Sixteen Salmonella Enteritidis (SE), thirteen Salmonella Gallinarum (SG), and seven unique strains were found. Five unique strains were designated as UN0038, and the other two were designated as UN0052 and UN0054. DNA hybridization microarray assigned serovars Isangi, Branderup and Yoruba to the unique ISR sequences, respectively. This is the first report on the characterization of different serotypes of Salmonella present in commercial layer farms in Colombia. The discovery that SE and SG could be isolated in the same time period, in similar commercial brown layer hens, and in different regions indicates it is important to investigate the dynamics of infection associated with the co-existence of zoonotic serotypes, such as SE, and species specific serotypes, such as SG, circulating within the same ecological niche. Programs that aim to monitor and control infectious disease affecting people and the foods they consume will benefit from this information.

**Key Words:** Salmonellosis, S. Enteritidis, S. Gallinarum, Salmonella serotyping, Ribotyping

### M14 Evidence of Salmonella Infantis infection in humans linked to contamination of poultry products in Peru, South America

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Salmonella enterica subspecies enterica serovar Infantis was indicated as the third most frequently isolated serotype from human cases of salmonellosis in Peru. During 2010, a characterization study of Salmonella Infantis in Lima, Peru, showed the presence of similar PFGE patterns and antibiotic sensitivity in isolates from five clinical cases in humans and two from poultry meat, suggesting the possibility of the disease being transmitted to humans via poultry products. The present study was conducted to identify the Salmonella serotypes most commonly detected in poultry and poultry products for local consumption in Lima. The Salmonella strains evaluated were isolated in 2010 and 2011 from chicken carcasses, feed, and poultry houses corresponding to 40 farms located around Lima. Serotyping was performed using a previously reported Intergenic Sequence Ribotyping (ISR) method on the Salmonella strains identified at the serogroup level by the White-Kauffmann-Le Minor scheme. Salmonella serotypes Infantis (29), Kentucky (6), Mbandaka (4) and Senftenberg (1) were identified. Two genotypes of Salmonella Infantis were detected in poultry carcasses (100%), and only one genotype in drag swabs (70%), and chicken feed (37.5%). Salmonella Infantis was only found in poultry houses (drag swabs) and Salmonella Mbandaka and Senftenberg in chicken feed. The high frequency of Salmonella Infantis isolated from poultry farms to the processing plant, and during the same time frame when this serotype was detected in cases of human salmonellosis in Lima-Peru supported the relevance of poultry product contamination in the epidemiology of the disease. Serotyping assessment by the ISR method aided in the definition of Salmonella control methods at the pre- and post-harvest level to reduce the incidence of Salmonella in poultry products. Further studies are required to establish the factors associated with the transmission of Salmonella Infantis from poultry products that resulted in clinical manifestation of salmonellosis in humans to confirm the association suggested in this study.

**Key Words:** Salmonellosis, Salmonella Infantis, Poultry, Salmonella serotyping, Intergenic Sequence Ribotyping

### M15 Detection of Salmonella from trachea in commercial poultry as an epidemiological tool

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Several investigators have demonstrated the importance of airborne Salmonella sp. as a source of cross-infection in poultry. In the present study, two experiments were conducted to evaluate the detection of Salmonella in trachea. In experiment 1, seven-day-old broiler chickens were inoculated intra-tracheal with 107 cfu of S. Enteritidis (SE). Twenty-four hours later, chickens were humanly killed and trachea, cecal tonsils, and liver and spleen were aseptically removed and cultured for SE recovery by overnight enrichment in tetrathionate broth (TT). Enriched samples were streaked onto XLD agar containing novobiocin (NO) and nalidixic acid (NA). SE was recovered from 80% of cecal tonsils, 50% of tracheas, and 50% of liver/spleen. For experiment 2, trachea and ceca were aseptically removed from 16-week-old commercial turkeys for evaluation of Salmonella prevalence. After septic removal from the birds, tracheas were clamped on each end and 20 mL of peptone water added for 8 hours of incubation at 37 °C. The peptone water from each trachea was collected and enriched with an equal volume of 2X TT for overnight incubation. Samples were then streaked onto XLD agar with NO only. From these samples, 97/100 (97%) of tracheas were positive for E. coli and 34/100 (34%) were positive for Salmonella. Cecal content was collected and weighed, and a 5X w/v dilution was made with sterile 0.9% saline. Samples were then plated onto XLD agar with NO for cfu determination. Additionally, 2X TT broth was added to the remaining sample and incubated for overnight enrichment, followed by plating onto XLD agar with NO. Cecal recovery of Salmonella was 15% with a mean level of 0.18 ± 0.11 log10. The results of these studies suggest tracheal recovery of Salmonella is a viable detection organ, and the airborne movement of Salmonella in poultry houses is a relevant control point to limit the spread of infection within flocks.

**Key Words:** Salmonella, trachea, poultry

### Metabolism & Nutrition I

**M16 The effect of calcium lignosulfonate and mixer-added fat on feed manufacture and 23–42d broiler performance**

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Pelleting technique can affect feed form and nutrient availability. Past research demonstrates that increased mixer-added fat (MAF) decreases frictional heat and pressure within the pellet die. The increased lubrication can maintain digestibility of heat sensitive nutrients, but may also decrease pellet quality. The use of pellet binders could enable high inclusions of MAF without causing detriment to pellet quality. The objective of the study was to evaluate the effect of calcium lignosulfonate binder (CaLS), MAF, and feed form on feed manufacture and 23–42d broiler performance. Treatments were arranged in a 3 x 2 x 2 factorial design consisting of CaLS (0, 0.5, or 1%), MAF (1 or 3%), and feed form (pellet or ground pellet). Feed mill efficiency and pellet quality were assessed by manufacturing four replicate batches of each treatment. Live
performance was assessed by feeding treatments to eight replicate pens of 23 straight-run broilers during the 23-42d finishing phase. The use of CaLS and 3% MAF independently decreased measures of electrical energy use of the pellet mill and hot pellet temperature post pellet die extrusion (P<0.05). The use of CaLS increased pellet durability and the use of 3% MAF decreased pellet durability (P<0.05). The use of CaLS with 3% MAF improved pellet durability compared to diets without CaLS and 3% MAF (P=0.05). The use of CaLS increased broiler feed intake and live weight gain (P<0.05). In addition, a three way interaction of main effects occurred for feed conversion ratio (FCR) (P<0.05).

The interaction demonstrated that 3% MAF was most beneficial to broiler FCR for ground pellets and that FCR benefit was dependent on the interaction of MAF and CaLS for pellets. These data demonstrate that MAF and CaLS have an effect on feed manufacture variables, and combined with feed form, can affect broiler performance; however, the mechanism of interaction remains unclear.

**Key Words:** calcium lignosulfonate, mixer-added fat, feed manufacture, pellet quality, broiler performance

M17 In vitro evaluation of calcium sources and particle sizes on calcium and phosphorus solubility Hannah Wladecki1, Audrey McElroy Department of Animal and Poultry Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA

Calcium and P solubility and the influence on pH of 2 Ca sources and 3 particle sizes (PS; Exp 1) or 4 Ca source locations and 2 PS (Exp 2) were evaluated in an in vitro assay simulating the gastric and small intestine (SI) phases of digestion. The Ca sources were mixed into corn/soy diets to provide 0.68% (limestone) or 0.67% (highly soluble marine Ca; HSC) total Ca, and the PS were defined as fine, medium, or large. Limestone sources were from Bloomington, IN (BL), Franklin, IN (FR), Swazee, IN (SW), or ILC Iowa (ILC). Significance was reported at P < 0.05. In Exp 1, in the gastric phase, an interaction between Ca source and PS resulted from the medium PS limestone or HSC having no difference in Ca solubility, but fine and large HSC had higher solubility than limestone. Fine PS HSC had the highest Ca solubility in the gastric phase, and large PS limestone had the lowest. Fine PS of both HSC and limestone yielded the two highest Ca solubilities, and large PS of both sources had the lowest. In the SI phase, medium PS limestone led to the highest Ca solubility, and this was higher than medium PS HSC. Large PS from both sources resulted in the lowest Ca solubility and were not different from each other. There was no effect on P solubility in Exp 1. In Exp 2, a location x PS interaction was observed in both the gastric and SI phase. In the gastric phase, large PS limestone from all locations had the lowest Ca solubility, and the medium PS limestone from BL had a higher Ca solubility than the other medium PS samples. In the SI phase, medium PS from BL had the highest Ca solubility of all samples. Medium PS from FR had higher Ca solubility than large PS from this location. In contrast, Ca solubility was not different between the medium PS and large PS from SW or ILC. The only difference in P solubility occurred with the large PS having higher solubility than medium PS. Overall the results indicate that PS affected Ca and P solubility in this in vitro digestion assay. However, the response was dependent upon Ca source and location, and fine and medium PS and HSC diets appeared to have the highest Ca solubilities overall.

**Key Words:** calcium source, in vitro, particle size, solubility

M18 Calcium, calcium source and phytase impact on bird performance during a natural necrotic enteritis outbreak Diego Paiva1, Carrie Walk2, Audrey McElroy1 1Department of Animal and Poultry Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 2AB Vista, Marlborough, UK

Researchers have extensively reported benefits on nutrient availability and broiler performance as a consequence of phytase supplementation. However, the poultry industry has little information of the effects of phytase supplementation in disease settings. The objective of this study was to determine the influence of Ca source (high soluble calcified seaweed or limestone), phytase supplementation, and dietary levels of Ca on bird performance during a natural necrotic enteritis (NE) outbreak. Cobb 500 male broilers were weighed and randomized into 8 treatment groups (9 pens/treatment; 30 birds/pen) at day of hatch. The 21 d trial was designed as a 2 x 2 x 2 factorial, which included 2 dietary levels of Ca (0.60% and 0.90%), 2 Ca sources (limestone and calcified seaweed), and 2 levels of an E. coli phytase (0 and 1,000 FTU/Kg). Birds were placed on dirty litter from a previous flock that exhibited clinical signs of NE. Birds and feed were weighed on d 7, 14, and 21, and body weight (BW), BW gain (BWG), feed intake, and feed conversion (FC) were calculated for each of these periods and cumulatively. Mortality was recorded daily, and pH of the gizzard and duodenum were measured on d 7, 14, and 21. Significance was reported at P<0.05. Birds began exhibiting clinical signs of NE on d 9, and elevated NE-associated mortality persisted until the end of the trial. Mortality was significantly affected by an interaction between Ca source and Ca levels. Significantly higher mortality was observed when animals were fed diets formulated with 0.90% calcified seaweed from d 0-21 compared to 0.60% Ca diets (regardless of Ca source) and 0.90% Ca diets formulated with limestone. From d 0-7, animals fed 0.60% Ca in diets supplemented with phytase had heavier BW than the other treatments regardless of Ca source. From d 0-14 and 0-21, animals fed diets with calcified seaweed had significantly higher FC than animals fed diets with limestone. On d 21, the gizzard of animals fed 0.90% Ca in the diet was significantly less acidic than the gizzard of animals fed 0.60% Ca in the diet. In conclusion, this research indicated that a lower Ca level (0.60%) resulted in improved broiler performance. Furthermore, this research is indicative of a role of dietary Ca in necrotic enteritis induced mortality.

**Key Words:** Calcium, Calcified Seaweed, Phytase, Necrotic Enteritis, Broiler Performance

M19 The effect of corn particle size, dietary energy level, post pellet liquid fat application, and time-limited feeding on broiler live performance to 28 days of age. Satid Auttawong1, John T. Brake1, Peter R. Ferket1, Charles R. Stark1, Shlomo Yahav2 1Department of Poultry Science, North Carolina State University, Raleigh, NC 2Institute of Animal Science, ARO the Volcani Center, Bet Dagan, Israel

A litter floor pen experiment evaluated the effect of corn particle size, dietary metabolizable energy (ME) level, mixer or post-pellet liquid fat application, and time-limited feeding on broiler live performance to 28 d of age. The 1,440 Ross 344 x 708 male chicks were assigned to a factorial arrangement of treatments consisting of 2 dietary inclusions of coarse corn (CC; 0 and 20% or 0 and 35 % of total dietary corn in starter and grower diets, respectively), 2 dietary ME levels in grower diets (2.95 kcal ME/g or 3.05 kcal ME/g), 2 liquid fat application methods (all fat in mixer or 0.75% in mixer plus the remainder added post-pellet), and 2 feeding programs (ad libitum or time-limited). Each of the 16 treatment combinations was replicated with 6 pens of 15 birds each. Fine corn (FC) was ground with a hammermill to 262 microns (2.4 mm screen) while CC was ground with a roller mill to 1082 microns. The FC and CC were blended to create the CC inclusion levels. Feed intake (FI) and BW were determined at 14 and 28 d of age and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of mortality. Dietary CC significantly reduced BW at 14 d of age, but not at 28 d of age. The CC significantly reduced FI but improved AdjFCR relative to 100% FC. Both lower and higher ME level produced the same
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BW and FI at 28 d, but the higher ME level significantly improved AdjFCR. Time-limited feeding significantly decreased BW and FI at 28 d but with improved AdjFCR. Time-limited feeding with lower ME decreased BW at 28 d, even though birds had the same FI compared to the higher ME level while low ME increased FI when feed was presented on an ad libitum basis. Post-pellet liquid fat application resulted in lower FI in the presence of ad libitum feeding, but BW was similar. The results of this study confirmed that although CC had a negative effect on FI during the starter phase, this was accompanied by improved AdjFCR. Both the higher dietary ME from added fat and CC treatments appeared to improve AdjFCR in an independent manner as evidenced by an absence of interactions.

Key Words: broiler live performance, corn particle size, roller mill, hammermill

M20 Evaluation of Roller Mill Ground Corn Inclusions on Broiler Growth Performance, Digesta Retention time, and Gastrointestinal Tract Characteristics Yi Xu1SC, Charles Stark, Peter Ferket, John Brake Department of Poultry Science, NC State University, Raleigh, NC

Previous research has shown that the addition of coarsely ground corn (CC) improved broiler live performance. The objectives of the present study were to evaluate the effect of CC inclusion on broiler growth performance, digesta retention time, and gastrointestinal characteristics. A total of 180 1-d-old male broiler chicks were randomly assigned to 1 of 3 levels of CC treatment (0, 25, and 50%) with 6 replicate pens per treatment and 10 birds per pen. Fine corn (FC) and SBM were ground with a hammermill (3.4 mm screen, 294 and 490 microns dgw, respectively) while the CC was ground with a roller mill (1362 microns dgw). The same starter diet was fed as crumbles and contained 100% FC and the grower and finisher diets were fed as pelleted with the fines removed and contained a combination of FC and CC (75:25% or 50:50%). Feed intake (FI) and BW were determined at 14, 28, 35, and 42 d of age and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of all dead birds. Digesta retention time was measured by oral gavage of feed containing 85 ppm chromium oxide following a 10 h food withdrawal and then 1 h feeding. The results showed no difference in feed consumption or BW at 42 d of age. There was an improvement in AdjFCR at 35 d (1.82 vs. 1.74 and 1.69) and 42 d (1.94 vs. 1.86 and 1.82) of age for the birds fed the 25% CC and 50% CC as compared to 100% FC, respectively. The addition of CC resulted in increased absolute gizzard weight at 42 d of age, and 50% CC decreased gizzard pH at 28 d of age and increased ileum tensile strength compared with FC. The digesta retention time was increased at both 30 d and 45 d of age by 25% and 50% CC, (1.58 vs. 1.75 and 1.96 h, and 3.54 vs. 4.52 and 4.32 h, respectively). Birds fed pelleted and screened diets that contained 25% and 50% CC exhibited improved AdjFCR with no difference in FI, and the addition of CC increased digesta retention time and absolute gizzard weight.

Key Words: corn particle size, broiler, pellet, gizzard, retention time

M21 Effects of dietary NSPase inclusion in low energy corn-soybean meal diets on broiler performance and carcass yield Joseph Klein1SC, Mallori Williams1, Blynn Brown2, Shivaram Rao3, Jason Lee1 1Poultry Science Department, Texas A&M University, College Station, TX 2Enzyvia LLC, Sheridan, IN 3Foster Farms, Delhi, CA

An experiment was conducted to evaluate the inclusion of a cocktail NSPase (Enspira) in low energy corn-soybean meal diets on broiler growth performance and carcass yield. The experimental design included a total of three dietary treatments including a positive control (PC), negative control (NC) with a reduction of 130 kcal/kg throughout the experiment compared to the PC, and NC supplemented with NSPase. Each treatment included 12 replicate pens with 25 male broilers placed per treatment group (900 total chicks placed). Dietary program consisted of a 5 phase program, starter, grower 1, grower 2, finisher and withdrawal. Broilers were weighed and feed consumption determined on days 9, 23, 32, 40, and 44. Following an 8 h feed withdrawal, eight broilers per replicate pen were processed for carcass and fat pad yield determination. Body weight was reduced (p<0.05) in the NC diet as compared to the PC diet beginning on day 9 and continuing throughout the remainder of trial. Inclusion of the NSPase in the NC diet increased (p<0.05) body weight as compared to the NC diet on each evaluate day and was similar to the PC diet on day 23, 41, and 44. Feed conversion (FCR) was increased (p<0.05) at day 9 of age in the NC as compared to the PC. Inclusion of NSPase in the NC reduced (p < 0.05) day 9 FCR compared to the NC diet. Inclusion of NSPase in the NC diet resulted in similar cumulative FCR as compared to the PC throughout the entire trial. Carcass and fat pad yield were reduced in the NC diet compared to the PC. Inclusion of NSPase increased (p<0.05) carcass yield compared to the NC diet. These data confirm that NSPase inclusion in low energy diets improves growth performance and processing yields in corn soybean meal diets.

Key Words: enzyme, energy, broiler, performance, processing

M22 Effect of β-Mannanase Supplementation of High and Low Fat Diets on Energy and Protein Utilization, Gut Morphology, and Mucin Secretion of Turkey Poults. Ayub Ayoola1SC, Peter Fer ket, Ramon Malheiros, Jesse Grimes Department of Poultry Science, North Carolina State University, Raleigh, NC

Beta-Mannanase is hypothesized to improve the nutritional value of soybean meal-containing diets for poultry by enhancing dietary energy utilization and gut health. This hypothesis was tested in turkey poult fed experimental diets consisting of a 2 X 2 factorial arrangement of two levels of dietary energy (E) differing by ~150 kcal ME/kg (high vs low fat), and two dietary inclusion levels of endo-beta-D-mannanase (0 vs 0.05% CTCy zie®, CTCBIO, Inc., Seoul, Korea). Turkey poult (1-d old) were randomly assigned to 48 pens with 9 poult per pen according to each of the 4 dietary treatments. Feed intake (FI), body weights (BW) and feed/gain (FCR) were determined at 0, 7, 14, 21, and 28 d. Jejunum sections were collected at 7, 14 and 21 d for histomorphometric analysis. Fecal samples were collected from 22 to 24 d and pooled by pen for AMEn and apparent N retention (ANR) determination. On 28 day, the ileum was sampled for mucin secretion quantification and the contents assayed to determine ileal digestibility of dry matter dDM, crude protein (dCP), and crude fat (dCF).

There were no dietary energy X enzyme effects on BW, FI, FCR, AMEn, ANR, dDM, dCF, or jejunum mucosal morphology. The high E diets increased 21 d BW by about 10% (p<0.0001) without effecting FCR, increased AMEn (2721 vs 2556 kcal/kg, p<0.0001), ANR (55.9% vs 52.3%, p<0.0001), and dCF (94.0% vs 91.8%, p<0.001) and decreased villi surface area by 20% in comparison to the low E diets. Dietary inclusion of CTCzyme had no effect on BW, FI, FCR, or AMEn, but it increased fecal DM by 10% (p<0.05), ANR by 4% (p<0.05), dCF by 1.4% (p<0.05), and 21d villi surface area by 34% (p<0.001). Significant interaction effects (p<0.05) on dCP and mucin secretion were observed at 28 d: CTCzyme supplementation increase dCP and reduce mucin secretion only among poult fed the high E diets. Although dietary CTCzyme supplementation had minimal effect on growth performance and AMEn, it apparently improves intestinal mucosa health, nitrogen retention and fat digestibility, especially when fed high fat diets.

Key Words: Dietary energy, β-mannanase, Energy and nutrient utilization, Gut morphology, Mucin secretion
M23 Energy utilization of reduced oil-dried distillers grains with solubles (RO-DDGS) in chicks 
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As increasing quantities of corn is diverted to ethanol production, the reliance on alternative feed ingredients like dried distillers grains with solubles (DDGS) becomes requisite. The recent trend of removing oil from the thin stillage before mixing with residual grains has resulted in new DDGS products with reduced oil content. A chick metabolizable energy experiment was conducted to determine the effects of oil removal from DDGS on AMEn in broiler chicks. Four experimental diets were fed to 10 experimental units (EU) of 4 male Ross 308 broiler chicks. Experimental diets included a corn-soybean meal (SBM) basal diet and the same diet with one experimental DDGS directly substituted for 20% of the diet. Experimental DDGS ranged from low (5.61% EE), medium (7.45% EE) or high (10.88% EE) oil content. Chicks were raised on a corn-SBM-DDGS (5%) diet until d 14, and corn-SBM diets that contained experimental DDGS at 10% from d 14 to 21 to acclimatize the experimental DDGS intake before the start of experiment. Experimental corn-SBM-DDGS diets were fed from d 21 to 28. There were no significant differences in either BW gain or feed intake among any of the dietary groups from d 14 to 21 and d 21 to 28. Medium oil DDGS treatment resulted in reduced feed efficiency compared to other dietary groups from d 21 to 28, but this did not exclude medium oil DDGS from being used in AMEn determination. The AMEn values for each DDGS, determined from the difference in basal AMEn and experimental AMEn, were plotted against the determined oil content of DDGS samples. An equation was generated to describe the best fit line of the relationship between determined oil content of DDGS and DDGS AMEn. Regression analysis of AMEn by EU resulted in the equation AMEn = 2120.4 + 45.6 x DDGS oil content, showing a fit (R²) of 0.10 and (P ≤ 0.10). Decreasing oil content resulted in decreased AMEn of DDGS. These results indicate that in broilers at 27-28 d of age, each 1% decrease in the oil content is directly proportionate to a 45.6 kcal reduction in DDGS AMEn.

Key Words: oil-extracted DDGS, broiler, AMEn

M25 Effects of xylanase enzyme in combination with 50% coarse corn in broiler diets containing low phytate versus normal phytate soybean meal on male broiler live performance, development of the gizzard and proventriculus, and total phosphorus digestibility. 
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This study investigated the addition of phytase enzyme in combination with 50% coarse corn (CC) to pelleted and crumbled broiler diets containing low phytate (LP) versus normal phytate (NP) soybean meal (SBM) to 21 d of age. From 1 to 8 d, all birds received four diets (50%CC or 0%CC), with and without phytase with a single commercial NP-type SBM. From 9 to 21 d, birds were fed either NP-50%CC, NP-0%CC, with and without phytase, or LP-50%CC, or LP-0%CC, with and without phytase, in a 2 x 2 x 2 design. Diets were adjusted for phytase contribution to calcium and phosphorus but no adjustments were made for differences in total phosphorus (P) among the SBM sources. There were 8 pens of 8 birds each for each interaction cell from 9 to 21 d. Broiler BW gain, feed intake (FI), feed conversion ratio (FCR), and weights of the gizzard and proventriculus were measured at 21 d, and ileal contents were collected for total P digestibility on a dry matter basis. Feed intake and live performance to 21 d of age were not affected. Upon necropsy at 21 d, gizzard weight was increased significantly by 50%CC and LP SBM but was not affected by phytase. Proventriculus weight was significantly lower due to 50%CC and phytase but was not affected by SBM. Total P digestibility was improved significantly by 0%CC, LP SBM, and phytase enzyme. There was an interaction between SBM and phytase addition where better P digestibility was observed with the combination of phytase and LP SBM relative to phytase and NP SBM (59.11 versus 41.01%). There was also an interaction of corn particle size and phytase where P digestibility with phytase present was greater in the presence of 0%CC (53.24%) versus 50%CC (46.88%). These data suggested that the digestive environment created by both SBM phytate level and CC affect phytase function and that these effects may involve changes in gizzard and proventriculus weight and function.

Key Words: xylanase, enzyme, heat-stable, viscosity, broilers
Clostridium perfringens induced subclinical necrotic enteritis (NE) and mycotoxins both cause important economic losses in the broiler industry. The Fusarium mycotoxin deoxynivalenol (DON) is a common feed contaminant that can affect the intestinal epithelial barrier function, and may as such increase the availability of free amino acids in the intestine. This can promote the massive intestinal proliferation of C. perfringens. The goal of this study was to evaluate and explain the predisposing effect of DON on NE.

Therefore, an in vivo infection trial mimicking subclinical NE was conducted, comparing intestinal NE lesions in broilers after feeding DON at a contamination level below the European maximum guidance level of 5000μg/kg feed, with broilers receiving non-contaminated feed. Subsequently, total and fractional nitrogen analyses were performed on the intestinal content to investigate the total protein concentration, and differentiate in proteins of animal, vegetable and bacterial origin. Furthermore, the nitrogen isotope ratio of intestinal content, intestines and diet was measured. An ex vivo Ussing chamber experiment was also conducted to assess the effect of DON on the barrier function of intestinal mucosa of broilers. Finally, the influence of different concentrations of DON on the growth of different C. perfringens strains was tested in vitro by a well diffusion growth inhibition test and by assessment of the growth curve measuring the optical density of the C. perfringens culture.

Significantly more chickens showed NE lesions in the in vivo study when their diet was contaminated with DON. The fractional nitrogen analyses showed a relative increase in protein amount of animal origin in the intestinal content. In the Ussing chamber experiments, the duodenal tissue resistance (Rt or TEER) was significantly lower in chickens who received DON contaminated feed. This indicates an altered barrier function after exposure to DON. DON did not have an effect on the in vitro growth of C. perfringens strains.

In conclusion it is shown that feeding DON contaminated feed in concentrations below the maximum European guidance contamination level to broilers is a predisposing factor for the development of NE due to its effect on the intestinal barrier function.

M27 Growth performance of male broilers fed diets varying in digestible threonine from 1 to 14 days of age Kate Meloche¹SC, Paul Tillman², William Dozier, III¹ ¹Department of Poultry Science, Auburn University, Auburn, AL ²Poultry Technical Nutrition Services LLC, Buford, GA

Threonine (Thr) is the third limiting amino acid for broilers fed corn-soybean meal based diets. This study examined growth responses of broilers provided experimental diets varying in digestible (dig) Thr from 1 to 14 d of age. One-thousand five hundred and thirty-six Hubbard × Cobb 500 male chicks were randomly distributed to 60 floor pens (25 birds per pen; 0.09 m² per bird) and fed experimental diets from 1 to 14 d of age. Two diets (dilution and summit) consisting of corn and soybean meal were formulated to be adequate in all other amino acids with the exception of Thr and Lys. The dilution and summit diets were blended to create 6 intermediate diets, for a total of 8 titration diets resulting in dig Thr ranging from 0.62 to 0.86% (calculated). All diets were formulated to contain 1.13% dig Lys, which is slightly below the dig Lys requirement for male broilers from 1 to 14 d of age. Each treatment was represented by 2 replicate pens. Bodyweight gain, feed intake, dig Thr intake, dig Thr intake/BW gain, feed conversion, and mortality were assessed during experimentation. Optimal digestible Thr to Lys ratios were estimated using broken-line methodology. Linear (P = 0.003) and quadratic (P = 0.005) increases in BW gain were observed for broilers fed diets with progressive greater concentrations of dig Thr. Additionally, linear (P < 0.001) and quadratic (P = 0.018) improvements in feed conversion were observed as digestible Thr consumption increased. Based on linear broken line methodology, optimal digestible Thr to Lys ratios for BW gain and feed conversion were 70 and 68, respectively. These data support a minimum dig Thr ratio of at least 68 for Hubbard × Cobb 500 male broilers from 1 to 14 d of age.

Key Words: amino acid, broiler, digestible threonine

M28 The effect of chick methionine status and methionine source on broiler performance and physiological response to acute and chronic heat stress Kevin Bolek¹SC, Yves Mercier², Michael Persia¹ ¹Department of Animal Science, Iowa State University, Ames, IA ²Adisseo France SAS, Antony, France

Various sources and concentrations of methionine were evaluated on growth performance, antioxidant status, and physiological response to broiler chickens under acute and chronic heat exposure. A 2 x 2 x 3 factorial arrangement was utilized with methionine source; DL Methionine (DLM) or 2-hydroxy-4-methylthiobutanoic acid (HMB) at two concentrations (adequate: starter 0.94%, grower 0.84% total sulfur amino acids or superadequate: adequate concentrations +20% methionine) and three environmental treatments (heat treatment (HT; constant 35° C), thermoneutral (TN; constant 24° C), or thermoneutral with pair-feeding commensurate to the feed intake of the heat treated birds (TN-PF)). Dietary treatments began from hatch and environmental treatments were applied from days 21–27. Blood and liver samples were taken at 6 hours (acute) and 6 days (chronic) of heat exposure to determine blood gas parameters and hepatic concentrations of reduced (GSH) and oxidized (GSSG) glutathione. Heat treatment lowered FI and BWG while increasing FCR regardless of dietary treatment. Using TN-PF birds, approximately 54% of the reduced BWG can be attributed to metabolic differences associated with the effects of increased temperature and not direct results of reduced feed intake. During the acute phase, heat treatment lowered pCO₂, hematocrit, and hemoglobin and increased blood pH. There were no significant differences in GSH, GSSG or the ratio of GSH/GSSG or GSH/total GSH. Results indicate that heat treatment significantly impaired bird performance, but had no impact on hepatic glutathione concentrations. Birds were able to quickly adapt to changes in blood parameters as differences in blood chemistry noted over the acute exposure were not seen after 6 days of heat exposure. Methionine source or concentration had little effect in this experiment, possibly due to adequate dietary concentrations even under high environmental temperatures.

Key Words: DL methionine, 2-hydroxy-4-methylthiobutanoic acid, broiler, glutathione, heat stress

M29 Increased dietary amino acid density from 1 to 42 d of age optimizes profitability in Ross × Ross 708 male broilers Kurt Perryman¹SC, Paul Tillman², William Dozier, III¹ ¹Department of Poultry Science, Auburn University, Auburn, AL ²Poultry Technical Nutrition Services LLC, Buford, GA

An experiment was conducted to determine the effects of feeding broilers diets formulated with progressive increases in digestible Lys (dLys) on growth performance, meat yields, and economic return over feed costs (ROFC) during a 6 wk production period. Fifteen hundred Ross × Ross 708 male chicks were randomly distributed to 60 floor pens (25
M30 Program Nutrition strategy on the productive performance and egg quality of brown laying hens fed distillers dried grains with solubles (DDGS) diets Megan van Benschoten*SC, Anthony Pescatore, Austin Cantor, Tuoying Ao, Ryan Samuel, Mike Ford, William David King, James Pierce  Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY

A study was conducted to evaluate the effects of feeding up to 35% DDGS with Programmed Nutrition (PN) premix on the productive performance and egg quality of brown laying hens from pre-lay through the first phase of production (25 weeks). This experiment utilized 288 Hy-line Brown hens that were randomly allocated to five treatment groups (12 birds per replicate). Dietary treatments consisted of a 1) Corn-soybean (positive control), 2) 25% DDGS, 3) 25% DDGS with Alltech PN Broiler Grower Premix®, 4) 35% DDGS, and 5) 35% DDGS with Alltech PN Broiler Grower Premix®. Diets were formulated to meet NRC recommendations with reduced available P (0.29 vs. 0.19%) and Ca (4.2% vs. 4.1%) in the DDGS diets. Egg quality was analyzed by randomly selecting 6 eggs from each replicate group every 4 weeks. PN premix added to 35% DDGS significantly improved Haugh Unit values (P<0.05) compared with the control diet. Yolk color lightness (L*) values decreased, while red (a*) and yellow values (b*) increased (P<0.001) with the inclusion of DDGS. Dietary treatment had no effect on shell breaking strength, egg weight and yolk weight. Dietary inclusion of DDGS at 35% decreased hen-day production compared to the positive control (P=0.03). PN premix alleviated some of the deleterious effects of 35% DDGS inclusion by improving hen-day production values. Body weight and feed conversion rate were unaffected by up to 35% inclusion of DDGS. However, DDGS inclusion reduced feed intake (FI) in early lay (P=0.04). Adding PN premix significantly improved the deleterious effects of DDGS on FI at both 25 and 35% inclusion levels. These results indicate that inclusion of up to 35% DDGS can reduce FI in early lay and overall egg production, while adding PN premix lessens these negative effects and increase Haugh Units.

Key Words: DDGS, Brown Layers, Egg Quality, Program Nutrition Strategy

M31 Improving Attic Inlet Ventilation Through CFD Simulation Jonathan Olsen*SC, Jeremiah Davis1, Joseph Purswell2, Brian Luck1 Agricultural & Biological Engineering Department, Mississippi State University, Mississippi State, MS USDA ARS Poultry Research Unit, Mississippi State, MS

Sourcing incoming ventilation air from the attic space of a broiler house provides a means to implement passive solar energy capture. Currently, no prescriptive guidelines for attic inlet placement exist, and variability of attic temperature may reduce energy extraction. The goal of this project was to improve energy extraction efficiency through computational fluid dynamics (CFD) simulation.

A 13.1 x 155.4 m commercial broiler house (oriented east-west) was monitored in northern Alabama to develop boundary and initial conditions for the simulation analysis. A data acquisition system was constructed in the attic space to measure temperature in the vertical plain above a single attic inlet under winter conditions. The data was used to develop a CFD model of attic inlet ventilation; 24 combinations of attic inlet location, attic inlet riser height, and the presence of a ridge diverter were simulated.

The simulation model demonstrated that installation of a riser is critical to prevent intake of cold air from the eave areas, regardless of placement. Placement of a 2.44 m diverter along the north roof surface and a 1.3 m riser on a centrally located attic inlet may increase thermal energy extraction by 40% to 50% over an attic inlet flush mounted with the ceiling. Placing a 1.0 m riser on an offset attic inlet under the south roof surface may increase extraction by 20%. Numerical simulation successfully identified candidate design options for testing under field conditions and reduced design and analysis cycle duration.

Key Words: attic inlet, CFD, modeling, solar energy

M32 Assessing spatial variability of air velocity in a commercial broiler production facility Brian Luck1*SC, Jeremiah Davis1, Joseph Purswell2, Jonathan Olsen1 Agricultural & Biological Engineering Department, Mississippi State University, Mississippi State, MS USDA ARS Poultry Research Unit, Mississippi State, MS

The objective of this study was to determine the effect of measurement density on accuracy of flow characterization. Air velocity data were collected in a 12.19 x 121.9 m curtain-sided broiler house equipped with ten 12.19 cm exhaust fans. The Scalable Environment Assessment System (SEAS) was used to distribute 40 hot-bead type anemometers attached to five masts (8 per pole) along a cross-section. Air velocity cross-sections were measured at two axial intervals; 12.19 m and 3.05 m. Air velocity was measured for 2 min at 1 Hz sampling interval. Three replicate measurements were obtained per cross-section. Kriging interpolation was used to generate velocity maps both in the transverse/vertical and transverse/axial planes for visual assessment of flow variations and identification of regions of transitional flow. Kriging variance, mean error and mean squared prediction error (MSPE) were used as an estimation of map quality.
Kriging variance for the 12.19 m axial interval was ≤ 0.6 while variance for the 3.05 m axial interval was ≤ 0.16 indicating that higher sampling density improved the prediction in the transverse/axial plane. Cross validation methods revealed that mean error and MSPE for the interpolation were lower for the 3.05 m axial interval compared to the 12.19 m axial interval, (-0.014, 0.10) and (0.038, 0.52) respectively. The reduced Kriging variance and errors produced by the 3.05 m axial interval indicate that accuracy of flow characterization improved with measurement density. The velocity profile in non-transitional flow regions was parabolic in shape, indicative of similarity to traditional duct flow. Areas of transitional flow near inlets or obstructions should be avoided to improve accuracy of mean velocity measurement. Average velocity reduction between center house and side walls in non-transitional areas was 0.22 m/s and 0.81 m/s, at 0.46 m and 1.68 m above the litter surface, respectively.

Key Words: air velocity, broiler, anemometer

M33 Effect of in-house windrow composting on odors during land application Scott Winkler, Daren Harmel, Terry Gentry, Eddie Caraway, Nathan Fuchs, Craig Coufal

The application of poultry litter as a fertilizer and soil amendment is a common practice. Some major concerns when land applying litter are nuisance odor complaints, nutrient values and bacterial content. The fate and transport of E. coli from animal wastes has become an important concern due to the potential for surface water contamination problems. Composting is an aerobic process known to stabilize organic wastes, reduce the potential for offensive odors and reduce pathogens. In-house windrow composting (IWC) of poultry litter has become a common litter management practice in the poultry industry. A demonstration project was conducted to determine if IWC could influence odors and reduce E. coli counts in poultry litter prior to land application. A commercial broiler house was divided in half lengthwise. The litter on one side of the house was formed into a windrow (treated litter) and the other half of the house was not disturbed (raw litter). The windrow was turned on day 4, and both types of litter were removed from the house and hauled to the litter application site on day 9. Each type of litter was land applied to separate, nonadjacent fields the following day. Litter samples were collected and analyzed for nutrient content, moisture and E. coli counts. To assess impact to odors, volatile gases were collected from litter piles prior to application via wind tunnel flux chambers into sorbent tubes for GC/MS analysis and Tedlar bags for olfactory analysis. E. coli counts were 185 CFU/g for raw litter and below the level of detection (10 CFU/g) for the treated litter. Nutrient analysis showed no differences between the raw and treated litter with the treated litter having slightly higher moisture content. GC/MS analysis of volatile gas samples resulted in significant increases and decreases of various individual odors, while olfactory analysis resulted in significantly reduced detection threshold values for the treated litter compared to the raw litter. All of these data indicate that IWC could be a useful best management practice to treat poultry litter prior to land application.

Key Words: litter, windrowing, land application, odor, composting

M34 Evaluation of embryonic differences between 1950s broilers and the modern high yielding broiler Katie Collins, Beverly McLendon, Jeanna Wilson

The Athens Canadian Random bred (ACRB), a 1950s meat-type chicken control strain, was compared to the 2012 Cobb 500 high yielding broiler as an embryo. Two trials were evaluated using a Cobb 500 breeder flock of similar age to the ACRB breeding population. The breeders were 41 weeks old in trial 1 and 48 weeks old in trial 2. Eggs were incubated in Natureform incubators set at 99.9°F and 53% relative humidity in the setter and 99.5°F and 53% relative humidity in the hatchet. Air temperatures were monitored using HOBO temperature and humidity probes and Chickmaster eggloggers. Three eggs per strain were sampled on 3.5, 5.5, 7.5, 10.5, 12.5, 14.5 and 17.5 days of incubation and measured for eggshell temperature, embryo, heart and intestine weight, and body, wing flat, shank, beak and third toe length. A hatch pattern was recorded every 6 hours starting at 468 hours of incubation. At hatch, a residue breakout was performed, and chicks and yolks were weighed. The Cobb 500 hatched 6-12 hours earlier than the ACRB. The ACRB had significantly greater percent hatch of fertiles. The ACRB had a larger percentage of early dead embryos, while the Cobb experienced greater late dead mortality as well as higher percentages of dead pips and dead chicks. No difference in eggshell temperature was found between the two strains. The modern broiler had significantly larger egg size, yolk-free chick weight and yolk weights while the 1950s chick had a greater moisture loss. The Cobb 500 also had larger embryo weights, but as a percentage of egg weight, embryo weights between the two strains did not differ. Cobb embryos were longer than ACRB for all parts measured. The heart and intestine weights were also greater in the modern broiler, but as a percentage of the embryo weight, these weights did not differ between the strains. The larger modern high yielding broiler embryo does not handle higher than standard incubation temperatures as well as 1950s broilers.

Key Words: embryo, broiler, Athens Canadian Random Bred, heart, intestine

M35 Comparison of broiler flock daily water consumption and water-to-feed ratios for flocks grown in 2000-2001 and 2010-2011 Chance Williams, Tom Table, Susan Watkins

Water is essential for many life sustaining and metabolic processes within the bird while also accounting for a large majority of muscle composition and weight. Over the years, genetic advancement for increased weight gain, feed intake and feed conversion have lead to the current commercial broiler that attain heavier weights in less time with greater yields. It is estimated that birds consume approximately 1.7 pounds of water for every pound of feed. Therefore, there is still much to be explored about how these genetic advancements have impacted commercial broiler water intake.

The objective of this study was to determine if any differences exist in daily water consumption and daily water-to-feed ratios for current flocks (January, 2010 – November, 2011; n=10) and flocks reared 10 years ago (January, 2000 – December, 2001; n=11). All flocks were grown under commercial settings in four broilers houses (40’ x 400’) at the University of Arkansas Applied Broiler Research Farm. Water consumption and feed intake were recorded daily for the entirety of each flock. Daily water consumption and daily water-to-feed ratios were adjusted to per 1000 birds, with daily mortality taken into account, to standardize data across all flocks. Data collected were grouped according to grow out date and evaluated for differences by day and group using SAS GLM. Results show a significant increase (P ≤ 0.047) in daily water consumption per 1000 birds for days 7-42 for present flocks when compared to flocks grown out 10 years ago, with a daily percentage increase as high as 26.7 %. Additionally, a significant (P < 0.05) reduced daily water-to-feed ratio was found for present flocks versus
10 year flocks for days 14, 16, 17, 18, 19, 31, 32, 34, 35, 36, 40, 41 and 42. These results suggest that water intake has increased over time for the commercial broiler, mirroring feed intake and feed efficiency.

**Key Words:** broiler, water, water consumption, water-to-feed ratio

M36 Effects of limestone particle size on pullet growth and keel bone deformities raised in aviary or conventional cages

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This study evaluated the effects of limestone particle size in pullet diets of Lohmann Brown (B) and Bovan White (W) pullets raised in aviary units (A) or cages (C) located in the same environmentally controlled room. For this purpose, a total of 432 1-d old pullets were placed into units (A) or cages (C) located in the same environmentally controlled room. All floor raised pullets were moved to 8 aviary units (26 B and 26 W pullets/pen) and 256 1-d old pullets were allocated in 21 brooder battery cages (6 B and 6 W pullets/cage). All floor raised pullets were moved to 8 aviary units (1.7 ft²/bird) at 6 wk. C birds were randomly allocated to 64 layer cages (0.5 ft²/bird) at 10 wk. Hens were given isocaloric and isoprotein diets containing either fine (F) or a blend of fine and coarse particle size (FC) limestone (Unical S=0.431 mm vs. FreFlo=0.879 mm; ILC Resources, Des Moines, IA) from 7 to 17 wk of age. Data were analyzed as a split plot factorial design with 4 replicates for each treatment combination. Housing systems and limestone particle sizes were considered as main factors and strains were considered subplots. Half of the birds were individually weighed at 11, 13, 15, 17 wk of age. At 15 wk of age, incidence of keel bone depressions, twists, and fractures were recorded. BC pullets had the highest BW, BA pullets had intermediate BW, and WC or WA had the lowest BW during the pullet-rearing phase (P<0.030). WC had poorer uniformity compared to BC; however the difference between genetic lines was not observed in A pullets (P<0.05). Also, W pullets suffered more keel bone depressions compared to B pullets only when they were fed F diet (13 vs. 5 %, P=0.015). “A” pullets shown higher incidence of severe keel bone depressions compared to caged pullets only when they were fed F diets (14 vs. 3 %, P=0.023). The utilization of FC limestone reduced incidence of mild (P=0.029) and severe (P=0.13) twisted keel bones compared to F limestone. Thus, strains performed differently in A or C systems and the utilization of FC limestone helped alleviate keel bone deformities in pullets.

**Key Words:** Aviary system, Pullet growth, Limestone particle size

M37 Effects of feeding diets naturally contaminated with deoxynivalenol (DON), aflatoxin B1 (AFB1), and / or fumonisin (FUM) on laying hen performance

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The effect of feeding pre-peak production laying hens diets formulated using corn naturally contaminated with DON, AFB1, or FUM on indices of mycotoxicosis or reproductive development were evaluated in a 10 week feeding trial. Relative weights of liver, kidney, ovary, and oviduct, in addition to numbers of large yellow follicles (LYF) and small yellow follicles (SYF) were recorded during necropsy at 4 and 10 weeks. 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 x 2 factorial with 4 mycotoxin diets with or without a commercially available deactivating compound (DC). Mycotoxin challenge diets with 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. Relative liver weights were increased (P<0.05) in AFB1/FUM challenge, but not in other (P>0.05) groups at both necropsy time points. At week 4, AFB1/FUM challenge relative kidney weight was increased (P<0.05) compared to the controls and increased (P<0.05) compared to both control and DON challenge groups on week 10. There was an increased (P<0.05) number of SYF observed in AFB1+FUM challenge compared to DON challenge on week 10. Relative weights of ovary or oviduct were not affected. An interaction with DC inclusion was not observed in these parameters.

**Key Words:** aflatoxin, deoxynivalenol, fumonisins, organ weights, necropsy

M38 Influence of select feed additives on broiler performance to 42 days following day-of-age coccidiosis vaccination

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Early broiler performance can be negatively affected by coccidiosis vaccination. The objective of this study was to evaluate the response of commercial broilers to select dietary feed additives following coccidiosis vaccination on day-of-hatch. This trial consisted of placing 2,200 Cobb 500 broilers on used litter for a 42-day rearing duration. Treatment groups consisted of: 1) negative control; 2) bacitracin methylene disalicylate (BMD; 50g/ton) in starter and grower diets and virginiamycin (VM; 20g/ton) in the withdrawal diet; 3) a cinnamaldehyde-based (CIN) additive (300g/ton) in starter, grower, and withdrawal diets; 4) BMD (50g/ton) in starter and grower diets and tylosin tartrate (TT; 20g/ton) in the withdrawal diet; and 5) TT (20g/ton) in starter, grower, and withdrawal diets. Average body weights and mortality corrected feed conversion were determined on days 15, 29, and 41. Compared to control broilers, average body weight of broilers at the end of the starter phase was increased (P<0.05) in BMD/VM and TT treatments, but not in CIN or BMD/TT treatments. Grower phase FCR in BMD/VM, TT, and BMD/TT broilers was significantly reduced (P<0.05) compared to controls, while FCR in CIN broilers was not different from controls. In the grower phase, average broiler body weight was increased (P<0.05) in BMD/VM, CIN, TT, and BMD/TT treatments when compared to control broilers. Further, average body weights in BMD/VM and TT broilers were greater (P<0.05) than broiler weights in the CIN treatment, but not greater than weights in the BMD/TT treatment. In the withdrawal phase, broilers in BMD/VM, TT, and BMD/TT treatments had higher (P<0.05) ending body weights when compared to control broilers. These findings suggest using certain feed additives may positively influence weight gain and FCR of broilers following day of age coccidiosis vaccination.

**Key Words:** Broiler performance, coccidiosis vaccination, feed additives

M39 Effect of chitosan on Salmonella Typhimurium in broiler chickens

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The effect of feeding pre-peak production laying hens diets formulated using corn naturally contaminated with DON, AFB1, or FUM on indices of mycotoxicosis or reproductive development were evaluated in a 10 week feeding trial. Relative weights of liver, kidney, ovary, and oviduct, in addition to numbers of large yellow follicles (LYF) and small yellow follicles (SYF) were recorded during necropsy at 4 and 10 weeks. 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 x 2 factorial with 4 mycotoxin diets with or without a commercially available deactivating compound (DC). Mycotoxin challenge diets with 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. Relative liver weights were increased (P<0.05) in AFB1/FUM challenge, but not in other (P>0.05) groups at both necropsy time points. At week 4, AFB1/FUM challenge relative kidney weight was increased (P<0.05) compared to the controls and increased (P<0.05) compared to both control and DON challenge groups on week 10. There was an increased (P<0.05) number of SYF observed in AFB1+FUM challenge compared to DON challenge on week 10. Relative weights of ovary or oviduct were not affected. An interaction with DC inclusion was not observed in these parameters.

**Key Words:** aflatoxin, deoxynivalenol, fumonisins, organ weights, necropsy
Public concern regarding the occurrence of antibiotic resistant bacteria, particularly among zoonotic pathogens such as *Salmonella*, is challenging the poultry industry to find alternative means of control. The purpose of the present study was to evaluate the effects of chitosan on *Salmonella enterica* serovar Typhimurium (ST) both *in vitro* and *in vivo*. For *in vitro* crop assay experiments, tubes containing feed, water and ST were treated with either saline or 0.2% chitosan. The feed tube crop assay was repeated for three duplicate trials. In all three trials, 0.2% chitosan significantly reduced total CFU of ST at 0.5 or 6 h post-inoculation when compared with control (P<0.05). In two independent *in vivo* trials, 40 broiler chicks were assigned to untreated control diet or dietary treatment with 0.2% chitosan for 7 days. On day 4, chicks were challenged with 2x10⁷ CFU of ST/bird. In both trials, dietary chitosan significantly reduced total CFU/g of ST recovery from cecal contents, though no statistical difference was noted for the incidence recovery of ST. In ovo vaccination of a selected spore-forming probiotic *Bacillus subtilis* spores, germination, direct-fed microbials for the purpose of reducing ST in broilers.

**Key Words:** chitosan, chickens, Salmonella

**M40 Influence of Marek’s disease virus vaccine on the incidence of Salmonella in chicks vaccinated in ovo vs. day-of-hatch.** Javier Garcia1,2, James Allen Byrd1, David Caldwell1,2 1Department of Poultry Science, Texas A&M University, College Station, TX 2USDA, ARS, Southern Plains Agricultural Research Center, College Station, TX

Vaccines have been an essential component in the control of diseases within flocks in the commercial broiler industry. In this study, we evaluated the application of Marek’s disease virus (MDV) vaccine administered *in ovo* vs. day-of-hatch to determine a possible association between vaccine administration and the prevalence of *Salmonella*. Three hundred embryos incubated for 19 days were obtained from a commercial hatchery. Half of the embryos were vaccinated at the hatchery *in ovo* while the other half remained unvaccinated. The two set of eggs were then placed into incubators for the remaining 1-2 days under commercial hatchery conditions. At day-of-hatch, all unvaccinated chicks were vaccinated for Marek’s disease virus. One hundred chicks from each set were selected and divided into eight groups of twenty-five chicks each. Chicks from each group were designated to act as seeder animals in a horizontal challenge model for *Salmonella*. To accomplish this, ten chicks per group were challenged with one of three *Salmonella* Typhimurium levels (10⁶, 10⁵, 10⁴). At day 10, all birds were euthanized and ceca were removed to determine *Salmonella* intestinal colonization. *In ovo* MDV vaccinated chicks challenged with 10⁶ *Salmonella* had higher *Salmonella* cecal recovery (3.582 Log 10 cfu) than chicks MDV vaccinated at day-of-hatch (1.625 Log 10 cfu). This may suggest that *day-of-hatch* MDV vaccinated chicks challenged with low levels of *Salmonella* are more resistant to *Salmonella* colonization than *in ovo* MDV vaccinated chicks.

**Key Words:** Salmonella, vaccination, ceca, Marek’s disease

**M41 Fate and dissemination of *Bacillus subtilis* spores in a chicken model** Juan Latorre1,2,3, Anita Menconi1, Neil Purnford1, Marion Morgan1, Ross Wolfenden2, Christopher Pixley2, Lisa Bielke1, Olivia Faulkner1, Billy Hargis1, Guillermo Tellez1 1Department of Poultry Science, University of Arkansas, Fayetteville, AR 2PacifiC Vet Group-USA, Fayetteville, AR

Bacterial spores are popular as probiotics, though little is known about their mode of action. We have studied the persistence and dissemination of a selected spore-forming probiotic *Bacillus subtilis* administered as either a single gavage dose to day-of-hatch broiler chicks or constantly in the feed. During two independent experiments, chicks were housed in isolation chambers and fed sterile corn-based diets. In experiment one, chicks were supplemented with 10⁹ *B. subtilis* spores per gram of feed. For experiment two, chicks were gavage with 10⁸ *B. subtilis* spores per chick on day of hatch. In both experiments crop, ileum, and ceca were sampled from four chicks at 0, 24, 48, 72, 96 and 120 h. viable spores were determined by plate count method after pasteurization (75°C for 10 min). Recovered spores were constant through 120 h in each of the tissues from chicks receiving spores supplemented in the feed. However, recovered spores were consistently about 10⁸ spores per gram of tissue, which is about a 1-log₁₀ reduction of the feed inclusion rate, indicating approximately a 10% germination rate in the gastrointestinal tract (GIT) when fed. However, recovered spores from chicks that received a single gavage dose decreased with time, with only approximately 10⁴ spores per gram of tissue by 120 h. This suggests that *Bacillus* spores are transiently present in the GIT of chickens but persistence of vegetative cells is presently unknown. In conclusion, to have a lasting benefit effect of *Bacillus subtilis* as vegetative cells or spores, continuous administration is advisable.

**Key Words:** Bacillus subtilis, spores, germination, direct-fed microbial, probiotic

**M42 Evaluating different hydrogen peroxide products for residual and efficacy over time** Pramir Maharjan1,2, Mary Scantling, Tyler Clark, Caroline Kuenzel, Bruna Boaro Martins, Susan Watkins 1Department of Poultry Science, University of Arkansas, Fayetteville, AR

A study was conducted for different products of hydrogen peroxide to determine the peroxide residue in water and its effectiveness to control microbes over time. Four different products; product A (50% stabilized), product B (20% stabilized with peracetic acid), product C (34% stabilized) and product D (28% non-stabilized) of hydrogen peroxide were tested. Each product was added at the rate of 2, 4, and 6 ounces per gallon of water creating stock solutions and then final mixtures from each stock solution were made mixing 1 ounce of stock solution added to a gallon of water. The 3 different concentration levels for each product and the control without any treatment were replicated thrice. The water used was municipal water and was allowed to sit in an open container for 48 hours to remove chlorine residues. After the solutions were prepared they were covered to prevent access to sunlight, except during the residue measurement and plating. Peroxide residues were measured for each product and at each concentration level for day 0, 1, 2, 3, 4 and 5 using Water Works test strips that measure from less than 0.5 ppm to 100 ppm. Product A maintained fairly higher residues while product D was the lower among all 4 products at each concentration level from day 0 to 5. However, product D maintained around 25 ppm until day 1 at the 2 ounce concentration level. At 48 hours post treatment, a 5ml challenge (contaminated algae water) was introduced to each of the 4 products for all 3 concentration levels. It was then plated at 0 and 1 hour post challenge introduction and the total plate count was done for microbes. There were significant reductions in bacterial count (p<0.05) at 0 hour interval with all four products at all concentration levels compared to the control. At 1 hour interval, there were again marked reductions (by a log) with respect to the count values at its 0 hour interval for all the products and at all concentration levels. Results suggest that each product holds enough peroxide residues in water to control microbes for at least 2 days post treatment starting from 2 ounces per gallon.

**Key Words:** water, hydrogen peroxide, residue, efficacy, microbes

**M43 Evaluation of an egg sanitization system using hydrogen peroxide and ultraviolet light at commercially feasible speeds** Nathan Fuchs1,2, Scott Winkler, Craig Coufal 1Department of Poultry Science, Texas A&M University, College Station, TX
Previous studies have shown that spray application of hydrogen peroxide ($H_2O_2$) followed by UV light exposure is an effective method of eggshell disinfection. Previously, this procedure has been applied in a manual, laboratory-scale manner. In order to make the process more feasible for commercial application, a prototype apparatus was constructed to automate the $H_2O_2$ spraying and UV light exposure process. Three experiments were conducted to evaluate the effectiveness of the apparatus for disinfecting eggshells. The first experiment used 15 visibly clean floor eggs. Ten of the eggs were treated using the sanitization machine while the other five served as controls. Experiment 2 was conducted over five consecutive days using visibly clean nest eggs. Each day, 300 eggs were collected, and half were treated using the machine and the other half were not. Each day, five eggs were randomly selected from the treated and control groups for enumeration of total aerobic plate counts (APC). Experiment 3 was designed to assess the effect of conveyor speed on effectiveness. The two conveyor speeds used in the experiment were 5.5 cm/sec and 10.2 cm/sec. In all experiments, total eggshell aerobes were enumerated by rinsing the egg in 20 ml of sterile PBS, followed by inoculation of 1 ml of rinsate onto Petrifilms. For eggs yielding zero counts, a value of 10 CFU/egg was used for calculation of mean eggshell counts. In Experiment 1, APC of treated eggs was lower than that of control eggs (1.4 log CFU/egg vs 4.4 log CFU/egg). The 25 treated nest eggs in Experiment 2 had an average APC of 1.2 log CFU/egg while the untreated controls averaged 4.5 log CFU/egg. In Experiment 3, conveyor speed did not influence effectiveness of the process. Average APC of the eggs treated at the slower and faster speeds was 1.1 and 1.3 log CFU/egg, respectively. Untreated control eggs averaged 4.5 log CFU/egg in Experiment 3. The results of these 3 experiments demonstrate that eggshell sanitization via $H_2O_2$ and UV light application can be highly effective at commercially feasible speeds.

Key Words: Eggshell, disinfection, UV light, hydrogen peroxide, machine

M44 Disinfection of poultry transport coops with a compressed air foam system Carolee Hinojosa, David Caldwell, Erin Fowlkes, Marta Ross, Stephanie Isett, Javier Garcia, Jason Lee, James Byrd, Morgan Farnell

Department of Poultry Science, Texas A&M AgriLife Research and Extension, College Station, TX

Disinfection, Salmonella, food safety, transport coops, chicken

M45 Correlation between footpad dermatitis, walking ability, and performance in turkeys at market age Manuel João Da Costa, Jesse L. Grimes, Edgar O. Oviedo-Rondón, Ilana Barasch, Caitlin Evans, Marcelo Dalmagro, Jessica Nixon

Department of Poultry Science North Carolina State University, Raleigh, NC

Footpad dermatitis (FPD) and walking ability are both parameters used on poultry welfare audits however there is not much information about their relationship with live performance. One survey was conducted to determine the correlation between FPD severity, gait score (GS), body weight (BW) and litter condition on turkeys at market age. A total of 24 commercial tom flocks, of 16 to 19 weeks of age, were evaluated between May 2011 and September 2012. On each visit, 50 toms were selected, weighed and evaluated for GS and FPD. The GS system consisted in 6 levels. Turkeys with no abnormalities were classified as 0 and turkeys showing reluctance to move and high degree of limping as 5. The FPD lesions were classified in 8 levels being 0 normal footpads and 7 generalized footpad ulceration. Litter was also scored from 1 to 5 according to moisture content and caking. Data analyses consisted in pairwise correlations and three separate multiple linear regression models using FPD, GS and BW as response variables. Fixed effects included litter score, hatching day within a year, FPD, GS, and BW. Geometric, company and age were used as covariates. Pairwise correlations indicated significant but weak correlations of FPD with age ($r=0.30$) and BW ($r=0.20$). The GS was correlated with BW ($r=0.25$) and litter score ($r=0.31$). In addition, BW was also correlated with litter score ($r=0.18$). On multiple linear regression analysis it was observed that litter conditions, BW and GS affected ($P<0.001$) FPD severity. As litter condition and walking ability worsened and turkeys became heavier the FPD severity increased. Walking ability was mainly affected by litter score ($P<0.001$). High scores of litter decreased turkey walking ability. Moreover increasing BW and FPD severity also affected ($P<0.001$) negatively GS. The BW was affected ($P<0.001$) in a similar way by FPD and GS. A negative effect ($P<0.001$) was observed by FPD and GS on BW. In conclusion, FPD, GS and BW are correlated and litter condition is a major factor in FPD development and locomotion ability.

Key Words: turkeys, welfare, footpad dermatitis, walking ability

M46 Germicidal Ultra-Violet Light to Eliminate Low Numbers of Listeria monocytogenes on Raw Chicken Meat Mark Berrang, Richard Meinersmann

USDA-ARS Russell Research Center, Athens, GA

Listeria monocytogenes can be transferred from broiler slaughter plants to commercial cooking plants with raw product. Once in a cooking plant, this organism can become a long term resident and colonize floor drains. Earlier work showed that during plant wash down, an inadvertent short hose spray can result in low numbers of airborne Listeria being transferred to surfaces and product. Germicidal ultra violet light (5 min at 1000 µW/cm²) is effective to lower numbers of inoculated L. monocytogenes on raw breast fillets from about 10⁶ to 10⁴. In the cur-
rent study we tested the use of lower doses of germicidal ultra violet light (5, 3 or 1 min at 800 µW/cm²) to eliminate L. monocytogenes at the levels that we estimate can be transferred during processing plant wash down. Fresh skinless boneless breast fillets were inoculated with a mean of 42 cells streptomycin resistant uutes after inoculation, fillets were treated with ultra violet light (254 nm, wash down.

the levels that we estimate can be transferred during processing plant

M48 Reduction of Salmonella in skinless, boneless chicken breast fillets by lauric arginate Chander Shekhar Sharma*, Amanda Ates, Poulson Joseph, Rama Nanapanneni, Aaron Kiess Department of Poultry Science, Mississippi State University, Mississippi State, MS

Lauric arginate (LAE) is a USDA approved antimicrobial for use in meat and poultry products and has been found effective against various foodborne pathogens. The objective of this study was to evaluate the effectiveness of LAE at reducing Salmonella on fresh, skinless and boneless chicken breast fillets. The effect of LAE treatments on total aerobe counts, pH and color of breast fillets was also determined. Chicken breast fillets were inoculated with a four strain Salmonella cocktail (S. Enteritidis ATCC 4931, S. Heidelberg ATCC 8326, S. Kentucky ATCC 9263 and S. Typhimurium ATCC 14028) and treated with sterile DI water (positive control), 200 ppm and 400 ppm of LAE. After treatments, the chicken breast fillets were stored at 4 °C and analyzed on d 0, 1, 3, 5, and 7 for Salmonella, total aerobes, color and pH. The fillets treated with 400 ppm LAE had lower (P < 0.05) Salmonella counts as compared to the positive control on d 0, 1 and 7. The log cfu/g reductions for Salmonella ranged from 0.7 to 1.0 and 0.7 for 400 ppm and 200 ppm treatments, respectively. No treatment effect was observed on the growth of mesophilic microorganisms, pH and color of chicken breast fillets (P > 0.05) following 200 ppm and 400 ppm treatments of LAE. The results from the present study indicate that surface application of LAE was effective in reducing Salmonella in chicken breast fillets during refrigerated aerobic storage without negatively affecting the color of chicken breast fillets.

Key Words: lauric arginate, Salmonella, chicken breast fillets, color, total aerobes
both *Salmonella* and *Campylobacter* on broiler parts, and could be used to enhance food safety of raw chicken products.

**Key Words:** Salmonella, Campylobacter, breast meat, wings, thyme orange oil

**M50 Chill Water Additive Controls Transfer of *Salmonella* and *Campylobacter* by Improved Chlorine Efficacy** Brad Schambach,1,* Mark Berrang1, Mark Harrison2 1USDA-ARS Russell Research Center, Athens, GA 2Food Science Department, University of Georgia, Athens, GA

In earlier work, we showed that a proprietary additive (T-128) maintains chlorine activity in the presence of organic material such as broiler parts. T-128 improves the efficacy of chlorine to control transfer of *Campylobacter* and *Salmonella* from inoculated wings to un-inoculated wings during immersion chilling. However, T-128 causes a substantial drop in pH, and it is unclear if the beneficial effect is simply due to the enhanced acidic conditions. The objective of this study was to compare the effectiveness of T-128 to its acid component (phosphoric acid, H₃PO₄) to lower numbers of *Salmonella* and *Campylobacter* transferred in chill water. To test this, four containers were prepared containing two broiler wings, water, and ice in a weight to weight ratio of 1:2:4 chicken meat to water to ice. One of the two wings was inoculated with approximately 10⁶ cells each of an antibiotic resistant strain of *Salmonella* and *Campylobacter*; the second wing was left un-inoculated. Containers were assigned to each of two treatments, as follows: a combination of 50ppm chlorine and 0.5% T-128 by volume, and a combination of 50ppm chlorine and 0.01% H₃PO₄ by volume. Both treatments resulted in initial water pH of 3.5. All containers were covered and shaken at 130 rpm for forty-five minutes. After the 45-minute chill treatment, pH of T-128 solution averaged 6.04 with a free chlorine level of 10 ppm. The H₃PO₄ solution however, had a mean pH of 5.86 with a free chlorine level less than 0.10 ppm. Each wing was rinsed in 30 mL of PBS. Antibiotic resistant marked *Salmonella* and *Campylobacter* were enumerated per mL of rinse solution by plating on BG-Sulfa agar with the addition of nalidixic acid and Campy-Cefex agar with the addition of gentamicin, respectively. Following chill treatment, no statistically significant difference in the number of *Salmonella* was detected per mL of chill water; however, T-128 treatment resulted in significantly (P < 0.01) fewer *Campylobacter* per mL of chill water. T-128 treatment also resulted in significantly (P < 0.01) fewer *Salmonella* and *Campylobacter* detected from un-inoculated wings than the acid only treatment. These data suggest that T-128 used in conjunction with chlorine has the ability to control cross contamination of poultry carcasses with human pathogens during immersion chilling by a greater reduction, chill tank, solution pH, Campylobacter, Salmonella

**Key Words:** Bacterial Reduction, chill tank, solution pH, Campylobacter, Salmonella

**M51 Effect of zinc and sex on broiler blood zinc protoporphyrin, raw marrow color, and cooked meat color** Rashaa Qudsieh*NC, Basheer Nusairat, Doug Smith, John Brake Poultry Science Department, North Carolina State University, Raleigh, NC

Red discoloration of cooked poultry meat is a significant problem for fully cooked poultry products. Redness has been shown to occur due to excessive zinc levels in processed meat and may vary due to gender. The objective of this study was to determine the effect of dietary zinc supplementation and sex on zinc protoporphyrin (ZPP) levels in blood, CIE a* (redness) of raw bone marrow, and redness of cooked meat from broiler chickens. Broilers were fed diets containing 0, 120, or 240 mg Zn/kg diet. A total of 144 males and females were processed at 56 d of age, and 2 femurs were collected from each bird. Blood samples were taken from each bird and ZPP measured. Bone marrow was collected from the interior epiphyseal end caps of femurs. Marrow was minced and color was measured. Marrow was placed in glass tubes adjacent to broiler breast meat and cooked to an internal temperature of 75 C, and immediately cooled. Meat color was measured at the contact surface with the marrow. Dietary zinc had no effect on ZPP, raw marrow or cooked meat color. Excessive levels (224 mg/kg) of zinc found in the used litter utilized in all pens may have contributed to the lack of observed dietary effect. Females had significantly higher ZPP values than males (54.3 vs. 40.8 mmol/mol, respectively). Redness of raw bone marrow was higher in females than males (34.1 vs. 30.8, respectively).

Cookred meat redness was not affected by sex (13.62 vs. 14.92, respectively). In this study, dietary zinc did not affect ZPP, raw marrow or meat color, but females showed elevated ZPP levels and marrow redness. Additional studies will be required to determine effect of zinc and sex on ZPP, and bone marrow and meat color

**Key Words:** Broilers, Red discoloration, Zinc protoporphyrin, Bone marrow, Cooked meat

**M52 Cook yield, shear value, and color of breast fillets from broilers fed diets containing different levels of zinc, copper, and Roxarsone** Rashaa Qudsieh*, Basheer Nusairat, Doug Smith, John Brake Poultry Science Department, North Carolina State University, Raleigh, NC

The objective of this investigation was to determine the effect of zinc (Zn), copper (Cu), and Roxarsone (As) supplementation on cook yield, Warner-Bratzler (WB) shear values (kg shear), and CIE L* a* b* color of raw and cooked broiler breast fillets. 1024 Ross 708 male and female broilers were raised sex separate and fed 1 of 8 diet series in a 2 x 2 randomized complete block design with a factorial arrangement of Zn x Cu x As x gender. Diets contained (as mg/kg diet): Zn 120 or 240; Cu 10 or 100; and As 0 or 0.5. At 56 d of age, 2 birds per pen were randomly selected and processed. Deboned breast fillets were weighed, cooked to an internal temperature of 75 C, and reweighed to determine cook yield. Raw breast fillet yield was not affected by either Zn or As. However, Cu 100 reduced raw breast fillet yield in males by 1.3%. Cook yield was lower in females versus males (68.1 vs. 70.6%, respectively). Zn 240 decreased WB shear (3.6 kg) versus Zn 120 (4.1 kg). However, As 0.5 resulted in higher WB shear (4.27 vs. 3.46 kg). Females exhibited lower WB shear as compared to males (3.6 vs. 4.1 kg, respectively). Cu 100 decreased WB shear in females as compared to males (3.5 vs. 4.4 kg, respectively). Raw fillets from females were lighter (52.4 vs. 49.6), less red (1.4 vs. 1.9), and more yellow (6.8 vs. 5.7) than males. Cooked fillets from females were lighter (84.5 vs. 83.2), but there was no gender difference for redness or yellowness. Zn did not affect color of raw or cooked fillets. Cu 100 reduced redness in raw but not cooked fillets. As 0.5 reduced redness of cooked fillets. Cu 100 and As 0.5 increased yellowness of raw and cooked fillets. Results indicated that mineral supplementation and gender affected broiler breast muscle quality

**Key Words:** Broilers, Zinc, Copper, Roxarsone, Breast meat quality

**M53 EFFECT OF DIFFERENT PROCESSING TECHNIQUES ON PROTEIN QUALITY OF HATCHERY WASTE MEALS** AThAr MAhmud1 Department of Poultry Production, University of Veterinary and Animal Sciences, Lahore, Pakistan

In two experiments, the nutrient composition and protein quality of hatchery waste was evaluated by using different processing techniques i.e., cooking, autoclaving and extrusion. The protein contents of the cooked, autoclaved and extruded hatchery waste meals were 43.67, 44.10, and 41.64%, respectively. Microbial analysis of the raw HW ex-
hibited high microbial counts. Different processing techniques reduced the microbial count of HW. Autoclaving reduced both the total viable count (TVC) and total coliform count (TCC) to the minimum as compared to other heat treatments. Protein quality of cooked, autoclaved and extruded HWM was measured in terms of protein efficiency ratio (PER) and net protein utilization (NPU). The weight gain in group of broilers consuming reference diet (casein) as sole source of protein was significantly (P<0.05) higher as compared to the other experimental groups. The PER results from all processing techniques along with NPU data supported an overall conclusion that processing HW with cooking and autoclaving is comparable in terms of NPU. Autoclaving proved more beneficial in terms of PER. But overall values of PER and NPU revealed that processing of HWM can generate nutrient rich, palatable product that was comparable to the traditional feed ingredients.

**Key Words:** Hatchery waste, microbial count, NPU, PER, protein quality

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**SCAD**

**M54 Efficacy assessment of omega-3 bio-fortified-eggs against hypercholesterolemia in human subjects** Zafar Hayat1, Hussain Rasul2, Muhammad Nasir2 1Department of Animal Sciences, University of Agriculture, University of Sargodha, Sargodha, Pakistan 2Department of Food & Nutrition, University of Veterinary & Animal Sciences, Lahore, Pakistan

Omega-3 polyunsaturated fatty acids including alpha linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) might reduce risk factors for heart disease through lowering total blood cholesterol, low density lipoprotein, blood pressure, triglycerides and enhancing the level of blood high density lipoprotein. Omega-3 bio-fortified eggs are excellent source of these vital nutrients. The objective of present study was therefore, to assess efficacy of omega-3 bio-fortified-eggs against hypercholesterolemia in human subjects. Twenty-two hypercholesterolemia (cholesterol level > 200mg/dl) adult subjects of both sexes were recruited after informed consent, divided into two groups having 11 in each group. Group “A” was control and kept normal diet without eggs. Group “B” was provided with bio-fortified eggs one egg per day in morning for 5 weeks. The blood samples of the individuals were obtained at the start of the study, after this blood sample was obtained only weekly basis for 5 weeks. The blood was analyzed for blood lipid profile to assess the impact of omega-3 bio-fortified eggs against various blood lipid fractions. Omega-3 polyunsaturated fatty acid bio-fortified eggs improved the lipid profile in hypercholesterolemic humans. The bio-fortified eggs decreased blood serum total cholesterol (mg/dl) in 5 weeks in subjects as compared to control group. The cholesterol level in first two weeks remained non-significant but afterwards it decreased significantly as compared to control in 3rd & 4th week. During last week cholesterol did not further decrease in bio-fortified groups. Serum triglycerides level (mg/dl) were noted to be somewhat more in bio-fortified group, however, after 2nd week triglycerides started decreasing and mean TG concentration in biofortified group at the end of 5th week was less than control. There was variable but non-significant results for HDL level (mg/dl) in bio-fortified group compared to control group. The serum LDL levels (mg/dl) decreased significantly in bio-fortified group and followed the cholesterol pattern.

**Key Words:** Omega-3, Eggs, Cholesterol, Triglycerides, Human

**M54 Listeria monocytogenes from slaughter plant to fully cooked product - sources, sites and potential intervention** Mark Berrang* USDA-ARS Russell Research Center, Athens, GA

Listeria monocytogenes is a human pathogen that has been associated with fully cooked poultry products. This organism is not highly prevalent on live broilers; however, prevalence tends to increase as carcasses proceed through an initial processing plant. In one study we found no L. monocytogenes on pre-scaled carcasses but when we examined deboned thighs from the same flock, 4% were positive. Even a low percentage of positive cut up chicken parts translates to a substantial number when one considers the vast numbers of parts moved from a slaughter plant to a large commercial cooking operation. We have documented raw poultry meat as the most important source of L. monocytogenes to commercial cooking facilities. Once a cooking plant has been exposed, some subtypes of L. monocytogenes can colonize the plant and become long term residents in floor drains. Floor drain contamination is a concern because we have found that Listeria can become airborne when a hose is sprayed into a drain during wash down. Aerosolized Listeria can result in the contamination of product in either a slaughter plant prior to shipment or ready-to-eat product that has been fully cooked. Therefore, interventions are needed to control L. monocytogenes before it can be transferred from a slaughter plant to a cooking plant on raw product. In studies involving floor drains, we found that sanitizers, especially peroxide based chemicals, can effectively lower the numbers of L. monocytogenes both in floor drain liquid and attached to the inner surfaces of the drain pipe as a biofilm. In some cases adding a physical disruption such as ultra-sound may help to breakup biofilm architecture making chemical treatment more effective. Another approach is to lower numbers of L. monocytogenes on cut up broiler parts prior to packing for transport to a cooking plant. We have found that germicidal ultraviolet light shows promise as a means to significantly lower numbers of Listeria on raw product. Currently, work is being conducted to further optimize potential interventions and better understand the microbial ecology of human pathogens in poultry processing environments.

**Key Words:** Listeria monocytogenes, Poultry products, UV light

**M55 Evaluation of methods for detection of IgA in orally vaccinated broiler chickens** L.R. Bielcke1, O.B. Faulkner1, N.R. Pumford1, M.J. Morgan1, A.D. Wolfenden1, S. Shivaramaiah1, L.R. Berghman1, J. Barta1 1Department of Poultry Science, University of Arkansas, Fayetteville, AR 2Department of Poultry Science, Texas A&M University, College Station, TX 1Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, Canada

Mucosal immunity is important for preventing infection and disease, but IgA responses are frequently suboptimum. Recently, vectored vaccines have been investigated for effectiveness in controlling multiple diseases affecting poultry including avian influenza, Eimeria, Salmonella, and Campylobacter in our laboratories. However, detection of IgA after vaccination has proven difficult due to lack of appropriate controls and well-defined sampling methods in poultry. Here, we have evaluated sampling methods and data analysis for multiple vectored vaccine candidates. In each of three different experiments, with a total of four sample collections, mucosal samples included trachea (TR) and ileal mucosa scrapings (GIT). Immediate addition of a protease inhibitor to preserve IgA was consistent among all groups prior to freezing. For determination of IgA levels in TR, processing was conducted by homogenization with a tissue homogenizer (TRH) or mild tearing of the tissue with a 1.5mm pestle (TRT). We have found that germicidal ultraviolet light shows promise as a means to significantly lower numbers of Listeria on raw product. Currently, work is being conducted to further optimize potential interventions and better understand the microbial ecology of human pathogens in poultry processing environments.

**Key Words:** Listeria monocytogenes, Poultry products, UV light
each processing method. TRT consistently showed the highest MSE, while TRH and GIT each had the lowest MSE in two different experiments, suggesting that TRH and GIT are equally reasonable as processing methods for IgA detection, even when antigens are delivered orally. Normalization of samples, to eliminate ELISA plate to plate variation, was difficult using a sample-to-negative ratio which reinforced the need for chicken-specific IgA positive control for specific ELISA validation. These data suggest that appropriate positive controls, type of sample, and processing of samples are each important factors for detection of IgA in orally vaccinated chickens.

Key Words: IgA detection, vaccine, trachea, mucosa, ELISA

M56 Immune enhancing molecules expressed in Bacillus subtilis stimulate macrophage phagocytic activity Olivia Faulkner1, Lisa Bielke1, Amanda Wolfenden1, Matthew Faulkner1, Neil Pumford1, Marion Morgan1, Courtney Kremer1, Guillermo Tellez1, Luc Berghman1, Billy Hargis1 1JKS Poultry Health Laboratory, University of Arkansas, Fayetteville, AR 2Department of Biology, University of Arkansas, Fayetteville, AR 3Department of Poultry Science, Texas A&M University, College Station, TX

Bacillus subtilis were engineered to express segments of CD154 and HMGB1 protein with the CVI988 strain of Marek’s disease virus. For the 4WCH study, immunity against ILT induced by various vaccination approaches that included a) recombinant; b) live-modified attenuated; and c) inactivated virus vaccines. Commercial layer pullets were randomly distributed in experimental groups of chickens vaccinated using one or more vaccines and challenged at 4, 9 or 35 weeks of age (4WCH, 9 WCH and 35 WCH, respectively). All layers were vaccinated at hatch with the CVI988 strain of Marek’s disease virus. For the 4WCH study, the experimental vaccination approaches included: a) non-vaccinated challenged; b) recombinant POX-LT at hatch; c) recombinant HVT-LT at hatch; d) TCO at 2 weeks of age; e) POX-LT at hatch + TCO at 2 weeks; f) HVT-LT at hatch + TCO at 2 weeks; and g) non-vaccinated non-challenged. For the 9WCH study, the distribution was similar except that the TCO vaccine was given at 6 weeks of age and a CEO-vaccinated group, vaccinated at same age, was added. For the 35 WCH the groups were the same as for the 9 WCH, except that two different inactivated vaccines, each delivered intramuscularly and the other delivered by spray, were included, as well as their combinations for a total of 14 groups. The 4WCH and 9WCH were performed in isolation units with 5 birds per group with one replicate; while 35 WCH was done in isolated floor pens, with all experimental groups commingled in the same environment with one replicate pen containing the same groups. Protection against ILTV challenge was assessed by clinical sign scoring and quantification of challenge virus shedding in the trachea as determined by qPCR at 5 days post challenge.

When statistical comparison with the positive control was performed, the POX-LT vaccine group did not show a reduction of clinical signs or viral shedding after the 4, 9, or 35 WCH; the HVT-LT+TCO association provided better reduction in clinical signs and viral shedding than HVT-LT or TCO groups alone at 4WCH and 9WCH but all three were similar at 35 WCH; unexpectedly, the POX-LT+TCO group showed less protection than the HVT-LT+TCO group at 4WCH and 9WCH but it was similar at 35 WCH. Neither of the inactivated vaccines resulted in reduction of clinical signs or viral shedding at 35WCH. Finally, the CEO vaccine group provided the greatest reduction of clinical signs and viral shedding at 9WCH and 35 WCH.

Key Words: Infectious laryngotracheitis, Layers, HVT-LT, POX-LT, Immunity

M57 Lasalocid related ionophore toxicity in pen-raised bobwhite quail and ring-necked pheasants. Douglas Anderson 1Georgia Poultry Laboratory Network, Forsyth, GA

Lasalocid sodium is approved for use in pen-raised chukar partridges at 113gm/ton of feed as a preventative against Eimeria legionensis. As an approved product, it is often used as a feed additive to prevent coccidiosis in pen-raised bobwhite quail and ring-necked pheasant. In recent years, an increased number of ionophore toxicity cases have occurred while on lasalocid sodium treated feeds. An experiment was designed to evaluate the occurrence of ionophore toxicity in bobwhite quail and ring-necked pheasants while on lasalocid treated feed.

Key Words: Infectious laryngotracheitis, Layers, HVT-LT, POX-LT, Immunity

M58 Immunity against a virulent field isolate of ILTV induced by inactivated, recombinant, and modified live virus vaccines in commercial Layers Victor Palomino*1, Guillermo Zavala, Sunny Cheng, Maricarmen Garcia 1Department of Population Health, University of Georgia, Athens, GA

Infectious Laryngotracheitis (ILT) is an economically important respiratory disease of chickens. Although ILT has been prevented by vaccination with live-modified virus for decades, a new generation of recombinant vaccines has been developed claiming to provide similar immunity without the live-modified vaccine drawbacks, such as reversion to virulence and reactiveness. The objective of this research was to study the immunity against ILT induced by various vaccination approaches that included a) recombinant; b) live-modified attenuated; and c) inactivated virus vaccines. Commercial layer pullets were randomly distributed in experimental groups of chickens vaccinated using one or more vaccines and challenged at 4, 9 or 35 weeks of age (4WCH, 9 WCH and 35 WCH, respectively). All layers were vaccinated at hatch with the CVI988 strain of Marek’s disease virus. For the 4WCH study, the experimental vaccination approaches included: a) non-vaccinated challenged; b) recombinant POX-LT at hatch; c) recombinant HVT-LT at hatch; d) TCO at 2 weeks of age; e) POX-LT at hatch + TCO at 2 weeks; f) HVT-LT at hatch + TCO at 2 weeks; and g) non-vaccinated non-challenged. For the 9WCH study, the distribution was similar except that the TCO vaccine was given at 6 weeks of age and a CEO-vaccinated group, vaccinated at same age, was added. For the 35 WCH the groups were the same as for the 9 WCH, except that two different inactivated vaccines, each delivered intramuscularly and the other delivered by spray, were included, as well as their combinations for a total of 14 groups. The 4WCH and 9WCH were performed in isolation units with 5 birds per group with one replicate; while 35 WCH was done in isolated floor pens, with all experimental groups commingled in the same environment with one replicate pen containing the same groups. Protection against ILTV challenge was assessed by clinical sign scoring and quantification of challenge virus shedding in the trachea as determined by qPCR at 5 days post challenge.

When statistical comparison with the positive control was performed, the POX-LT vaccine group did not show a reduction of clinical signs or viral shedding after the 4, 9, or 35 WCH; the HVT-LT+TCO association provided better reduction in clinical signs and viral shedding than HVT-LT or TCO groups alone at 4WCH and 9WCH but all three were similar at 35 WCH; unexpectedly, the POX-LT+TCO group showed less protection than the HVT-LT+TCO group at 4WCH and 9WCH but it was similar at 35 WCH. Neither of the inactivated vaccines resulted in reduction of clinical signs or viral shedding at 35WCH. Finally, the CEO vaccine group provided the greatest reduction of clinical signs and viral shedding at 9WCH and 35 WCH.

Key Words: Lasalocid, bobwhite quail, pheasant, ionophore toxicity
M59 Failure of sprayed Arkansas type IBV to replicate in vaccinated broilers Ha-Jung Roh1,2, Deborah Hilt, Mark Jackwood Department of Population Health, University of Georgia, Athens, GA

Infectious bronchitis (IB) is highly contagious upper-respiratory disease of chickens, which causes mortality, weight loss, and decreased egg production. The current strategy for control of IB is using attenuated live vaccines. In broilers, live vaccines are applied at one day of age using a hatchery spray cabinet and at two weeks of age by an aerosol spray or via drinking water. Priming of commercial broilers using hatchery spray vaccination is an important step in infectious bronchitis virus (IBV) vaccine schedules. Proper priming of the immune system at an early age is required for birds to develop adequate protection and to be able to clear challenges from homologous pathogenic IBV. In commercial broilers, Ark type vaccine virus has been frequently isolated in the field, indicating that initial vaccination did not adequately prime the birds. Our recent data suggests that this could be due to failure of Ark hatchery spray vaccinations to induce protection, as Ark vaccine applied via intraocular route successfully established protection against homologous challenge. To obtain a better understanding of the Ark spray vaccine failure, we spray vaccinated different numbers of one-day-old broilers with single or double doses of Ark vaccine. Tracheal swabs were collected on days 3, 7, 10, 14, 17, 21, and 28 for vaccine virus detection by qRT-PCR. Results showed no significant differences between double doses and single doses on birds, no matter how many birds vaccinated, indicating sprayed Ark vaccine failed to replicate in birds. Since eye-drop inoculation provided protection where spray did not, the possibility of mechanical damage to Ark virus from commercial hatchery spray cabinets was examined using electron microscope (EM). Vaccine solutions were collected before and after spray and were prepared for EM analysis, focusing on the S1 protein.

Key Words: Infectious bronchitis virus, Hatchery vaccination, Arkansas

ABSTRACT OF PAPERS

M60 Evaluation dietary NSPase inclusion in low energy corn-soybean meal diets containing DDGS on broiler performance and carcass yield Tucker Allcorn1,2, Joseph Klein1, Mallori Williams1, Blynn Brown1, Michael Kidd1, Roy Brister2, Jason Lee1 1Poultry Science Department, Texas A&M AgriLife Research, College Station, TX 2Enzyvia LLC, Sheridan, IN

An experiment was conducted to evaluate the inclusion of a cocktail NSPase (Enspira) in low energy corn-soybean meal diets containing DDGS on broiler growth performance and carcass yield. The experimental design included a total of three dietary treatments including a positive control (PC), negative control (NC) with a reduction of 55 kcal/kg (starter) and 88 kcal/kg (finisher and withdrawal) compared to the PC, and NC supplemented with NSPase. Each treatment included 16 replicate pens with 40 male broilers placed per treatment group (1920 total chicks placed). Dietary program consisted of a three phase program, starter (5% DDGS), grower (10% DDGS) and finisher (15% DDGS). Broilers were weighed and feed consumption determined on days 14, 27, and 39. Following an 8 hr feed withdrawal, seven broilers per replicate pen were processed for carcass and fat pad yield determination. Body weight was reduced (p<0.05) in the NC diet as compared to the PC diet on days 14 and 27. Inclusion of the NSPase increased (p<0.05) body weight compared to NC and was similar to the PC. Feed conversion ratio (FCR) was increased (p<0.05) in the NC cumulatively at the end of each dietary phase as compared to the PC. Inclusion of NSPase reduced (p < 0.05) cumulative FCR at day 27 and 39 as compared to the NC diet. Inclusion of NSPase in the NC diet resulted in similar cumulative FCR as compared to the PC at day 27 and 39. Carcass and fat pad yield were similar for all three treatment groups. These data confirm that NSPase inclusion can compensate for losses in performance associated with reductions in dietary energy.

Key Words: enzyme, energy, broiler, performance, processing

M61 Increased dietary amino acid density from 1 to 35 d of age optimizes profitability in Hubbard M99 × Cobb 500 male broilers Paul Tillman1,2, Kurt Perryman1, William Dozier, III1 1Poultry Technical Nutrition Services, Buford, GA 2Department of Poultry Science, Auburn University, Auburn, AL

An experiment was conducted to determine the effects of feeding broilers diets formulated with progressive increases in digestible Lys (dLys) on growth performance, meat yields, and economic return over feed costs (ROFC) during a 5 wk production period. Fifteen hundred Hubbard M99 × Cobb 500 male chicks were randomly distributed to 60 floor pens (25 birds per pen; 0.09 m2 per bird at 1 d of age). Five experimental diets were fed over 3 phases including starter, grower, and finisher (1 to 14, 15 to 28, and 29 to 35 d of age, respectively). A basal (low dLys) and summit (high dLys) diet were formulated and blended to create 3 additional diets. The 5 experimental diets were basal, industry low, industry high, requirement, and summit and had weighted (based on feed intake) dLys concentrations of 0.88, 0.95, 1.02, 1.09, and 1.16%, respectively. Diets were formulated to similar digestible ratios of Thr, TSAA, Val, Ile, Arg, and Trp to dLys. At 35 d of age, 8 birds per pen were selected for processing. Linear (P = 0.028) and quadratic (P = 0.024) increases in BWG were observed for broilers consuming incremental concentrations of dLys from 1 to 35 d of age. Additionally, broilers grew more efficiently (P = 0.012) when consuming higher concentrations of dLys. Incremental increases in dLys concentration resulted in a quadratic (P = 0.002) feed intake response. Broilers consuming diets formulated with a 1.02% weighted dLys concentration consumed the greatest quantity of feed. Increases in carcass weight (linear: P = 0.046), carcass yield (linear: P = 0.001), breast weight (linear: P = 0.038), breast yield (linear: P = 0.018), drumstick weight (linear: P = 0.033, quadratic: P = 0.014), wing weight (linear: P = 0.049, quadratic: P = 0.001), and thigh weight (linear: P = 0.030, quadratic: P = 0.009) were observed as dLys consumption increased. Economic ROFC was maximized ($3.06 vs. $2.66 per bird) for broilers consuming the industry high treatment (1.02% weighted dLys) compared with broilers consuming the basal diet (0.88% weighted dLys) from 1 to 35 d of age. These data indicate the importance of providing adequate dietary amino acid density for optimum feed conversion, production of saleable meat, and profitability.

Key Words: digestible lysine, processing, broiler, amino acid density

M62 Increased amino acid density, reduced metabolizable energy, and inclusion of L-Threonine maximizes performance and profitability of Ross × Ross 708 male broilers Leonel Mejia1, Donna Morgan1, Paul Tillman2, Wei Zhai1 1Department of Poultry Science, Mississippi State University, Mississippi State, MS 2Poultry Technical Nutrition Services, Buford, GA

A study was conducted to evaluate the performance, processing yields, and economic return over feed cost of broilers during a 45-day grow-out. Eight treatments from a 2 × 2 × 2 factorial design varying in amino acid (AA) density, metabolizable energy (ME), and L-Threonine (L-
Thr) inclusion were fed to broilers, which were maintained on a given level of nutrition across three dietary phases. The levels for each factor, during each phase, are shown in the table below.

<table>
<thead>
<tr>
<th>2 x 2 x 2</th>
<th>Starter</th>
<th>Grower</th>
<th>Finisher</th>
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<td>29-45d</td>
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<td>dLys, %</td>
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<td>0.9 or 1.1</td>
<td>0.8 or 1.0</td>
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<tr>
<td>ME (Kcal/ Kg)</td>
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<td>L-Threonine</td>
<td>Yes or No</td>
<td>Yes or No</td>
<td>Yes or No</td>
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</table>

A total of 1,152 Ross × Ross 708 male broilers were randomly placed across 96 floor pens (12 birds/pen). Feed intake and mortality at 45 d of age were unaffected (P>0.05) by feeding any of the dietary treatments. Body weight, body weight gain and feed conversion were improved (P<0.0001) when broilers were fed the higher AA density diets to 45 d of age. The higher AA density diets also optimized (P<0.0001) both weights and yields of carcass, breast meat, leg quarters, and abdominal fat as well as weights of breast tenders and wings at 45 d of age. ME levels and L-Thr inclusion, despite the latter reducing dietary crude protein, had no impact (P>0.05) on live performance or processing parameters. A three-way interaction (P<0.001) was observed for breast meat yield, which could be attributable to the large response in AA density versus the lack of response from ME or L-Thr inclusion. Increasing AA density in diets fed to commercial broilers optimized live performance, and processing parameters. Based on an economic analysis of return over feed cost when the study was conducted, the most profitable diet was based on the higher AA density, the lower ME, and the inclusion of L-Thr.

Key Words: amino acid, lysine, L-Threonine, processing yields, profitability

M64 INCLUSION OF A NATURAL SOURCE OF METHIONINE IN THE STARTER DIET OF BROILER CHICKENS Sergio Gomez-Rosales1, Maria del Carmen Mojica-Enriquez2, Maria de Lourdes Angeles1 1NATIONAL FORESTRY, AGRICULTURE AND LIVESTOCK RESEARCH INSTITUTE, Ajuchitlan, Mexico 2Nutritec International Sàrl, Veracruz, Mexico

The objective of the experiment was to compare the productive parameters, carcass measurements and feather growth in broiler chickens fed a low methionine (Met) diet supplemented with crystalline Met (DL-Met) or a natural source of Met (Herbomethionine: HBMet). In the study, 270 Ross B308 male broilers were allocated in 90 holding pens in groups of three chicks per pen from 8 to 21 d of age. Chicks were assigned to 9 dietary treatments: A low-Met corn-soybean meal diet (0.31% dig. Met) added with 4 levels (0.05, 0.10, 0.15 and 0.20) of either DLMet or HBMet. There were 10 replicates per treatment. At the end of the study, one chick from each pen was killed to remove the feathers from the body. Feathers were weighed and ashed. The same procedure was followed in six chicks killed at the beginning of the trial. The unfeathered body was weighed and processed. Data were subjected to ANOVA using the GLM procedures of SAS. Regression analysis and slope comparison analysis were carried out in the response variables that were affected by the Met sources. The final weight and daily gain were lower (P<0.01) and the feed conversion was higher (P<0.05) for chicks fed the Basal diet compared to the average values of HBMet and DLMet. The final weight, daily weight gain and the feed conversion ratio showed quadratic responses (P<0.01) in regards to the dietary Met levels. The inflexion points for HBMet and DLMet were, on average, 0.46 and 0.44, and the equivalence value of HBMet compared to DLMet was on average, 0.96, for the performance parameters. The feather weight at 21 days, feather gain from 8 to 21 days and the weight of the legs, thighs, breast and carcass showed quadratic responses (P<0.01) related to the dietary Met levels. For HBMet and DLMet the inflexion points were similar, on average, 0.45, for the feather weight and carcass measurements. The equivalence values of HBMet compared to DLMet was 0.94 for the feather weight and carcass measurements. In summary, the results show that the equivalence of HBMet compared to DLMet was on average 0.95, for the production parameters, carcass measurements and feather growth. Regardless of the source, the digestible Met requirement in broiler chickens from 8 to 21 days of age was 0.45%.

Key Words: Broilers, DL-Methionine, Herbomethionine, productive parameters, feather growth

M65 ALTERNATIVE INGREDIENTS TO SYNTHETIC METHIONINE FOR ORGANIC BROILER DIETS Heather Burley*, Paul Patterson, R. Michael Hulet, Paul Patterson Department of Animal Science, Pennsylvania State University, University Park, PA

Two experiments investigated Brazil nut meal (BN) and spray-dried edible egg white (EW) and egg blend (70:30 albumen:yolk) (EB) as alternatives to synthetic methionine (Met) in organic broiler diets. A third experiment measured apparent (AD) and true (TD) ileal amino acid (AA) digestibility of BN, EW, EB, naked oats (OAT), hullless barley, and de-hulled sunflower seed meal (SSSM). In experiment 1, 280 male Cobb x Ross 308 broilers were fed 5 diets (7 cages/diet; 8 birds/cage) from 0-21d: a non-organic commercial control (COM) with synthetic Met and standard crude protein (CP), an organic control (ORG) without synthetic Met and higher CP, and three organic diets without synthetic Met, but with BN, EW, or EB. In experiment 2, 310 male Cobb x Ross 308 broilers were fed 6 diets (7 cages/diet; 8 birds/cage) from 0-21d: a COM and ORG diet, two EW and two EB diets (egg diets had either low or high biotin supplementation). Formulated Met level was 0.51 and 0.45% for all starter and grower diets, respectively. Growth
and feed intake (FI) were monitored from 0-21d and processing yields determined at 21d. In experiment 3, 210 male Ross x Heritage broilers were fed 6 diets (each with one of the above ingredients as the sole protein source) and a protein-free diet to measure endogenous AA loss (6 cages/diet; 5 bd/cage) from 31-35d. Acid insoluble ash (AIA) was included as an indigestible marker in all diets. At 35d, ileal digesta was collected (for AA and AIA analysis) and AD and TD were calculated. Data analysis used a one-way ANOVA and Tukey’s test for mean comparisons; P≤0.05 was deemed statistically significant. In experiment 1, the BN diet did not alter body wt (BW)/gain, FI/efficiency, or most processing parameters versus the COM. Biotin deficiency symptoms were seen for egg diets in experiment 1 (due to biotin-binding egg white protein avidin), but these symptoms were halted in experiment 2 by additional dietary biotin. Egg diets had lower growth, FI/efficiency, and processing wts versus the COM diet (P<0.01), with BW gain averaging 696 versus 597g for the control diets compared to the egg diets. Egg and BN diets had lower $/ton and $/kg bled, breast, and sum of parts wts compared to the ORG. In experiment 3, EW had lower AD and TD versus the ORG and BN diets did not alter body wt (BW) (P=0.0020) and egg diets had increased NH3 flux versus the COM (P=0.0012). The BN and egg diets were lower in $/ton, $/dozen eggs, and $/kg of eggs versus the ORG. The ingredients assessed herein could, therefore, be used to replace synthetic Met in organic hen diets in a cost-effective manner, without impacting egg production, and even improving feed efficiency, but with potential alterations in egg quality, manure nutrients, and NH3 emissions.

Key Words: organic, methionine, Brazil nut, inedible egg, laying hen

M66 Brazil nut meal and inedible egg as alternatives to synthetic methionine in organic laying hen diets
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Brazil nut meal (BN) and spray-dried inedible egg white (EW) and egg blend (70:30 albumen:yolk) (EB) were investigated as alternatives to synthetic methionine (Met) in organic hen diets. Hy-Line Brown hens (270 total) were fed 5 diets from 22-38 wks, with 6 replicates of 3 adjacent cages/diet and 3 hens/cage. Diets included a non-organic commercial control (COM) with synthetic Met and standard crude protein (CP), an organic control (ORG) without synthetic Met and higher CP, and three organic diets without synthetic Met, but including BN, EW, or EB; Met was formulated as 0.45% for all diets. Egg production was recorded daily and egg wt determined every 2 wks. Body weight, egg quality, and feed intake data were collected every 4 wks. Ammonia (NH3) flux and manure nutrients were measured at 30 and 34 wks. Overall data was analyzed with a repeated measures design and Tukey’s test for multiple mean comparisons; P≤0.05 was deemed statistically significant. Body weight averaged 1.82kg across all diets and was significantly greatest for the COM diet (P=0.0001). Feed intake was lower, but feed efficiency improved for egg diets compared to the COM diet (P=0.0001). Egg production averaged 94.70% across all diets and did not differ between the BN, egg, and COM diets. Mean egg wt was 61.3g across all diets and was greatest for the ORG diet compared to all other diets (P=0.0001). Egg albumen ht, Haugh units, and percent albumen were greater for the EW diet compared to the COM, ORG, and/or BN diets (P=0.0001 for albumen ht and Haugh units and P=0.0043 for percent albumen). The BN diet had greater egg percent shell compared to ORG and egg diets and greater egg specific gravity compared to all other diets (P<0.0001). Egg percent yolk was greater for the EB versus EW diet (P=0.0140) and yolk color was darkest and lightest for COM and ORG diets, respectively (P=0.0001). Manure DM and potash were greatest for the COM and BN diets, respectively, compared to all other diets (P<0.0001). The EB diet had greater manure ammonium N versus controls (P=0.0020) and egg diets had increased NH3 flux versus the COM (P=0.0012). The BN and egg diets were lower in $/ton, $/dozen eggs, and $/kg of eggs versus the ORG. The ingredients assessed herein

Key Words: methionine, Brazil nut, inedible egg, broiler

M67 Effects of feeding an encapsulated source of butyric acid (ButiPEARL) on the performance of male Cobb 500 broilers
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An experiment was conducted with male Cobb 500 broilers to determine the effect of feeding an encapsulated source of butyric acid (ButiPEARL3®) in broiler diets from 0 to 42 d of age. Diets were corn-soybean meal based with 8% corn dried distillers grains with solubles. Treatments were replicated with 12 floor pens with 45 broilers per pen. The treatments were as follows: 1) Positive control (PC) diet formulated to provide adequate nutrition to meet the broiler requirements across all three feeding phases; 2) PC + 100 g/t ButiPEARL (100 g/t); 3) PC + 200 g/t ButiPEARL (200 g/t); and 4) PC + 300 g/t ButiPEARL (300 g/t). All ButiPEARL inclinations were added “on top as a feed additive” for mixing prior to pelleting. Body weight gain and feed consumption were not significantly different (P>0.05) across treatments at 21 d of age, but all three levels of ButiPEARL addition (100, 200, or 300 g/t) elicited an improved feed conversion response compared with the PC (P<0.05). At 35 d of age, BW gain was increased (P<0.05) for broilers fed 300 g/t compared with broilers fed the PC. Body weight gain for broilers fed 100 or 200 g/t were not significantly different (P>0.05) from broilers fed the PC or 300 g/t. At 35 d of age, broilers fed 200 or 300 g/t had improved feed conversion response (P<0.05) compared with broilers fed the PC or 100 g/t; furthermore, broilers fed 100 g/t had improved feed conversion compared with broilers fed the PC. At 42 d of age, BW gain was significantly increased (P<0.05) for broilers fed 300 g/t compared with broilers fed either PC or 100 g/t. Body weight gain for broilers fed 200 g/t were not significantly different (P>0.05) from broilers fed the PC, 100 g/t, or 300 g/t. At 42 d of age, feed conversion results were the same as those noted for 35 d data across all treatments. Based on the results of this experiment, butyric acid added to poultry diets in the form of ButiPEARL had a positive effect on performance. The recommended inclusion level for ButiPEARL in broilers reared to 42 d of age is 300 g/t based on BW gain and feed conversion.

Key Words: butyric acid, broiler, BW gain, feed conversion

M68 A balanced mixture of medium chain fatty acids improves zootechnical performances and slaughter results of broilers
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For years the focus of broiler breeding companies has been the improvement of growth rate and feed conversion, putting tremendous stress on the health of the animals. To be able to reach the increased potential of genetic selection birds can benefit to a large extent from functional feed ingredients. The objective of the described studies was to determine the effect on production performances of Aromabiotic Poultry, a carefully balanced mixture of MCFAs in broilers. Trial A and B were designed as a complete block design with male Ross 308 broilers. In both cases a 3-phase feeding scheme was applied with periods of 13 days each. Trial A consisted of two dietary treatments (control and Aromabiotic) with each 9 replicates of 32 birds or 576 birds in total. Diets were wheat/corn/soy based. The test product was added at a dosage of 1.7 g/kg, 1.25

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g/kg and 0.8 g/kg to the starter, grower and finisher diet, respectively. Trial B, consisting of three dietary treatments (with each 7 replicates of 30 birds or 630 birds in total) was also wheat/corn/soy based. Aromabiotic was added during the whole experimental period at 0.8 g/kg or 1.2 g/kg, respectively. For each trial, average pen weight was recorded at day old, 13, 26 and 39 days of age. Feed intake was recorded for 1-13, 14-26, and 27-39 days. Feed conversion, daily growth rate, bird-days and daily feed intake per bird were calculated. At the end of trial B from each pen 2 broilers with average pen weight were selected to determine slaughter results. In trial A growth performances were influenced in a positive way. Average daily gain was significantly (P<0.05) better in the starter, grower and overall period (67.6 vs. 64.6 g/d). After correction for weight differences the feed conversion ratio was two points better compared to the control group (1.62 vs. 1.64). In trial B average daily gain and feed conversion were significantly (P<0.05) improved with the best results using the lower dosage (ADG: 64.9 vs 62.6 g/d; WAFCR: 1.53 vs 1.58). Breast meat yield was only improved using the higher dosage (23.1 vs 22.6 %). In conclusion, Aromabiotic Poultry proves to be a valuable functional feed ingredient to sustain the rising production potential of broilers.

Key Words: Aromabiotic Poultry, medium chain fatty acid, breast meat, feed conversion ratio

Environment Management II

**M69 WITHDRAWN**

**M70 Strain differences among Salmonella serotypes** Paula Fedorka-Cray1, Jovita Haro1, Tiffanie Woodley1, Jodie Plumblee1, Nelson Cox2, Charlene Jackson1 1 USDA-ARS-Bacterial Epidemiology and Antimicrobial Resistance Research Unit, Athens, GA 2 USDA-ARS-Poultry Microbiology Safety Research Unit, Athens, GA

It is well documented that there are over 2500 different serotypes of *Salmonella*. Less well documented is the strain variation that can exist within each serotype as well as knowing whether each variant is capable of causing food borne illness. Pulsed field gel electrophoresis (PFGE) is used to determine genetic relatedness between isolates. PFGE of *Salmonella* isolated from humans and food animals at slaughter and processing is also used by the CDC PulseNet and USDA VetNet programs, respectively to assist in food borne outbreaks. The purpose of this study was to determine the most frequently observed PFGE patterns for poultry in VetNet. *Salmonella* Kentucky, Heidelberg and Enteritidis are historically the top serotypes recovered from poultry. Of the 8290 pulsetypes examined from poultry, 10 patterns represented 46.2% of the isolates and were distributed among only 4 serotypes, Kentucky, Heidelberg, Enteritidis, and 14,[5],12:i:-. The top three patterns, JGXX01.0003ARS (Kentucky), JEGXX01.0003ARS (Enteritidis) and JF6X01.0015ARS (Heidelberg) accounted for 14.4%, 8.1%, and 4.8% (27.3% total) of pulsetypes, respectively and all have a matching PFGE pattern indicating that these pulsetypes have been associated with human illness. Of the top 10 PFGE patterns, four were represented by Kentucky, three by Enteritidis, two by Heidelberg, and one by 14,[5],12:i:-. These data illustrate the heterogeneity observed among isolates within the same serotype and suggest that when intervention and control measures are developed, strain variation may need to be considered. VetNet data are also important in outbreak investigations and are routinely used in support of the PulseNet program.

Key Words: Salmonella, Pulsed field gel electrophoresis, USDA VetNet

**M71 Effects of feeding ducklings with aflatoxin contaminated diets and the efficacy of an adsorption-based feed additive** Karin Naehrer1, Ursula Hofstetter1, Carlos Mallmann2 1 BIOMIN Holding GmbH, Herzogenburg, Austria 2 Universidad Federal de Santa Maria, Santa Maria, Brazil

Aflatoxins can have severe economic consequences for poultry producers and especially ducks are very sensitive to these mycotoxins. An experiment with the aim to evaluate the effects of aflatoxins on ducklings and the efficacy of an adsorption-based feed additive (Mycofix® Secure) in diminishing the toxic effects of aflatoxins (Afla), was performed at the SAMITEC Institute, Santa Maria, Brazil. 168 one-day old male ducks were divided into 4 treatment groups with 6 replicates and 7 birds each replicate for 21 days. Dietary treatments were as follows: Group 1 - Control group (no aflatoxins, no feed additive), Group 2 - 250 ppb Afla, no feed additive, Group 3 - no aflatoxins, 0.5% feed additive and Group 4 - 250 ppb Afla, 0.5% feed additive. Ducklings were fed and given water *ad libitum*. Average weight of the birds and feed intake per replicate was measured on a weekly basis. At the end of the experiment, performance parameters, relative liver weight, serum total protein (Biuret method) and colorimetric analysis of the liver of 12 randomly selected birds was evaluated. The parameters evaluated were submitted to variance analyses (ANOVA). Differences between means were compared by Bonferroni test (P<0.05). Analyses were done by Statgraphics Centurion XV, version 15.1.

Addition of 250 ppb aflatoxins influenced statistically significant the average body weight, feed intake and feed conversion of ducklings. In animals challenged with aflatoxins significant effects on the total plas- matic protein were observed as levels were decreased in comparison with the control groups. Parameters evaluated in this study showed significant efficacy of an adsorption-based feed additive to diminish aflatoxins’ negative effects on ducklings.

Key Words: Mycotoxins, Aflatoxins, Ducks

**M72 37+ Mycotoxin Analysis on 2012-2013 North American and European Poultry Feeds and Feedstuffs** H.V.L.N. Swamy1, L. Breeding2, L. Jackson2, A. Yiannikouris2 1 Alltech India, Bangalore, India 2 Alltech USA, Nicholasville, KY

Numerous studies have shown that mycotoxins negatively affect the bottom line of poultry operations in North America and Europe. However, many in the poultry industry of these regions feel that poultry can manage the toxicity of one of the most common *Fusarium* mycotoxins, DON (vomitoxin). The studies with natural-contaminated grains clearly indicated that many other mycotoxins produced from *Fusarium, Penicillium, Aspergillus* and *Claviceps* can contribute to DON-toxicity. To analyze such multiple mycotoxins, Alltech recently established 37+ Program which includes the analysis of 38 mycotoxins using UPLC-MS/MS instrument. For the ease of understanding of the total toxicity to animals, the toxins of similar structure and effects were further clubbed into groups. Only 10 samples out of 162 tested were negative for all the mycotoxins tested giving 94% as level of contamination. Type B trichothecene mycotoxins (DON-Group) were quantified in 75% of the samples followed by fumonisins (59%), zearalenone (38%) and Type A trichothecenes (T-2-Group; 31%). Other mycotoxins were present between 3 and 23% of samples tested. On an average, fumonisins were present at the highest concentrations (12834ppb) followed by Type B mycotoxins (1712ppb) and ergot toxins (716ppb). A
Food safety is an ever growing public health concern, and in poultry production Salmonella Enteritidis is arguably the most serious food safety risk. In these experiments we tested the ability of a commercial Bacillus-based DFM, Sporulin®, and another candidate DFM to prevent horizontal transmission of Salmonella in broiler chicks under experimental conditions. In 2 experiments, 300 chicks were obtained from a local hatchery and randomly assigned to one of three experimental groups, control, Sporulin, or candidate DFM, (n=100) and placed in separate pens. Each group was fed a ration containing the appropriate DFM for the duration of the experiment. On day 4, 30 chicks per group were tagged and challenged by oral gavage with 10⁷cfu/chick Salmonella Enteritidis and placed back in the pen to serve as seeders. On day 11 in experiment 1 and day 8 in experiment 2, 15 seeders and 35 contact chicks were killed and liver, spleen and ceca were cultured for Salmonella positive liver/spleen and cecal tonsils. Challenged Sporulin treatment significantly (p<0.05) reduced recoverable Salmonella to 1.53 cfu/g log10 from the ceca of contact chicks when compared to both the control (3.47 cfu/g log10) and candidate DFM (2.65 cfu/g log10) treated birds. Treatment with either Sporulin or the candidate DFM significantly (p<0.05) reduced the number of positive liver/spleen and cecal tonsils when compared to controls. Similar results were seen in experiment 2. Sporulin treatment significantly (p<0.05) reduced Salmonella recovery from the ceca (0.91 cfu/g log10) of contact chicks when compared to both the control (2.13 cfu/g log10) and candidate DFM (1.62 cfu/g log10) treated birds. However, only Sporulin treatment in experiment 2 was able to significantly reduce Salmonella positive liver/spleen and cecal tonsils. These data suggest Sporulin® and perhaps other Bacillus-based DFMs are able to ameliorate horizontal transmission of Salmonella in broilers.

Key Words: Bacillus, Salmonella, broilers, DFM

M74 Effect of Essential Oil Compound on Salmonella Shedding and Colonization in Broiler Chickens

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Abstract: Foodborne illness, particularly salmonellosis, is a serious threat to public health. Essential oils may be an alternative to organic acids in broilers as preslaughter contamination control. The objectives of this study were to determine the effect of essential oil compared to non-pharmaceutical compounds on performance, mortality and prevalence of Salmonella in broilers. In broilers challenged with SH.

Significance: Essential oils may control SH contamination in crops of broilers when administered in drinking water. Furthermore, essential oils may be an alternative to organic acids in broilers as pre-slaughter intervention as SH reduction treatment.

Key Words: Salmonella, Essential oil, Broiler, Feed withdrawal

M75 Comparison of ring-necked pheasant brooding techniques on subsequent nesting and brooding success

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Wild restoration attempts with captive released ring-necked (RN) pheasants often result in poor nesting and brooding success, often reaching 100% failure. An attempt to improve nest/brood success from released RN hens by using chicken and RN pheasant broody parents as surrogate mothers was compared against captive reared and wild caught RN pheasant hens. Twenty five RN pullet hens and five RN roosters were selected from each of four groups (captive reared, chicken brooded, RN pheasant brooded, wild caught), radio-tagged, and placed in flight pens with heavy corn, sorgum, and legume cover. Roosters were removed after nesting occurred. Nesting and brooding success was monitored via the radio monitors for the 23-day incubation period and six weeks of brood.

There was no significant difference between the nesting and brooding success for the chicken brooded RN hens (85%/92%), RN pheasant brooded RN hens (84%, 93%) and wild caught RN hens (86%/94%). Captive reared hens (12%, 24%) were significantly lower for both nesting and brooding rates. Brooded reared hen pullets may provide an improved rate of nesting and brooding success upon release into the wild and provide the basis for restoration efforts.

Key Words: pheasant, brooding, nesting, restoration
M76 Evaluation of Captive Bolt Method of Turkey Euthanasia Device (TED) for Humane Euthanasia of Poultry R. Michael Hulet1, Terri L. Cravener1, Randall G. Bock2 1Department of Poultry Science, Penn State University, University Park, PA 2A Bock Industries, Philadephia, PA

Standards of humane euthanasia are changing as new and novel methods are introduced and used. Many culling situations have not been adequately addressed by current technology. The ability to euthanize a 20 kg tom turkey by current methods of carbon dioxide, cervical dislocation or blunt force trauma is inadequate when evaluated for humaneness, human safety, effectiveness, or repeatability. Many caretakers are physically unable to perform the task. A new method using a non-penetrating captive bolt device has been recently developed to meet this need. Evaluation of this device included effectiveness, speed of use, ease of use, human safety, economics, and repeatability for large fowl and turkeys. The TED was found to successfully euthanize 20 kg turkeys or 3.5 kg chickens with lack of nictitating membrane response by 2 seconds and 100% dead within 2 minutes (no respiration or heart beat). In summary, the device is light and ergonomic, low operational cost, and allows operators to successfully euthanize poultry in many different circumstances. The disadvantage is initial cost which is comparable to other similar devices.

Key Words: Euthanasia, Turkeys, Captive Bolt

M77 EVALUATION OF SELECTION PROGRESS IN TWO LOCAL EGYPTIAN CHICKEN LINES Mostafa Helal*, Essam El-Gendy Department of Animal Production, Cairo University, Cairo, Egypt

A study was conducted to evaluate selection progress in two local chicken lines selected for high six-week body weight in Egypt. The lines have been developed by selection for high 6-wk BW for 8 selected generations as normally feathered local broilers (Line CE1), and naked-neck local broilers (Line CE3). Both lines have been raised with their corresponding control lines CE2 and CE4. The data of generations 6, 7 and 8 were used for this study. In the 6th generations, the line CE1 was significantly heavier than its control line CE2 by 4.78% at hatch and line CE3 also showed a significant difference from line CE4 by 12.43%. The significant increases in body weights among the growing period of the selected lines were consistent and tended to be gradual and reached, by 20 weeks of age, to 54.70% and 70.84% for lines CE1 and CE3, respectively. Similar to the results obtained in the 6th generation, body weights of both selected lines responded to the selection throughout the growing period in the subsequent generations. The results of body weights over the subsequent generations indicate that line CE1 was significantly heavier than line CE2 throughout the growing period, which indicates that the naked-neck chickens grew at a slower rate compared to the normally feathered birds. The sex differences were significant and in fair magnitude, indicating that the differences were attributed to normal sex variation. Heritability estimates for growth measurements were apparently higher at early ages and decreased with age. Heritability estimates for 6-week body weight of line CE1 were 0.18 and 0.17 in both 7th and 8th selected generations respectively, versus slightly higher estimates of 0.21 and 0.19 in line CE3.

Key Words: growth, local chickens, heritability, selection

M78 Effects of nutrient variability in corn associated with geographical location and xylanase inclusion on broiler performance Helen Masey O’Neill1, Tryon A. Wickersham2, Ashley Campanino2, Jason T. Lee2 1AB Vista Feed Ingredients, Marlborough, UK 2Department of Poultry Science, Texas AgriLife Research, Texas A&M University, College Station, TX

The performance of broilers fed corn based diets has been shown to improve with the use of exogenous xylanase, the response being larger in poor compared with high quality corn samples. The objective of this study was to determine the effect of the source of corn and xylanase addition on broiler performance (body weight and FCR) and the interaction between these two factors. Six samples of corn were obtained from 6 different regions of the USA (IA, MN, ND, NE, SD, TX) to represent the variability in corn available to feed manufacturers. Starter (d1-17), grower (d18-34) and finisher (d35-41) diets were formulated to reflect current USA commercial practice and contained corn at a fixed rate (61.6, 65.0, 71.0% respectively). In the starter, grower and finisher phases, respectively, diets contained 3000, 3024, 3074 kCal/kg; 1.13, 1.04, 0.95 % available lysine; 0.95, 0.87, 0.80 % Ca and 0.45, 0.41, 0.38 available P. The twelve treatments were derived using corn source as the variable, with each corn diet being fed either with or without xylanase at 16,000 BXU/kg. The diets were fed to 2160 broilers with 10 replicates, each containing 18 birds per treatment from 0-41d of age. Corn samples were analysed for starch, protein, oil, fibre, protein solubility index (PSI), moisture and vitreousness using near infrared spectroscopy (NIR, AuNIR, Towcester, UK). These values were used to predict the AME (MJ/kg) of the corn samples. Samples of all treatments were collected and analyzed to confirm nutrient content and xylanase recovery. All broilers were weighed individually on days 1,17, 34 and 41 and feed intake recorded for each phase.

The corn samples varied in composition as follows: starch 76.1-78.5%, crude protein 7.8-9.0%; oil 3.6-3.7%; crude fiber 2.4-2.6%; PSI 36.0-45.5% and vitreousness 55.3-59.0%. In terms of performance, there were no interactions between corn source and enzyme inclusion (P>0.05). There was a main effect of corn source on BW between d1-14 and d1-34 (P= 0.007 and 0.048) with d34 weight varying between 2.012kg (MN) and 2.093kg (IA). There was a significant difference between the corn from different regions with regards to FCR (p<0.05 at all phases). For example, d41 FCR was greatest for corn from MN (1.711) and lowest with corn from TX (1.647). The effect of inclusion of enzyme was also significant (p=0.017) but only over the period d1-41; those fed xylanase had a mean FCR of 1.668 compared to those who were not, at 1.681. Day 41 FCR and predicted AME were significantly correlated (P=0.018, r2=–0.79).

These results suggest that corn source can affect broiler performance but that xylanase is efficacious in improving performance regardless of the source of the corn.

Key Words: Broiler, corn, feed conversion, xylanase

Metabolism & Nutrition III

M79 Performance and bone mineralization in broilers fed diets differing in fat source and phytase content Imke Kühn1, Kristof Kozlowski2 1AB Vista, Darmstadt, Germany 2University of Warmia and Mazury, Olsztyn, Poland

The efficacy of a thermostolerant 6-phytase (Quantum Blue) was evaluated in 432 male Ross 308 broilers when added to diets reduced in min-
eral and differing in fat supplement. Corn and soybean meal based starter (40-14, 0.8% Ca and 0.3% available P; 4.1% added oil) and grower diets (d15-35; 0.7% Ca and 0.27% available P; 5.1% added oil) were used in 6 dietary treatments (8 replicates, 9 broilers each). Phytase was added at 0, 500 or 1500 FTU/kg to diets containing either soy oil (DS) or palm oil (DP). Performance was measured at d14 and d35 and tibia for bone analyses taken from 10 birds per treatment at d35. The experiment was set up as a randomized complete block design and data were subjected to ANOVA.

Over the entire period with no phytase added, the weight gain of birds fed DS diets was superior to those receiving the DP diets (54.2 vs. 58g/d; P<0.05). Phytase when added at 1500 FTU/kg feed improved performance of birds fed DS diets (62.1 vs. 54.2g/d; P>0.05) but not when added to DP diets. Feed intake was higher in birds fed DS diets compared to birds fed DP diets (91.5 vs. 85.7; P<0.05). No effect of fat or phytase on feed conversion ratio was noted (1.51 to 1.57; P>0.05).

The calculated European broiler index (EPI) was improved by phytase for both application rates when added to DP diets (363 and 369 vs. 328, P<0.05) and for 1500 FTU/kg when added to DS diets (408 vs. 368, P<0.05). Bone ash was higher in birds fed DS diets compared to those fed DS diets (5.3 vs. 3.2 g/tibia, P<0.05). Phytase at both inclusion rates improved bone mineralization seen in DP birds was not further improved by phytase.

It can be concluded that broilers fed diets including the less digestible palm oil had a lower performance but higher bone weight and mineralization than broilers fed soy oil diets. Phytase improved performance parameter in both feed types, with the effect of high phytase dosing being more pronounced than broilers fed soy oil diets. Phytase improved performance parameter in both feed types, with the effect of high phytase dosing mainly seen in diets containing soy oil.

**Key Words:** broiler, phytase, performance, bone ash, fat source

**M80** In vitro degradation of soybean anti-nutritional factors by a mono component protease Preben Nielsen*, Katrine Pontoppidan†, Murtala Umar Faruk‡, Jiri Broz‡, Inge Knap* "Novozymes A/S, Bagsvaerd, Denmark" **DSM Nutritional Products, Village-Neuf, France**

Variability within soybean meals with regards to the content of anti-nutritional factors present in the final toasted meal is known but seldom accounted for in diet formulation. Anti-nutritional factors such as lectin and Kunitz trypsin inhibitor are heat labile peptides of 31 and 22 kd present in soybean (Glycine max) and other legumes. The objective of this study was to evaluate if a protease (RONOZYME® ProAct, DSM Nutritional Products, Basel, Switzerland) is able to degrade anti-nutritional peptides under conditions relevant for the gastrointestinal tract of mono-gastric production animals.

Protease (RONOZYME® ProAct, trypsin or chymotrypsin) dosed at 0.1 mg enzyme protein/ml was mixed with anti-nutritional factor (lecitin (Sigmaart. L1395) or Kunitz trypsin inhibitor (Sigmaart. T2327)) at 1 mg protein/ml and incubated at pH 7, 40 °C for 3 hours. The protease was inactivated and precipitated by addition of trichloric acid. Samples were analysed on SDS PAGE, Coomassie stained and bands were quantified using Image Lab 4.0 (Bio Rad). The results showed that RONOZYME® ProAct degraded approximately 85% of both lecitin and Kunitz trypsin inhibitor. No degradation of the anti-nutritional factors was detectable by trypsin and chymotrypsin.

In conclusion, RONOZYME® ProAct has the potential to reduce the pressure on the pancreatic proteases (trypsin and chymotrypsin) by counteracting the negative effect of soybean anti nutritional factors, and thereby reducing the sensitivity of animal performance to low quality soybean meal.

**Key Words:** Enzymes, Protease, Digestibility, Soybean, anti-nutritional factors


A commercial dried “tannic acid extract” (flavoring: Farmatan® powder, Tanin Sevnia; ~75% tannins) product from specific hardwood trees in Europe was used to determine live performance dose-responses of male Cobb broiler chicks 0-42 d on built-up litter top dressed with wood shavings in a June-July trial. Litter characteristics were evaluated at 21 and 42 d. Dietary Farmatan® tannin concentrations used were: 0 (negative control), 250, 500, 750, or 1,000 ppm. Positive control (antibiotic) diets had BMD® 55 ppm (0-35 d) and Stafac® 22 ppm (35-42 d). Corn-soy-meat meal based diets were used. Feeds were steam pelleted and fed as crumbles or pellets. There were 45 chicks/pen initially and 8 replicate pens/treatment (6 blocks; Randomized Complete Block Design; LSD p≤0.05). The BW gains were not significantly different from 0-21 d or 0-35 d, but from 0-42 days (p=0.002) were, respectively (kg): 2.238, 2.238, 2.299, 2.282, 2.290, 2.316. Mortality-adjusted feed conversion ratios (MAFCR) from 0-21 d (p=0.002) were, respectively: 1.513, 1.488, 1.476, 1.469, 1.454, and 1.442. The MAFCR from 0-35 d (p=0.001) were, respectively: 1.666, 1.657, 1.646, 1.626, 1.621, and 1.641. The MAFCR from 0-42 d (p=0.004) were, respectively: 1.694, 1.698, 1.685, 1.665, 1.661, and 1.655. Stafac® 22 ppm in finisher (35-42 d) gave the best BW gain and feed conversion ratio. Litter moisture % at 21 d was lower (p=0.032) using Farmatan® 500, 750, or 1,000 ppm than BMD® 55 ppm and at 42 d was lower (p=0.046) for each Farmatan® level than for negative control. Farmatan® 750 or 1,000 ppm improved (p=0.008) 42-d litter score (0 dreist to 5 wettest) compared to negative control. Mortality % from 0-42 d and litter nitrogen % at 42 d were unaffected by treatment. By interpolation, Farmatan® ~561 ppm (509 g/U.S. ton) was equivalent to BMD® 55 ppm for improving 0-35 d MAFCR. Farmatan® 500 ppm or more, or BMD®/Stafac®, increased 42-d BW, and Farmatan® 750 or 1,000 ppm, or BMD®/Stafac®, decreased 0-42 d MAFCR compared to negative control. Dietary Farmatan® at 500 ppm or higher improved 42-d BW gain, MAFCR, and/or promoted drier litter, compared to negative control.

**Key Words:** broiler, chestnut tannins, dose-response, Farmatan, litter

**M82** Bacillus subtilis (QST 713) spore-based probiotic for performance enhancement in broiler chickens Glenmer Tacutacan, Desmond Jimenez "AgraQuest Inc., Davis, CA"

Concerns over antibiotic residues and antibiotic resistance in food animals have led to banning or restriction in antibiotics usage in animal agriculture. Traditionally, low-level antibiotics known as antibiotic growth promoters (AGPs) are dietary supplemented in broiler chickens to enhance their production performance. Therefore, feed supplements that provide similar improvements in production parameters as seen in AGPs may provide a viable alternative. To this end, a study was conducted to compare the efficacy of a B. subtilis (QST 713) spore-based probiotic to a conventionally used AGP in enhancing the performance of broiler chickens. A total of 1080 day-old male broiler chicks kept in a floor pen type poultry house were randomly assigned to receive 1 of 3 dietary treatments: 1) basal diet, 2) basal diet + B, subtilis spores (1 x 10⁶ CFU/g of feed), or 3) basal diet + Bacitracin methylene disalicylate
(BMD) (50 g/ton) for 42 d. An RCBD was used with 3 dietary treatments in each of 8 replicated blocks of pens with each pen consisting of 45 birds. Data were subjected to ANOVA using the PROC Mixed procedure of SAS. The feed consumption and percentage mortality of broiler chickens was not affected (P>0.05) by the supplementation of Bacillus subtilis and BMD throughout the production period (1-42 d). The body weight gain at 21 d was similar among treatment groups; however, it increased significantly at 42 d in B. subtilis and BMD treated groups. Compared to the control, birds fed with B. subtilis and BMD had improved (P<0.05) FCR at 21 and 42 d. No differences were observed in FCR of birds fed with B. subtilis and BMD. Overall, this study indicated that in-feed supplementation of B. subtilis spores can enhance production performance of broiler chickens comparable to a conventional AGP. Therefore, dietary B. subtilis (QST 713) spores may serve as a viable alternative to AGPs in commercial broiler production.

Key Words: Bacillus subtilis, Bacitracin methylene disalicylate (BMD), antibiotic growth promoters (AGPs), spores, broilers

M83 Bacillus Subtilis PB6 based-probiotic (CloSTATM) improves intestinal morphology and microbiological status of broiler chickens under Clostridium Perfringens challenge Alaaeldin Abudabos1, Abdullah Alyemni2 1Department of Animal Production, College of Food and Agricultural Sciences, King Saud University, Riyadh, Saudi Arabia 2ARASCO for Feed, Riyadh, Saudi Arabia

The aim of the present study was to investigate the influence of a commercial Bacillus subtilis PB6 based-probiotic, CloSTATM, as an alternative to in-feed antibiotic, Enramycin, on growth parameters, intestinal morphology and ileal bacterial count of broilers during pre- and post-challenge with Clostridium Perfringens (C. Perfringens) challenge. 100, 1-d-old male Ross 308 broilers were allocated in four experimental treatments for 30 days. The experimental treatments received a corn-soybean basal diet and were as follows: positive control (+CONT); with no additions; negative control (-CONT); antibiotic with addition of Enramycin (ENRA); and CloSTAT (CS). Chicks in treatment 2 to 4 were challenged with C. Perfringens on d 18. Five birds per treatment were sampled at 16 and 30 d of age for morphometric measurements of the small intestine and ileal bacterial count. Overall, feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR) was not significantly different among the four treatments (P > 0.05). On the other hand, CS supplementation caused some changes in the intestinal mucosa morphometrics, birds which had received CS had longer jejunal and ileal villi as compared to other treatments (P < 0.05). There was a significant (P < 0.05) reduction in ileal C. perfringens count due to CS supplementation. The results from this study indicated that CS under the condition of this trail had a positive influence on broilers performance.

Key Words: Broiler, CloSTAT, intestinal mucosa morphometrics, performance

M84 Effect of Probiotics on Growth Performance, Oocysts Shedding and Gut Morphology of Broiler Chickens after Experimental Infection with Eimeria acervulina, Eimeria maxima and Eimeria tenella Oocysts Wael Abdelrahman1, Ilias Giannenas2, Dimitrios Tonits2, Elias Papadopoulos2, Sabine Hessenberger3, Klaus Teichmann1, Michaela Molan1, Gerd Schatzmayer4 1BIOMIN Holding GmbH, Herzogenburg, Austria 2Faculty of Veterinary Medicine, University of Thessaly, Karditsa, Greece 3Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, Thessaloniki, Greece 4BIOMIN Research Center, Tulln, Austria

Avian coccidiosis is considered one of the major diseases that have a negative economic impact on the poultry industry worldwide. There is an increasing body of literature indicating the relationship between using antimicrobials, including anticooccidial drugs, and the emergence of pathogens resistance to it. In addition, the increasing awareness and demand of consumers for chemical-free animal products enhances the necessity to identify and investigate alternative coccidia control strategies, such as probiotics which would also have the advantage to be closer to environmentally friendly farming practices.

The objective of this trial was to investigate the potential effect of feed probiotics (PoultryStar® - BIOMIN Holding GmbH) on broilers’ performance and gut health experimentally challenged with sporulated oocysts of Eimeria acervulina, Eimeria maxima and Eimeria tenella.

A total of 150 Day-old Ross 308 male broiler chicks were divided into five equal groups each with three replicates. The trial groups included; (1) unchallenged - untreated, (2) challenged with mixed Eimeria oocysts - untreated, (3 and 4) challenged with mixed Eimeria species and were given feed probiotic, and (5) challenged with mixed Eimeria species and treated with the anticooccidial lasalocid at 75 mg/kg. Each experimental group was given the corresponding diet throughout the trial period (42 days). Body weight, feed intake, feed conversion ratio, lesion score, bloody diarrhoea and oocysts count were recorded and calculated. At the end of the experiment, duodenum, jejunum and ileum samples were subjected to morphological evaluation.

The results of the study showed that probiotics supplementation exerted a coccidiostatic effect against Eimeria species, reflected on birds’ performance that was similar to lasalocid (P>0.05). Probiotic groups showed less oocyst numbers, lesion score values and bloody faeces than the control infected group but higher than the lasalocid group (P<0.05). Probiotic groups gave the highest values of villous height and villous area, showed less oocyst numbers, lesion score values and bloody faeces than the control infected group but higher than the lasalocid group (P<0.05).

In conclusion, probiotics gave substantial improvement in both growth performance and intestinal health in birds challenged with Eimeria species, in comparison to control infected birds and similar improvement to that exhibited by lasalocid.

Key Words: Probiotics, intestinal health, performance, broilers, coccidia

SCAD

T85 Outbreaks of tenosynovitis in broilers caused by a novel avian reovirus Holly Sellers’ Department of Population Health, University of Georgia, Athens, GA

Avian reoviruses are ubiquitous in poultry and usually not a major concern for poultry producers. While reoviruses can be isolated from healthy birds, they have been associated with several diseases including malabsorption syndrome, running and stunting syndrome although their role in these diseases is not always clear. In contrast, the association of some reoviruses with clinical cases of viral arthritis (VA)/tenosynovitis is quite clear especially when virus isolation is made from the tendons of affected birds. Vaccination of breeders with live and inactivated vacci-
(<50% amino acid identity) and the closest match to reoviruses in the public and PDRC databases was approximately 80%. In addition, the field isolates were not serologically related to S1133 and 2408 vaccine strains as evidenced by low VN titers (<2-4).

Pathogenicity and progeny protection studies were performed in commercial broilers using representative strains from one of the novel genotypes. Tenosynovitis was reproduced in both studies along with lower body weights and hydropericardium in reovirus field isolate challenged groups. Novel reoviruses have been isolated in recent cases of tenosynovitis from multiple broiler companies in several states. The preparation of autogenous vaccines is under consideration by several of the companies with affected flocks.

Key Words: Tenosynovitis, Novel Avian Reovirus, Lameness

T86 Adjuvant formulations designed to improve poultry vaccine stability Robert Parker1, Juliette Ben Arous, Sebastien Deville, Jerome Gaucherion, Laurent Dupuis SEPPIC Inc., Fairfield, NJ

Vaccine adjuvants are a key parameter in modern vaccine formulation. Most adjuvants are composed of synthetic components with immunomodulator properties combined to create a galenic antigen presentation. However, multivalent vaccine antigens often have properties which destabilize vaccine formulations. We have been working on innovative adjuvants that allow the formulation of vaccines able to resist to very destabilizing antigenic media and conditions while keeping safety parameters and efficacy at requested levels.

First, bacterial vaccines were prepared by using Montanide™ standard and resistant adjuvants for poultry vaccines and were compared for emulsion stability over time. The safety of formulations based on resisting adjuvant Montanide™ ISA 71R VG was then tested by intramuscular injection of a double dose (1ml) of formulated trivalent viral vaccine in chickens. Finally, safety and efficacy properties of a Riemerella vaccine were tested in geese in a 17 weeks trial. 20 animals per group received a subcutaneous injection of 0.3ml of vaccine. Behavior of the animals, body weight gain, local reactions at the injection site (during trial and at slaughter) were assessed during the trial. Specific antibody titers were measured by ELISA titration at D0 and at 6, 10, 14 and 17 weeks.

We could show that slight adjuvant composition modifications can allow the formulation of stable vaccines able to pass severe stress tests. In chickens and geese trials, both resisting and standard formulations showed comparable acceptable safety levels. Results in the goose model showed that there were no efficacy differences between standard and resisting adjuvants, and that one injection of vaccine conferred stable antibody titers over 17 weeks.

We have shown that new Montanide™ adjuvants developed to resist to destabilizing antigenic media maintain high antibody levels and an acceptable safety profile in poultry, even combined with reactogenic Gram negative bacterial antigens. This new line of adjuvant will help to increase long term stability of poultry vaccines which are based on destabilizing antigens or stored in stressing conditions.

Key Words: Vaccine, Adjuvant, Goose, Vaccine stability

T87 Genotypic analysis of GA07 nephropathic field isolates of infectious bronchitis viruses Vijay Durairaj1, Erich Limnemann, Vanessa Gauthiersloan, Susan M. Williams, Holly S. Sellers Poultry Diagnostic and Research Center; Department of Population Health, The University of Georgia, Athens, GA

Infectious bronchitis (IB) is an acute and highly contagious disease in chickens caused by infectious bronchitis virus (IBV). IBV is an enveloped, single-stranded RNA virus which primarily affects the respiratory and reproductive tract in chickens. Additionally, some viruses have a predilection towards kidneys and are known as nephropathic strains of IBV. Nephropathic IB viruses can cause flushing in chickens along with varying levels of mortality with or without respiratory symptoms. The cell tropism and pathogenesis of IBV is primarily dependent on the spike (S) glycoprotein. Several immunogenic regions are located within the S1 subunit of the spike glycoprotein which is responsible for protective immunity. The main objective of this study was to analyze genetic changes within the S1 subunit from previously isolated variant nephropathic isolates of IBV classified as GA07. The GA07 variant viruses were isolated from clinical cases of flushing on commercial poultry farms during 2007-2012. IBV was isolated from 61 submissions and genotyped based on S1 spike glycoprotein sequence. The nucleotide sequence analysis was performed using molecular and bioinformatics tools and was in silico translated to corresponding amino acids. Phylogenetic analysis of the nucleotide sequences from the field isolates were studied with the common vaccine strains. We compared the amino acid sequences of GA07 isolates from 2007-2012 and observed multiple amino acid mutations in the S1 subunit. These mutations were not only restricted to the hypervariable regions but also seen in the intravarietal regions.

Key Words: Nephropathic IBV, Spike Protein, Genotyping, Phylogenetic analysis, Flushing

T88 Assessment of live Newcastle disease virus VG/GA strain (Avinew®) subcutaneous vaccination. Francisco Perozo1, Rosmar Marcano2, Rafael Fernandez1, Francisco Rojo3 1University of Zulia Veterinary College, Maracaibo, Venezuela 2Venezuela Central University, Maracay, Venezuela 3Merial Select Inc., Gainesville, GA

The Villegas-Glisson/University of Georgia (VG/GA) strain of Newcastle disease virus (NDV) is used worldwide for Newcastle disease control and has been tested for spray, drinking water and in ovo application. Hatchery vaccination provides a controlled and clean environment for poultry vaccination, currently day-1 NDV vaccination in most endemic countries includes live coarse spray and killed subcutaneous applications. This work aims to assess the efficacy of including NDV live VG/GA strain subcutaneous vaccination at the hatchery. Four groups of ten 1-day-old commercial broilers were used (three replicates). Group 1: one-day-old dual (live/killed) vaccination with two field boosts (eight and 18 days). For groups 2 and 3, subcutaneous VG/GA strain was included with or without field revaccination. Group 4 remained as unvaccinated control. Percentage of survival, serological response and viral shedding were used as efficacy criteria. All birds where challenged at 28 days with a lethal dose of a genotype VII NDV. The control group died within five days after challenge. All vaccinated birds survived the challenge, including the group with no field revaccination. No adverse effects were observed after subcutaneous vaccination. Adequate protection, plus differences in serological responses and viral shedding suggest the suitability of VG/GA strain (Avinew®) subcutaneous vaccination and are discussed.

Avinew® is a registered trademark of Merial in the United States of America and elsewhere.

Key Words: Newcastle Disease, VG/GA strain, subcutaneous vaccination

T89 The impact of mergers on the history of the poultry industry John Donahoe* Industry Consultant, Flowery Branch, GA ^

Industry cycles tend to follow a temporal pattern of aging, consolidation, and mergers. This drives implementation of economies of scale. Early in these cycles, you see numerous businesses founded by entre-
The very virulent infectious bursal disease virus (vvIBDV) strains have long been considered to be antigenically similar to classic IBDV. The suspected reason for the early infection of broilers despite strong maternal immunity to classic IBDV has been their high virulence. Studies were conducted using reassorted IBDV strains with a vvIBDV genome segment A and a classic virus genome segment B. These viruses contained VP2 antigens identical to the vvIBDV but the presence of genome segment B from classic viruses reduced their virulence to that of a non-vvIBDV. Although their pathogenicity was reduced, these viruses still broke through maternal immunity earlier than the classic and variant IBDV controls. These results and our previous studies on amino acids contributing to antigenic drift in IBDV, indicate the vvIBDV may be antigenically distinct from classic viruses. The data also suggest a vaccine specific for vvIBDV may be more efficacious than the classic vaccines currently used to control these highly pathogenic strains.

Key Words: vvIBDV, Antigenicity, Maternal Immunity, Vaccines

T91 Evaluation of inactivated avian influenza H7 vaccines for protection of chickens against a highly pathogenic avian influenza virus H7N3 isolated from chickens in Jalisco, Mexico, during 2012. Darrell Kapczynski*, Simone Stoute The Ohio State University/OARDC, Wooster, OH

A recent outbreak of highly pathogenic avian influenza (HPAI) H7N3 was reported poultry in Jalisco, Mexico, beginning in June of 2012. To date more than 11 million birds have died or been slaughtered in an effort to stop the spread of disease. In response to the outbreak, vaccine efficacy trials were recently performed to determine if U.S.- and Mexican-origin inactivated H7 vaccine would protect birds from clinical disease and shedding of virus. In the first set of experiments, four phylogenetically-related U.S. low pathogenic avian influenza (LPAI) isolates, either H7N2 or H7N3, were formulated into inactivated emulsion vaccines and injected into 7 week old SPF birds. These isolates contained between 92-97 amino acid similarity to the hemagglutinin gene of the challenge virus (A/chicken/Jalisco/CPA1/2012 H7N3). The APHIS-approved H7 vaccine antigens were included into this experiment for testing. Birds were challenged at 10 weeks of age with 10^6 EID50 per bird delivered via intranasal route. Results demonstrate that three of the four H7 vaccine isolates tested provided 100 % protection, whereas the fourth isolate provided 90 % protection. In the second experiment, a Mexican-lineage LPAI H7N3 isolate from wild birds, with 98 % sequence similarity to the HPAI virus, was formulated into an inactivated vaccine and applied to 2 week old birds. Birds were challenged as previously described and demonstrated 100 % protection from challenge. All vaccines tested reduced shedding of virus compared to sham vaccinated birds. Taken together, these results indicate that both U.S. and Mexican vaccine isolates can provide protection to poultry against this recent HPAI H7N3 virus.

Key Words: highly pathogenic avian influenza, vaccine, poultry, H7N3, protection

T92 Comparison of serological methods for the detection of antibodies to Chicken Anemia Virus in chicken sera. Chinta Lamichhana*, Haichen Song, Dan Domingo Pfizer Animal Health, College Park, MD

Chicken Anemia virus (CAV) is the etiological agent of infectious anemia of chicken. The clinical symptoms are severe anemia with low hemacrit, retardation of growth, atrophy of the thymus, bone-marrow and bursa of fabricius, hemorrhages in skeletal muscles, and destruction of lymphoid tissues. Chicks are immunosuppressed and high morbidity and mortality are attributed to secondary infection.

Viruses neutralization and indirect immunofluorescent antibody tests are considered as gold standard methods for detecting antibodies to CAV. The enzyme-linked immunosorbent assay (ELISA) was developed for the rapid and efficient large scale screening of antibodies to Chicken Anemia Virus (CAV). This study examines the sensitivity and specificity of a new commercial CAV ELISA assay (ProFLOK® CAV PLUS Antibody Test Kit, Pfizer Animal Health), Indirect Immunofluorescence Antibody (IFA), and Virus neutralization (VN) tests on sera from controlled and field exposure conditions.

The efficacy data for the new CAV PLUS ELISA Kit demonstrate that the kit can accurately detect CAV antibody. Masked suitability panels show that the analytic specificity was 100% compared to IFA, detecting antibodies to CAV and not antibodies to other tested pathogens. The new CAV ELISA is highly correlated to currently available tests with an overall agreement of greater than 95% between the ELISA, IFA and VN tests. The kit demonstrated excellent well-to-well (%CV less than 5.7%) and plate-to-plate (%CV equal to 4.5%) reproducibility. The kit also demonstrated the ability to detect antibody to CAV one week post-infection (after maternal antibody is depleted, at which point, any antibody level is attributed to response to field exposure).

The new ProFLOK CAV PLUS ELISA can be used for quantitative and qualitative analysis of antibodies to Chicken Anemia Virus (CAV) in chicken sera.

Key Words: Chicken Anemia Virus ELISA, ProFLOK CAV PLUS ELISA, Chicken Anemia Virus, ELISA, Chicken Infectious Anemia Virus
**Metabolism & Nutrition IV**

**T93 Use of Actigen® as a tool to reduce the impact of necrotic enteritis in broilers**
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The efficacy of Actigen® (AG) as a replacement for zinc bacitracin (ZB) and salinomycin (SM) was investigated using necrotic enteritis (NE) challenge feeding study model. 480 d old male Ross 308 chicks were assigned to 48 floor pens (75 x 60 cm) in 2 rooms. Treatments were arranged in a 2 x 4 factorial design: challenge, - or +; feed additive, control (none), ZB 100/50 ppm; AG 800/400/200 ppm and SM 60 ppm in S, G, and F respectively. Wheat, sorghum, SBM, MBM, canola diets were formulated according to Ross 308 nutrient specifications. Birds in one room were gavaged on day 9 with 1 ml saline containing sporulated oocysts of vaccine strain E. maxima (5000), E. acervulina (2500) and E. brunetti (2500) following gavage on days 14 and 15 with 1 ml thiglycylcolate broth (TB) containing 108 CFU of C. perfringens (strain EHE-NE18, CSIRO). Unchallenged birds were dosed with saline or TB. Results on d 35 showed lower livability (LV), weight gain (WG) and feed intake (FI) in challenged vs unchallenged birds (P<.05). ZB, Actigen and SM increased LV, WG and FI on d 35 (P<.05). Challenge X additive interactions were observed for LV, WG and FI on d 35 (P<.01). In the - vs + challenge groups, LV was 92 vs 52, 97 vs 90, 92 vs 82 and 93 vs 93% while WG was 2541 vs 2105, 2597 vs 2474, 2699 vs 2561 and 2575 vs 2704g for control, ZB, Actigen and SM respectively. Control birds had greater incidence of NE lesions when challenged (P<.01). None of the additives completely protected birds from NE or coccidiosis lesions. Actigen was as effective as ZB and SM in preventing performance decline from coccidiosis. This study indicates that yeast base Actigen® has promise as a tool for controlling necrotic enteritis.

**Key Words:** necrotic enteritis, coccidiosis, yeast cell wall, bacitracin, salinomycin

**T94 The effects of necrotic enteritis and aflatoxin on growth performance, lesion scores, and mortality in young broilers and products to alleviate them**
Sara Johnston1, Ron Cravens1, George Goss1, Fang Chi1, Steve Davis1, Jane Richardson2, Edward De Boer1 1Amlan International, Vernon Hills IL 2Colorado Quality Research, Wellington, CO

Cobb 500 chicks (2,640, male) were used to determine the effects of disease challenge and products to decrease those effects. Three challenge levels were used; 1) no challenge; 2) necrotic enteritis (CPP) challenge; and 3) CPP+1 ppm aflatoxin B1. Products tested to alleviate disease challenges were: 1) no product (NP); 2) a proprietary clay-based product (CL1); 3) a second proprietary clay-based product (CL2); 4) a third proprietary clay-based product (CL3); and 5) virginiamycin (VM). In the 24 d study, 22 chicks (equalized to 20 on d-7) per pen were allotted to 15 treatments (3×5 factorial arrangement) with 8 replications (experimental unit = pen). Significant difference was set at P<.05. Weights were taken on d-0, 10, and 24 for calculation of feed intake, gain, and feed:gain. Birds consumed feed and water ad libitum. Increased negative responses to the combination of NE and AFL were seen in this study as FI (d-0–10), gain (d-10–24, d-0–24), and F:G (d-10–24) were increasingly poorer as challenge level went from no-challenge to CPP challenge to CPP+AFL challenge (P<.05). Other growth responses were worse than non- or CPP-challenges when both CPP+AFL were applied (P<.05). Lesion score was higher in CPP challenged birds with or without AFL (P<.05). Feeding VM improved performance in non-challenged birds (P<.05). In CPP challenged birds, adding CL1 or CL2 improved FI and gain compared to NP; with CL2 being equal to those fed VM during the challenge period (P<.05). Birds given CL1 had the highest gain and feed conversion when challenged with both CPP and AFL; feeding CL2, CL3, and VM had higher gains than adding NP (P<.05). In conclusion, increasing challenge level decreased bird performance. Birds with necrotic enteritis fed CL2 had gain that was equal to those fed VM during the challenge period. Feeding the clay-based products improved performance during a CPP+AFL challenge.

**Key Words:** necrotic enteritis, aflatoxin, virginiamycin, clay

**T95 The effects of necrotic enteritis, aflatoxin, and virginiamycin on growth performance, lesion scores, and mortality in young broilers**
Sara Johnston1, Ron Cravens1, Fang Chi1, George Goss1, Steve Davis2, Sam Hendrix2, Edward De Boer1 1Amlan International, Vernon Hills, IL 2Colorado Quality Research, Wellington, CO

A total of 2,112, male, Cobb 500 chicks were used to determine the effects of increasing aflatoxin concentration (AFL: 0, 0.75, 1.5 ppm) on broilers with or without necrotic enteritis or virginiamycin (VM). In the 23 d study, 22 chicks (equalized to 20 on d-7) per pen were allotted to 12 treatments (3×2×2 factorial arrangement) with 8 replications in a randomized complete block design; pen was the experimental unit. Significant difference was set at P<.05. Weights were taken on d-0, 10, 16, and 23 for calculation of feed intake, gain, and feed:gain. Birds consumed feed and water ad libitum. Aflatoxin decreased gain and feed intake and resulted in poorer feed:gain, mortality, and lesion scores (P<.05). Inducing necrotic enteritis (CPP) using Clostridium perfringens contaminated litter and a 10× dose of coccidiosis vaccine administered on d-10 increased lesion score and decreased feed intake and gain (P<.05). Adding VM to the diets improved gain, feed intake, and feed conversion, and decreased mortality (P<.05). However, there were interactions (P<.05) as challenging birds in the second period with CPP and feeding 0.75 ppm AFL had a negative synergistic effect on gain while even an additive effect was not seen when birds were fed 1.5 ppm AFL. At 1.5 ppm AFL non CPP-challenged birds fed VM had higher gain that those birds not fed VM, which was equal to gain from challenged birds with or without VM. A similar interaction (P<.05) was seen in the overall feeding period although VM helped CPP challenged birds at 0.75 ppm overall. Virginiamycin improved feed conversion with the greatest improvement at 1.5 ppm. Aflatoxin increased lesion scores in unchallenged but not challenged birds. Unexpectedly, VM increased lesion scores in challenged but not unchallenged birds (P<.05). Aflatoxin and necrotic enteritis decrease broiler performance and interact to decrease weight gain; VM helps improve gain in challenged birds at 0.75 ppm AFL but not at 1.5 ppm AFL.

**Key Words:** necrotic enteritis, aflatoxin, virginiamycin

**T96 Performance of broilers fed a broader spectrum antibiotic (virginiamycin) or a narrower spectrum antibiotic (bacitracin methylene disaclylate) over 3 consecutive growout cycles**
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Virginiamycin and bacitracin are widely used in commercial broiler feed regimens to improve performance, likely due to inhibition of intestinal clostridial populations. A floorpen study of 3 consecutive growout cycles was conducted using 4 feed regimens containing bacitracin (treatment 1), virginiamycin (treatment 2), or combinations of both after cycle 1 (treatments 3 and 4). On study day 0, 46 day-of-age, male
Cobb birds were placed in 11 pens per treatment group, with 1 extra pen per treatment group providing replacement birds for any mortalities. For cycle 1, virginiamycin-treated birds had significantly greater hot carcass weight, boneless skinless breast weight, and leg quarter weight than bacitracin-treated birds. For cycle 2 there were no significant differences. In cycle 3, treatment 4 weights were significantly greater than treatments 2 and 3, with treatment 1 intermediate. Across cycles for live weight and hot carcass weight, treatment 4 was significantly greater than 3, with 1 and 2 intermediate. Across cycles for breast weight, treatment 4 was significantly greater than 2, and treatments 4 and 1 significantly greater than treatment 3. Across cycles, there were no significant differences among treatments in leg quarter weight.

For cycle 3, post-7-day mortality attributable to bacterial infection other than with C. perfringens, treatments 2 (6.72%) and 4 (6.72%) were significantly higher than treatment 1 (2.3%), with treatment 3 intermediate (3.56%). Across cycles, there were no significant differences in post-7-day mortality.

During cycle 1, adjusted feed conversion ratios at day 43/44 were significantly lower for treatments 2 and 4 (virginiamycin) than for treatments 1 and 3 (bacitracin) in the starter, grower, and finisher phases. For cycle 3, Virginiamycin-fed birds experienced feed conversion and processing weight advantages over bacitracin-fed birds during cycle 1, but had a 4% higher mortality rate in cycle 3. The higher mortality, resulting primarily from bacterial infection, may be hypothesized to be due to the broad-spectrum suppression by virginiamycin of beneficial microflora in the gut, allowing opportunistic bacterial growth. Microbial suppression may help channel energy to bird growth rather than to microbial proliferation, but over consecutive growout cycles may also create gut dysbiosis that makes birds vulnerable to opportunistic infection.

Key Words: virginiamycin, bacitracin, broilers, feed conversion, mortality

T97 EFFECT OF ADDING A NATURAL SOURCE OF 1,25-DIHYDROXYCHOLECALCIFEROL ON THE CALCIUM AND PHOSPHORUS UTILIZATION OF BROILER CHICKENS Maria del Carmen Mojica-Enriquez1, Sergio Gomez-Rosas2, Maria de Lourdes Angeles3, Nutritec International Sàrl, Veracruz, Mexico 1National Forestry, Agriculture and Livestock Research Institute, Ajiuchitan, Mexico

A balance trial experiment was carried out to evaluate the productive responses, tibia measurements, calcium (Ca) and phosphorus (P) retention in broilers fed increasing levels of 1,25-dihydroxycholecalciferol (Panbonis). Sixty Ross B308 male broilers were individually allocated and assigned to four dietary treatments from 28 to 49 d of age: 1. Positive Control (PC) diet with 100% of the nutrient recommendations, 2. Negative Control (NC) with a 0.15% reduction in Ca and P, 3. As 2 + 50 ppm de Panbonis (Pan50) and 4. As 2 + 100 ppm of Panbonis (Pan100). Excrcera were totally collected from days 39 to 42 to estimate the retention of Ca and P. On day 49, broilers were killed and the right tibia was excised, weighed and ashed. Data was subjected to ANOVA using the General Linear Model Procedures of SAS. There was a trend for the weight gain being lower in NC-fed broilers, intermediate for Pan50 and Pan100-fed broilers and higher in the PC (P<0.10). Feed intake was lower (P<0.01) in broilers fed Pan100 and was similar for the other treatments. The feed conversion was lower (P < 0.05) for Pan100 and PC broilers, intermediate for Pan50 and higher for the NC. The fresh weight, dry weight, length and ash percentage of the tibia were similar among treatments. The ashes weight were similar for PC, Pan50 and Pan100 (P < 0.10) and were lowest for NC. The diameter of the epiphysis and the diaphysis were similar (P < 0.05) for PC, Pan50 and Pan100 and were lower in NC. The Ca and P intake were higher (P < 0.05) for PC than for the other treatments. The Ca and P excretion were higher (P < 0.05) for PC, intermediate for NC and Pan50, and were lower for Pan100. The Ca and P retention were lower (P < 0.05) for PC, intermediate for NC and Pan50 and were higher for Pan100. The results indicate that broilers fed a low Ca and P diet showed lower performance, tibia measurements and Ca and P retention compared to a normal Ca and P diet, but the addition of 100 ppm of Panbonis/ton of feed caused similar feed conversion ratio and tibia measurements and higher Ca and P retentions compared to the PC. The addition of 100 ppm of Panbonis/ton of feed increased the availability of Ca and P by 0.10 and 0.11%, respectively.

Key Words: virginiamycin, bacitracin, broilers, feed conversion, mortality

T98 Evaluation of zinc sources for broiler performance and breast meat yield Terri Parr1, Jeff Cohen1, Kirk Klassing2, James Usry1, 1Micronutrients, Indianapolis, IN 2University of California-Davis, Davis, CA

A trial was conducted to evaluate the performance and breast meat yield of broilers fed various sources and combinations of zinc for a 49-day period. Two thousand eighty, one-day old Ross 708 males were housed in floor pens on recycled litter at a high density to simulate commercial-type stress and growing conditions. Performance was measured for 49 days, with carcass yield measured at day 50. Chicks were randomly assigned to one of eight treatments (10 reps/treatment; 25 chicks/pen). The treatments included 1) positive control (PC; 80 ppm feed-grade ZnSO4), 2-5) 30, 45, 60 and 80 ppm Intellibond®Z (IBZ, Micronutrients), 6) sulfate/organic combination (60 ppm ZnSO4 + 20 ppm ZnOrg; Availa®Zinc, Zinpro), 7) sulfate/oxide combination (40 ppm ZnSO4 + 40 ppm feed-grade ZnO), or 8) sulfate/oxide/organic combination (30 ppm ZnSO4 + 30 ppm ZnO + 20 ppm ZnOrg). Single degree-of-freedom contrasts evaluated PC vs each IBZ level, sulfate/organic vs each IBZ level, and 45 ppm IBZ vs each remaining combination program. At 21 days, 30 and 80 ppm IBZ improved body weight gain (P<0.05) compared to PC, while 45 ppm IBZ decreased (P<0.05) FCR (g feed/g gain) compared to PC or any of the combination programs. By 49 days, 80 ppm Cu from IBZ resulted in greater body weight gain (P<0.05) than PC or any of the combination programs. By 49 days, meat yield was higher (P<0.05) for 45 ppm IBZ compared to the sulfate/oxide/organic combination, and 80 ppm IBZ compared to either PC or sulfate/organic. Leg meat yield was higher (P<0.05) when birds were fed 80 ppm IBZ as compared to the PC-fed birds. In conclusion, feeding 80 ppm Zn from IBZ for 49 days did not compromise feed conversion, resulted in heavier birds, and yielded more breast and leg quarter meat than birds fed 80 ppm Zn from any other source or combination of sources.

Key Words: zinc, broiler, yield, FCR, breast meat

T99 Comparison of copper sources for broilers fed diets with and without antibiotics Lucio Araujo1, C. Araujo1, J. Vittori2, C. Araujo1, F.A. Longo1, Fabio Goldflus1, Jeff Cohen1, Terri Parr1, 1University of Sao Paulo, Sao Paolo, Brazil 2Btech Tec. Agrop. e Com. Ltda., Valinhos, Brazil 3Micronutrients, Bauru, Brazil

When broilers are subjected to commercial stresses, the inclusion of dietary copper (Cu) and antibiotics (AGP) may improve bird performance. There is also evidence that the form of Cu is very important in determining the magnitude of improvement. A research trial was designed to differentiate between Intellibond® C (IBC – Micronutrients) and copper sulfate (CuSO4) with and without AGP’s. Growth perfor-
mance was measured from 0-40 days of age with carcass parameters recorded on day 40. Fourteen treatments were fed crumbled or pelleted diets and replicated with 9 pens of 18 male birds per pen. The litter in the floor pen was recycled, birds were vaccinated for coccidiosis at hatch and stocked at 13 birds per m² to induce additional stress. The treatments were 1) negative control (12.5 ppm Cu from IBC), 2) treatment 1 + AGP 3-5) 62.5, 125, and 187.5 ppm Cu from IBC), 6-8) 62.5, 125 and 187.5 ppm Cu from CuSO₄, 9-11) treatments 3-5 + AGP and 12-14) treatments 6-8 + AGP. Between 0 and 21 days of age, there was a main Cu source effect (P<0.04) for FCR. The birds fed IBC had >2 points in FCR advantage over the birds fed CuSO₄. Twenty-one day old body weight gain peaked at 125 ppm Cu for the birds fed IBC and 200 ppm Cu for birds fed CuSO₄. At day 40, the birds fed 200 ppm Cu (regardless of source) had better FCR (P<0.01) than the birds fed the other levels of Cu. When Cu was included at 200 ppm and the AGP was excluded, breast and leg meat yield was improved (P<0.05) for IBC over CuSO₄. Numerical improvements in breast and leg meat were also seen for birds fed IBC over CuSO₄ when the AGP was included in the diet and Cu level was 200 ppm. In conclusion, broilers fed 200 ppm Cu under simulated commercial conditions had better feed efficiency when IBC was the Cu source in diets at 21 days of age, while at 40 days of age, the birds fed 200 ppm Cu from IBC yielded more breast and leg meat than birds fed CuSO₄.

Key Words: Copper, Copper Hydroxylchloride, TBCC, CUSO₄, Broiler

T100 Comparison of copper sources in broilers from 0 to 21 days of age

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The source and level of copper used in broiler feeds for maximum performance can be financially rewarding to producers, especially when feed prices are high. A trial was designed to accurately differentiate between IntelliBond® C (IBC – Micronutrients) and basic copper carbonate (BC Carb) under field stress conditions. Birds were housed on recycled litter inoculated with _E. acervulina_ and _E. coli_ at day 7. Performance was measured from 0-21 days of age and intestinal lesions scored at day 21 (4 random birds / pen). Ten treatments were fed mash diets and replicated with 8 pens of 50 mixed-sex Ross 708 birds / pen. The treatments were 1) negative control (4 ppm Cu from CUSO₄), 2-5) 100, 125, 150 and 200 ppm Cu from BC Carb, 6-9) 100, 125, 150 and 200 ppm Cu from IBC and 10) 125 ppm Cu from CuSO₄. Using the technique of Littell et al., 1997, analysis was conducted to statistically determine if the slopes of the performance data and lesion scores were significantly different between Cu sources. All of the required assumptions were met so a slope ratio analysis could be performed on the data. The slopes between copper sources were significantly different (P<0.03) for day 21 body weight, 0-21 body weight gain, 0-21 FCR and 21 day lesion scores with IBC out-performing BC Carb for every measured parameter. At 125 ppm copper there was a significant difference (P<0.05) in 0-21 day FCR between IBC and CuSO₄ with BC Carb being intermediate. Using regression equations from the analysis, in order to replace 125 ppm Cu from IBC, it would take 160-180 ppm BC Carb to provide equal performance between the two sources. Based on the higher inclusion level of BC Carb needed for equal performance in this study and the lower concentration of copper in BC Carb, BC Carb would need to be priced at $5.75/kg to equate a price of $8.15/kg for IBC in order for diet costs not to increase at 125 ppm of dietary Cu (70% of IBC). In conclusion, IBC is a more efficacious in maximizing broiler performance than BC Carb.

Key Words: Copper, Copper Hydroxylchloride, TBCC, CuCO₃, Broiler

T101 An economic evaluation of dietary programs varying in protein and energy fed to female broiler griller

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A study was conducted with the objective of evaluating the cost of production related to feeding Brazilian type diets to broiler grillers (1.5kg live weight). A 3 X 3 factorial composed by 3 levels of protein (ideally balanced AA diets without CP restriction – AA diet) and 3 levels of ME (ME diet). A Moderate feeding treatment was set by averaging values obtained from the industry in a program having feeds from 1 to 7 (dig. Lys = 1.28%; ME (kcal/kg) = 3,050), 8 to 18 d (dig. Lys = 1.22%; ME (kcal/kg) = 3,100), and 19 to 29 d (dig. Lys = 1.07%; ME (kcal/kg) = 3,200). Ratios of essential dig. AA to Lys from 1 to 18 d were: TSAA = 75%, THR = 65%, Val = 75%, ILE = 65%; whereas Val and Ile were at 78% and 67% from 19 to 29 d. Low and High diets had reductions and increases in ME and dig. Lys of 1.5% and 10%, respectively throughout the feeding program. Diets were all vegetable having corn, soybean meal and acidulated soybean soapstock. Cobb 500 feather sexable females in the number of 2,880 were used, they were distributed in 9 treatments of 40 birds per pen (15 per squared m) in 8 replications per treatment. No interactions were observed between Energy x AA density, with the exception of FCR (P<0.001) and feed intake (P<0.01) from 1 to 18 d. Body weight gain was increased when birds were fed High AA density (P<0.01) and High ME (P<0.02) diets. Improvements in FCR were observed (P<0.0001) as AA density increased in the 3 levels as well as with ME (P<0.0001). An increased yield of whole carcass as percentage of live Bird was observed for birds fed High AA diets (P<0.05) and a concurrent reduction in abdominal and total body fat was also observed with High AA diets (P<0.001), without changes with ME diets. When different scenarios of corn, soybean meal and soybean fat market prices were taken in consideration, the best economic returns were always when Low AA and Low ME diets were used together, one exception was when high corn prices are used with low soybean meal and low soybean fat prices. Frequent fluctuations in ingredient market prices demand appropriate estimations on the impact of changing AA and ME concentrations in broiler diets, such that production profitability is maintained.

Key Words: Female broiler, Griller, Aminoacid, Energy, Economics

T102 D1-42 yeast product inclusion and D42-118 feed form effects on large tom performance using feed produced at a commercial mill

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The brooder period (D1-42) is crucial to obtaining a proper start that may carry over to overall turkey performance. The grower/finisher period (D42-118) is a time of high volume feed consumption that also may affect overall performance. Providing yeast products (YP) and high quality pellets (YP) in the brooder and grower/finisher periods respectively may enhance overall performance. The brooder period (D1-42) is crucial to obtaining a proper start that may carry over to overall turkey performance. Providing yeast products (YP) and high quality pellets (YP) in the brooder and grower/finisher periods respectively may enhance overall performance. The objective of the current study was to determine the effects of providing two different YP derived from _Saccharomyces cerevisiae_ in the brooder period and YP Carriover and Feed Form affects in the grower/finisher period on large Hybrid Convertor tom performance. On D1, 89 1-d-old poults were randomly allocated to one of 16 pens in a house that mimicked a commercial grow-out facility. Then, diets varying in YE inclusion (YP1 or YP2) were assigned in a randomized complete block design. On D42, a 2 YP Carriover x 2 Feed Form (HQP or ground pellets (GP)) factorial design was implemented to measure main effects and interactions over the different performance periods. All diets were manufactured.
T103 PROPIONIC ACID INCLUSION WITH PRESTARTER FOR POULTS FROM YOUNG BREEDERS

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Supplemental organic acids benefit first wk production, particularly for poult, prestarter, blood glucose, liver glycogen

Key Words: propionic acid, poult, prestarter, blood glucose, liver glycogen

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T104 In-vitro antimicrobial susceptibility of Clostridium perfringes from broiler origin

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Clostridial enteritis is a common disease affecting the intestinal health of many US commercial broiler flocks. Several antibiotic feed additives have been used to control this costly disease condition. Field isolates of Clostridium perfringes were collected between 2011 and 2012 in several broiler production complexes located in the Southern United States. These isolates were tested for their ability to produce visible growth in the presence of antibiotics on a series of agar plates containing dilutions of the antimicrobial agent (agar dilution). Updated information regarding Minimum Inhibitory Concentrations (MICs) against virginiamycin and other commonly used antibiotic feed additives will be presented.

Key Words: Enteritis, Necrotic, Clostridium, MICs

T105 Factors to consider in choosing poultry house lighting

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Energy conservation is as important as ever. Growers pay energy bills out of their earnings. The more they pay for power the less net return on the flock. Efforts to install motors, fans and lights, the components that use the most electricity in poultry houses, are being considered by growers. However, it is not as simple as replacing an old 60 watt incandescent bulb with a newer energy efficient bulb. Factors such as light intensity at floor level, uniform light distribution, life of the bulb and ease of maintaining it should be considered. The current field study evaluated incandescent, compact fluorescent (CFL), cold cathode and LED light bulbs in poultry houses. Light intensity was measured at floor level at the beginning of the study, 6 and 12 months into the study. Bulbs were cleaned prior to taking the light intensity measurements. The average light intensity was measured in a grid at 1, 10 and 20 ft off the side wall and every 5 ft down the length of the house for a total of 20 ft. Dimming curves for the bulbs were obtained and bulb losses in each house were recorded at the end of each flock. Data loggers were installed to monitor the house total power and the power utilized by the lighting system.

Dimming the light intensity below 5 lux resulted in higher CFL bulb losses. When the house dimmer was marked to show the grower how to limit dimming, bulb losses were reduced from 50% to less than 4%. The dimming curve of incandescent bulbs was the most linear, followed by cold cathode, LED and CFL. All bulbs exhibited a loss of light intensity that ranged from 25% to 50% depending on the type of bulb. The average light intensity at floor level was 6.8, 10.9, 10.4 and 20.3 for LED, CCFL, LED and CFL respectively. On a second farm Light intensity measurements were affected by bulb spacing and height from the floor and reflection off of the ceiling bedding material and walls. These data suggest that not all bulbs can be used at the current spacing of incandescent bulbs. Poultry producers should evaluate the intensity of the bulb at floor level prior to investing in bulbs for all houses on the farm.

Key Words: Lighting, Energy conservation, light bulb, Light intensity

T106 Effect of repeated application of litter amendment

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Ammonia (NH3) production by poultry litter is a recurring management concern for producers. Excessive NH3 exposure has negative impacts on eye and respiratory health, as well as production efficiency. Application of litter amendments is a common management practice to reduce NH3 concentration inside poultry houses during brooding. However, singular applications prior to chick placement typically provide meals. A separate 3% addition of starch to the crumbled basal was progressively replaced with 1, 2 and 3% propionic acid (PA) and offered for the first 7 D to comprise 4 treatments of similar nutritional value (28.5% CP, 2900 kcal ME/kg). After 7D, the basal feed having only starch continued until 21D. Each treatment represented 6 replicates of 10 poults in raised wire pens. All PA additions improved live performance similarly beyond the starch basal after 2D (L, P<.05) which was less apparent 2-7D (L, P<.07). Total 0-7D mortality progressively decreased from 5.8% for the basal to 1.7% with 3% PA (L, P<.05). Half of each pen’s birds provided body measurements at 7D. Blood glucose increased from 120 to 258 mg/Dl as PA increased while liver glycogen followed in parallel from 37 to 47 mg/100g with 1% PA providing the most dramatic responses (Q, P<.001). No treatment differences in contents pH with either crop (ca. 5.0) or ceca (ca. 6.5) were apparent. During the subsequent 14 days when all poults received the starch basal feed, birds that had not been given PA 0-7 days compensated in gain and F/G such that all treatments were similar at 21D; however, benefit of previous PA to mortality continued. Total 0-21D mortality progressively diminished from 15.5 to 1.7% as dietary PA that had been received 0-7D deceased from 0 to 3% (L, P<.01). PA is a gluconeogenic organic acid that provides survival advantages to the post-hatch bird.

Key Words: propionic acid, poult, presstarter, blood glucose, liver glycogen
NH₃ abatement for a limited time. The goal of this research was to determine the effects of repeated applications of an acid-based litter amendment during a growout cycle on equilibrium litter NH₃ concentration and live performance of broilers in a common airspace.

Three trials were conducted with approximately 14 d between flocks to mimic commercial conditions. Each trial consisted of four replicate pens of five treatments. Each pen contained 42 broilers and was equipped with a tube feeder and nipple drinkers. Treatments included negative control (no amendment), singular application one day prior to chick placement (-1 d), two applications (-1 and 28 d), late application (-1, 28, and 43 d), and bi-weekly application (-1, 14, 28, and 43 d). Litter amendment was applied at two-week intervals up to 43 d of a 56 d growout at the manufacturer’s recommended application rate (100 lb/1000 ft²).

Results indicated that bi-weekly application was the most effective in reducing litter NH₃ concentrations, followed by late application. Equilibrium litter NH₃ concentrations were reduced by 56.6% and 21.8% at 42 and 57 days, respectively, for bi-weekly application. Live production parameters were not affected by repeated applications of litter amendment.

Key Words: ammonia, ventilation

T107 Evaluation of a cellulose-based industrial wastewater by-product as broiler bedding material Brian Kiepper*, Casey Ritz, Brian Fairchild Department of Poultry Science, University of Georgia, Athens, GA

The increased cost and decreased availability of pine shavings, the traditional poultry bedding material, has facilitated the need to identify alternative bedding materials for poultry growers. The objective of this study was to evaluate different pine shaving and cellulose by-product mixtures based on bulk density, litter moisture and pH, and footpad quality over 6 weeks. The experimental design consisted of 25 pens (3.7 m² each) containing 55 Cobb broilers (0.07 m²/bird) for a total of 1375 birds. The 5 treatments consisted of bedding at 8 cm depth consisting of 0% (Control, 100% pine shavings), 25%, 50%, 75% and 100% cellulose by-product with 5 repetitions. The first phase of the experiment included bulk density at Day 0, and litter moisture and pH, and footpad dermatitis (FPD) scores taken at Day 0 and 7. Results from phase one of the study showed that the Day 0 mean bulk density (g/m²) of the 100% (84) and 75% (80) treatment pens were significantly higher than the 50% (71), 25% (59) and Control (53) treatment pens. At Day 7, the mean litter pH (S.U.) of the 100% (7.93) treatment was not significantly different from the 75% (7.33) treatment, but was significantly greater than the 50% (7.00), 25% (6.47) and Control (6.09) treatments. At Day 7, the mean litter moisture (%) of the Control (23.9) and 25% (23.9) treatments were not significantly different from the 50% (16.9) treatment, but were significantly greater than the 75% (15.0) and 100% (14.8) treatments. A Day 7, the mean percentage (%) of birds with no footpad downgrades in the 100% (99) and 75% (95) treatments were not significantly different from the 50% (87) treatment, but were significantly greater than the 25% (76) and Control (66) treatments. An evaluation of litter moisture versus FPD scores produced a correlation coefficient of 0.73, indicating a strong cause-and-effect relationship between increasing litter moisture and incidence of FPD. Based on phase one results, the cellulose by-product is at least comparable if not superior to pine shavings as a broiler bedding material based on litter moisture and subsequent incidence of FPD.

Key Words: broiler, litter moisture, litter pH, footpads, bulk density

T108 EFFECT OF CALCIUM FORMATE ADMINISTRATION IN THE DRINKING WATER DURING PRESLUGHTER FEED WITHDRAWAL ON Salmonella CONTAMINATION OF BROILERS J. Allen Byrd USDA-ARS, Southern Plains Agricultural Research Center, College Station, TX

New government guidelines for Salmonella and Campylobacter have brought the need for new control programs for these pathogens. One approach for controlling Salmonella is the use of sodium chloride products. One drawback is that high levels of sodium products produce the birds to consume excess water and in turn wet litter. Calcium formate is an organic acid salt for use in pig and poultry diets with similar properties as sodium chlorate. Presently, we evaluated the effect of calcium formate (15-30 mM) during an eight hour pre-transport FW. Market-age broilers were obtained from a commercial processing plant and randomly assigned to calcium formate-treated or control (non-treated) groups. Immediately upon arrival broilers were challenged by crop gavage with 10⁸ Salmonella Typhimurium (ST). Four day later, broilers were killed for ST cfu cecal enumeration. Broilers were provided calcium formate 24 hours prior to slaughter did not consume more calcium formate-water than broilers provided distilled water. Treatment with calcium formate caused a significant decrease (P < 0.05) in the incidence of ST in cecal contents (15%) as compared to the controls (52.5%). This study suggests that incorporation of calcium formate in the drinking water 24 hours prior to slaughter can reduce Salmonella contamination in broilers.

Key Words: Calcium formate, Broilers, Salmonella, Feed withdrawal

T109 Effect of corn gluten feed and/or DDGS on broiler breeder performance John Brake*, Mireille Arguelles-Ramos, Charles Stark Department of Poultry Science, North Carolina State University, Raleigh, NC

An experiment was conducted to evaluate the inclusion of corn gluten (CG; 21% CP) feed and/or distillers dried grain with solubles (DDGS; 27% CP) in feed during rearing and laying on broiler breeder performance. Ross 344 males and Ross 708 females were reared sex-separate in a black-out house from which they were moved to a curtain-sided slat-litter laying house at 21 wk of age, mixed, and photostimulated. Breeders were fed sex-separate from 21 to 64 wk of age. The corn-soy based starter diets contained either 0 or 2% CG feed and/or 0 or 2% DDGS in a 2 x 2 arrangement. The same dietary design continued with the grower and layer diets except the inclusion levels were either 0 or 4%. The diets were designed to be isocaloric and isonitrogenous. The breeders were managed in all aspects in a similar manner except for differences between the 4 dietary combinations. From 21 wk of age there were 4 replicate pens of 68 females and 8 males for each of the four dietary combinations with all birds receiving the same daily feed allocation at all times, irrespective of dietary treatment. Group BW was determined on a regular basis as a response variable rather than for determination of feed increments. Egg production and mortality were determined daily while percentage fertility and hatchability were evaluated on a weekly basis from sets of 60 eggs per replicate pen. Hens fed the CG and CG+DDGS diets exhibited increased egg production relative to the Control and DDGS diets. Female mortality was reduced by the DDGS and CG+DDGS diets probably due to reduced feather coat during hot weather. Male mortality was similar among the treatments but a numerical increase was observed with respect to the Control males. Fertility, hatchability of fertile eggs, and BW were not affected by diet.

Key Words: Broiler breeders, corn gluten feed, DDGS, egg production, hatchability
T110 Effects of Tylan®, dietary nutrient content and dried distillers grains with solubles on egg production and body composition of first cycle-laying hens. Neva Nachtrieb*, Michael Persia Department of Animal Science, Iowa State University, Ames, IA

A 16 wk experiment was conducted using 720 first cycle Hy-line W36 laying hens to evaluate performance and body composition responses to Tylan®, dietary nutrient content, and dried distillers grains with solubles (DDGS) inclusion. The experiment was a 2x2x2 factorial including 0 and 0.75lbs/ton of Tylan®, control and reduced nutrient diet (energy -66 kcal/kg, Lys, Met, TSAA, The, Iso and Val), and two concentrations of DDGS (15 and 30%). The eights experimental units (EU) consisted of 3 consecutive cages of 3 birds (68 in2/bird), resulting in 72 total hens per treatment. Dietary treatments were fed from 30 to 46 weeks of age. Egg production was collected daily, feed intake was measured weekly, and hen body weight and egg mass was determined at 4,8,12, and 16 wk. Body composition was determined by DXA on one hen per EU at 8 and 16 wk. Data were analyzed by ANOVA with Students T test used to separate means if significance was detected. Over the duration of the experiment, little difference was noted in hen housed -hen day egg production or feed intake. Hens fed diets supplemented with Tylan® had improved feed efficiency (g egg /kg of feed) at 4 and 8 wk (P<0.05), and near significant improvement of feed efficiency at 12 wk although this increase was lost at 16 wk. The reduced nutrient diet resulted in increased feed efficiency over the 4, 8, and 12 wk collection periods (P<0.01), but these differences were again lost by wk 16. DDGS inclusion rate did not affect the majority of the parameters measured. There were no differences in body weight or mortality over the experiment. At 8 wk, hens supplemented with Tylan® had a near significant effect on fat mass, increasing energy storage over non-supplemented diets. These data taken in context with increased feed efficiency over this period seem to indicate that Tylan® supplementation could reduce maintenance energy needs allowing for increased performance or storage energy availability. Therefore Tylan® increased feed efficiency over the majority of the experiment and a possible explanation for this increased efficiency could be a shift of nutrients (energy) from maintenance requirements to productive or storage use.

Key Words: Egg production, Tylan, DDGS, Body composition

T111 Effect of fiber removal from ground corn, distillers dried grains with solubles and soybean meal using the Elusieve process on broiler performance and processing yield Radhakrishnan Sinivasan1, Brett Lumpkins2, Elizabeth Kim1, Lorraine Fuller1, Joe Jordan1 1Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS 2Southern Poultry Research, Inc., Athens, GA 3USDA-ARS South Central Poultry Laboratory, Mississippi State, MS 4Poultry Science Department, University of Georgia, Athens, GA 5Office of Entrepreneurship and Technology Transfer, Mississippi State University, Mississippi State, MS

The Elusieve process, a combination of sieving and elutriation (air classification), has been found to be effective in fiber separation from ground corn, distillers dried grains with solubles (DDGS) and soybean meal (SBM). The objective of this study was to determine the effect of removing fiber from ground corn, DDGS and SBM on broiler live performance during the 42 d experimental period and assess the economic impact. A total of six dietary treatments were evaluated in which three treatments incorporated an additional non-starch polysaccharide (NSP) enzyme corresponding to the following three treatments: regular diet, direct substituted enhanced diet and an iso-caloric, iso-nitrogenous enhanced diet. The study consisted of 48 pens with 45 male broiler chicks per pen. Elusieve processing increased starch content of corn by 7.8%, and increased protein content of DDGS and SBM by 2.3 and 0.9%, respectively. Enhanced diets resulted in birds with 4.6 to 5.0% higher body weight gain, higher breast weight by 7.1 to 11.3% and feed conversion improvement by 4 to 6 points (2.4 to 3.2%) compared to regular diet. There was no effect of NSP enzyme on performance and feed consumption. Interaction effect (between NSP enzyme and dietary type) was observed only in two performance indicators of a total of 12 indicators. The increase in profit due to implementation of Elusieve process in a 1,000 ton/d feed mill is estimated to be $0.5 to 2.5 million/yr, which is 0.8 to 4.3 ¢ per bird produced. The payback period is estimated to be 0.9 to 4.7 yr.

Key Words: Milling, Fiber removal, Elusieve, Broiler, Nutrition

T112 Metabolizable Energy of Low-Oil DDGS Nick Dale* Department of Poultry Science, University of Georgia, Athens, GA

Increasing amounts of oil are being removed from DDGS. Levels of residual oil in what until recently was considered “low-oil” DDGS (7-8%) have at times been reduced to 5% or even less. To properly consider the role of “low-oil” and the new “very low-oil” DDGS in poultry feeds, their metabolizable energies must be defined. Attempts at this laboratory and elsewhere to develop a prediction equation to estimate ME of DDGS on the basis of differences in oil content have been only marginally successful, as other variations such as corn cultivar, agronomic conditions, ethanol manufacturing facility, fiber content, etc., may affect caloric value.

To avoid such possible variations, 2 samples of normal (10-11% oil) DDGS were assayed for ME. In addition, differing amounts of oil were removed from these same samples by ether extraction, and ME again assayed. Removal of half the oil in DDGS (from approximately 10% to 5%) reduced ME by 16.5%. In addition, ME as a percent of gross energy was reduced from 61.2% in original DDGS to 54.1% in the “very low-oil” samples. This presumably reflects a greater concentration of the less well digested fractions, such as fiber, in the low-oil samples.

Key Words: DDGS, low-oil DDGS, metabolizable energy

T113 Effects of guar meal, guar gum and saponin rich guar meal extract on productive performance of broiler chicks Sherif Hassan*, ABDUL AZIZ Alaqail King Faisal University, Al Ahsa, Saudi Arabia

Two hundred forty one-d-old broiler chicks were randomly distributed among four treatments with four replicates of 15 chicks per replicate. Chicks were assigned to one of the following treatments: 1) control basal starter diet, 2) the basal starter diet reformulated with 5.0% guar meal (GM), 3) the basal starter diet with 0.90% guar gum (GG), 4) the basal starter diet with 0.250% saponin-rich guar meal extract (GS). Weekly feed intake, body weight, body weight gain, feed conversion ratio and mortality rate were recorded from 0-21 d of age. Feed intake was only significantly lower for chicks fed 0.90% GG than chicks fed 5.0% GM at 1-7 and 8-14 d of age,feed conversion ratio (1-7d) for chicks fed 0.90% GG and 0.250% GS was significantly higher than other treatments. Feed conversion ratio (8-14d) for chicks fed 0.250% GS was significantly higher than chicks fed 0.250% GS was significantly higher than chicks fed 0.90% GG. Feed conversion ratio (15-21d) of chicks fed 0.250% GS was significantly higher than the control. The overall feed conversion ratio from 1-21 d was significantly higher for chicks fed 0.250% GS and 5.0% GM than chicks fed 0.90% GG and the control. Body weight (1-21 d) was significantly lower for chicks fed 0.250% GS than the control treatment. Body weight gain (15-21 d) was significantly lower in chicks fed either 5.0% GM or 0.250% GS than the control. Total body weight gains from 1-21 d was significantly lower for chicks fed 0.250% GS than the control. Results obtained indicate
that there are more negative effects associated with adding 0.250% GS than 0.90% GG suggesting saponins may play a prominent role in the growth inhibition effects of feeding GM to broiler chicks. Therefore, saponin may likely be the primary anti-nutritive factor in GM.

**Key Words:** Broiler chicks, Guar gum, Guar meal, Growth, Saponin

**T114 Effects of Adding Guar Meal on Productive Performance of Laying Hens**

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A completely randomized design experiment was conducted to evaluate the effect of feeding different levels (0, 2.5, 5.0, 10.0, 20.0%) of guar meal (GM) in laying hen diets over a 8-wk trial period. A total of 180 Hisex laying hens (25wk old) of similar body weight were randomly distributed among 5 treatments with 6 replicates with 6 hens each. Body weight, body weight gain, egg produced per hen, feed consumption, feed conversion ratio, egg weight, egg mass per hen, and Haugh units, yolk color, and egg specific gravity were measured. Body weight and body weight gain for hens fed 10 and 20% GM were significantly lower than hens fed 0, 2.5, or 5% GM. Hens fed 10% GM supported a significantly higher egg number and percentage of egg produced per hen than the control. Egg number and percentage of egg produced per hen were significantly lower for hens fed 20% GM than hens fed 0, 2.5,5, or 10% GM. Hens fed 20% GM consumed significantly lower feed than those fed 0, 2.5, 5, or 10% GM. A significant feed conversion ratio increase was existed for the 20% GM group compared to the remaining treatments. Egg weight decreased significantly for hens fed 20% GM compared to the other treatments. Egg mass for hens fed 5 and 10% GM was significantly higher than the control. However, hens fed 20% GM showed significantly the lowest total egg mass per hen. Egg yolk of hens received 5% GM were similar to the hens fed 10% GM, whereas hens fed 5% and 10% GM produced eggs with higher yellowness values than the control group. Egg specific gravity increased significantly for hens fed 20% GM compared to the other treatments. Mortality rate was significantly higher for the control group than hens fed 2.5 and 10% GM. Results showed that GM can be fed to laying hens at a level up to 10% without adverse effects on laying hen performance.

**Key Words:** Egg, Production, Performance, Guar meal, Laying Hens

**Metabolism & Nutrition VI**

**T115 In vivo efficacy of a Buttiauxella 6-phytase versus a novel Citrobacter 6-phytase in young broilers**

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Phytases are supplemented to poultry diets to hydrolyze phytate, improve nutrient digestibilities of which P is most important, and thereby decrease P excretion and feed cost. Phytase can be added to diets based on a standardized FTU determined in vitro by the AOAC method. It has been shown that the in vivo efficacy can differ between 6-phytases. A 6-phytase derived from Buttiauxella spp. and expressed in Trichoderma (BT) has been recently developed. The objective was to test if this phytase has a different efficacy in vivo than a 6-phytase derived from synthetic genes mimicking Citrobacter braakii and expressed in Aspergillus (CA). Nine experimental diets were fed as pellets to Ross 308 male broilers housed in 6 replicate cages, 16 birds per cage from 5-21 days of age. A low P diet (negative control, NC) with 2900 kcal/kg AMEn (broiler), 210 g/kg CP, 4.4 g/kg P, 1.8 g/kg ret. P, 2.5 g/kg phytate-P, and 6.5 g/kg Ca, was used. The phytase products and diets were analyzed for in vitro phytase activity according to the AOAC method by LUFIA, Oldenburg, Germany. Both phytases were added at 250, 500, 750 and 1000 FTU/kg on top of the NC diet. Feed and water were freely available. Performance was measured and at the end of the experiment tibiae were collected to determine ash content (of 4 birds per replicate). Results were analyzed by ANOVA. Statistical analyses of the phytase supplemented diets showed significant (P<0.001) differences between the phytases on FI, BWG, FCR and tibia-ash content. For FCR and tibia-ash content this phytase effect interacted (P<0.05) with dose level. BT phytase resulted on average in significantly 7% higher BWG and 5% higher FI compared to the CA phytase. For tibia-ash the difference between the phytases was significantly present at each dose level (8% higher for BT), while for FCR this was present at 500 and 1000 FTU/kg (3-5% lower for BT). Exponential curve fitting showed that 309, 287, 283 FTU of the BT was equal to 500 FTU CA phytase based on BWG, FCR and tibia-ash, respectively. It is concluded that based on a standardized in vitro activity (AOAC) the in vivo efficacy between recently developed 6-phytases can be highly different.

**Key Words:** Broilers, Phytase, Tibia-ash, Buttiauxella, 6-phytase

**T116 Modelling effects of Buttiauxella phytase on energy and amino acid utilisation in broilers.**

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A new 6-phytase derived from Buttiauxella spp. has previously been shown to be highly efficacious at improving phytate-phosphorus digestibility in broilers. As effects of phytase on amino acid (AA) and apparent metabolizable energy (AME) were previously shown to be correlated with the degree of phytate hydrolysis, it was of interest to quantify effects of Buttiauxella phytase (BP) on AA and AME. Seven different ileal and 7 total tract digestibility trials and were conducted. Trial methodology was to rear day-old broiler chicks in battery cages on a single starter feed to between 5 and 12 d of age following which birds received different test diets to 21-d of age that were deficient in Ca and P and supplemented with graded doses of BP. Test diets in the 7 ileal digestibility trials were corn/soy-based, while the 7 AME studies included basal diets with corn/soy (5 trials) or wheat/soy (2 trials). Ileal AA digestibility was determined at 21-d by collecting digesta from the anterior ileum from all birds in a pen. Energy digestibility was determined on pooled feces from a 3-day collection per cage from 17-20d of age. All observations from the 7 AA digestibility or 7 AME trials were combined and analysed as two separate datasets. Non-linear mixed models were used to describe the response in AA digestibility or AME to increasing analysed doses of BP and also evaluated effects of phytate and cereal source as additional factors. AA digestibility of all 18 AA measured increased (P<0.001) with added BP dose and was dependent on dietary phytate level. BP significantly increased AME in both corn- and wheat-based diets with the response in AME to added phytase reaching a plateau between 1000 and 2000 FTU/kg feed. In conclusion, BP significantly increased AME and AA digestibility in multiple studies in a dose-dependent manner with increasing phytase dose. The continued improvement in AA and AME at phytase doses above conventional levels of 500 FTU/kg should be considered in feed formulation to further increase nutrient digestibility and reduce feed cost.

**Key Words:** Phytase, Buttiauxella, Amino acid digestibility, AME, Broiler
T117 Comparative efficacy of Buttiauxella and E. coli phytase on energy, protein, amino acid and mineral digestibility, tibia ash and performance in broilers. V Ravindran1, Luke Barnard2, Peter William Plumstead2 1Monogastric Research Centre, Massey University, Palmerston North, New Zealand 2DuPont Industrial Biosciences - Danisco Animal Nutrition, Marlborough, UK

A 21-d broiler experiment compared the efficacy of two phytase enzymes; one from Buttiauxella spp. and the other a commercially available E. coli phytase. Male Ross 308 broilers were fed a common starter diet from 0-7d and allocated to battery cages based on similar body weight (BW). Dietary treatments fed from 8-21d were a positive control (PC; Ca 0.90% and Available P (AvP) 0.40%), a negative control (NC) reduced in Ca (0.73%) and AvP (0.20%) and 6 enzyme treatments based on the NC diet supplemented with 250, 500 and 1000FTU phytase/kg feed from Buttiauxella or E. coli. Results were analyzed by ANOVA with significance indicated at P<0.05.

The NC treatment had significantly poorer performance vs. the PC. The addition of 250 FTU Buttiauxella or 1000 FTU E. coli to the NC restored BW gain to the PC. Broiler FCR improved with increasing phytase dose and exceeded (P<0.05) that of the PC by 6 points when 1000 FTU of Buttiauxella was added to the NC. Tibia ash% was restored to similar levels as PC with 500 FTU Buttiauxella or 1000 FTU E. coli phytase. AME was similar between PC and NC and increased stepwise with each incremental phytase dose, being significantly greater from 1000FTU Buttiauxella vs. E. coli. Improvements in ileal and total tract P digestibility, Ca digestibility also supported a greater efficacy from Buttiauxella phytase.

In conclusion, both phytase sources were effective in enhancing performance and energy, amino acid and mineral digestibility in a step-wise manner to the highest dose of 1000 FTU. However, the new Buttiauxella phytase demonstrated a significantly greater efficacy than E. coli phytase when supplemented at the same level.

Key Words: Buttiauxella Phytase, E. coli Phytase, Broiler, Energy digestibility, Phosphorus

T118 Assess the efficacy of a phytase and 25-hydroxylcholecalciferol (25-OH-D3) on mineral metabolism and performance of broilers fed a corn-soybean diet. Rafael Hermes1, Thiago Pereira Ribeiro2, Ivânio Bueno2, Diego Surek2, Fabiano Dahlke3, José Otávio Berti Sorbará1, Alex Maiorka2 1DSM Nutritional Products, Sao Paulo, Brazil 2Departamento de Zootecnia, Universidade Federal do Paraná, Curitiba, Brazil 3Departamento de Zootecnia e Desenvolvimento Rural, Universidade Federal de Santa Catarina, Florianópolis, Brazil, 4DSM Nutritional Products Ltd., São Paulo, Brazil

A trial was conducted to determine whether a higher dose of OptiPhos phytase and dietary 25-OH-D3 (25-OH-D3) on mineral metabolism and performance of broilers corn-soybean meal diets, from 1 to 41 days old. To reach this objective, 792 one-day-old chicks (Ross) were randomly distributed in 4 treatments (9 replicates each one): Positive Control, optimal nutritive levels (PC); Negative Control, reducing 0.15% nPP (NC); Phytase (200ppm or 1000 FTY/kg) in NC diet up to 41d of age; and Phytase (1000 FTY/kg) in NC diet up to 21d then Phytase (800ppm or 4000 FTY/kg) up to 41d combined with the withdrawal of dicalcium phosphate from diet (4000PHY). The phytase (from Citrobacter braakii) used in this study was RONOZYM® HiPhos-M (DSM Nutritional Products Ltd.). Animal performance was weekly recorded and at the end of experiment, tibial bone ash and P content were measured. Data were analyzed by ANOVA and means compared by Tukey test at 5% of probability. Treatments PC and 4000PHY presented higher (P<0.05) BW (2617g and 2692g, respectively) than NC (2470g), but it was not statistically different from 1000PHY (2566g). Also for FCR, PC (1.703) presented better (P<0.05) results than NC (1.734) and 1000PHY (1.738), although it was not statistically different from 4000PHY (1.718). The relative contents (%) of tibial bone ash and phosphorus were lower (P<0.05) in NC (40.6% and 7.1%) than PC (43.1 and 7.9); 1000PHY (43.1 and 7.8); and 4000PHY (42.7 and 7.8), respectively. The use of 4000PHY in the last 21d and without any inorganic P presented similar performance than PC treatment; therefore resulting in a reduction of production cost of 2 cents of dollar per kilogram of live broiler weight.

Key Words: phytase, inorganic phosphorus, broilers, costs reduction

T120 Efficacy of a Higher Dose of OptiPhos® Phytase and dietary phosphorus concentration on broiler performance S.A. Adedokun1, C. Nelson1, M. Roux2, N. Augspurger2, J.T. Applegate1 1Department of Animal Science, Purdue University, West Lafayette, IN 2Enzyvia, LLC, Sheridan, IN

A trial was conducted to determine whether a higher dose of OptiPhos phytase (1000 FTY/kg) would improve performance beyond a phosphorus (P) adequate diet. The experiment was designed with 4 dietary treatments (corn/SBM) fed from 0-14, 14-28, and 28-40 d, respectively,
including: a high non-phytate P (nPP; HP; 0.49, 0.45, and 0.36); near requirement nPP (REQ; 0.49, 0.32, and 0.25), the high nPP with 1000 FTU OptiPhos/kg less 0.12% nPP (HP+PHY; 0.40, 0.32, and 0.24%), and the near requirement nPP with 1000 FTU OptiPhos/kg less 0.12% nPP (REQ+PHY; 0.40, 0.23, and 0.13%) (values = determined nPP). Phytase supplementation improved broiler BW over the REQ at 14, 28, and 40 d of age by at least 4.7, 3.9, and 4.6% (P < 0.05). Interestingly, broiler BW gain to 28 d of age was 76 g (5%) greater for the HP+PHY vs. the HP diet without phytase. Similarly, gain:feed from 0 to 40 d of age was improved by phytase supplementation to the HP+PHY vs. the REQ diet alone (0.67 vs. 0.63; P < 0.05). At 40 d of age, 6 median BW birds were euthanized for tibia ash and breast meat yields. Diet had no impact on breast meat yields. Tibia lengths were measured and cut into three portions: proximal and distal epiphysis (upper and lower 25%) and diaphysis (mid-50%). Tibia portions by pen were dried, defatted, and ashed; thereby allowing for determination of total and portion bone ash on a dry-defatted basis. Tibia ash (epiphysal, diaphysal, or whole bone) as a percentage of dry-defatted weight was not significantly affected by diet (P > 0.05). In summary, this experiment supports the extraphosphoric effects of 1000 FTU of OptiPhos phytase/kg diet based on broiler BW to 28 d beyond what could be explained by dietary nPP safety margins alone.

Key Words: Broiler, Phosphorus, Phytase, Tibia Ash

T121 Effect of Supplemented Phytase on Phytate Phosphorus from Feedstuffs of Vegetable Origin in Broiler Rations Saima Naveed*, Rizwan Akram, Talat Naseer Pasha, Makhdoom Abdul Jabbar, Yasir Allah Dita University of Veterinary & Animal Sciences, Lahore, Pakistan

This research examined the effects of phytase on PP of vegetable origin feedstuffs with deficient phosphorus by using no exogenous source of phosphorus. For this a 1200 day-old commercial broiler chicks from 1 to 35 days of age were fed with 8 dietary treatments (A, B, C, D, E, F, G, H) and six diets (-ve control diet) by using different diets of phytase with two different levels (500 and 1000 FTU/kg of feed). Body weight gain, feed intake, feed conversion ratio (FCR), plasma calcium and phosphorus, were studied. The results of the experiment revealed that body weight gain, feed intake, feed conversion ratio (FCR), plasma calcium and phosphorus, of group D were significantly higher than group A, C, F, E, G, H and B, (P < 0.05). The performance of group D were comparable with that of group A (+ve control). A significant difference was observed between A and D groups. Birds also responded differently to different brands of phytase supplemented at levels of 500 & 1000 FTU/kg of feed. Therefore, with supplementation of phytase it is possible to use maximum phytate phosphorus of vegetable origin feedstuffs and to reduce dietary levels of phosphorus and other minerals to below the recommended levels of feeding standards of NRC.

Key Words: Phosphorus, Phytate, Phytase, Broilers

T122 EFFECT OF ENZYMES TREATMENT AND FERMENTATION ON THE UTILIZATION OF COCOA BEAN SHELL BY BROILER CHICKS Martha Olumide1, Rasheed Hamza2 1Department of Animal Science, University of Ibadan, Ibadan, Nigeria 2Department of Chemical Sciences, Crescent University, Abeokuta, Nigeria

Cocoa (Theobroma cacao Lin) bean shell (CBS) is a waste product from the chocolate and cocoa processing industries, the disposal of which is causing problems. CBS has a potential to be used as a source of protein and energy substitute for grains in poultry diets. However, there is paucity of information on the extent of its replacement value for maize in poultry diets.

In a 3 x 4 factorial experiment, 390 day-old broiler chick were randomly allocated to 13 diets of three replicates with 10 birds each and 12 test diets in which maize was replaced with 5.0, 10.0, 15.0 and 20.0% of Raw CBS (RCBS), enzymes rovabio treated CBS (ECBS) and CBS fermented by solid state (FCBS), respectively, with a common control. The experiment lasted eight weeks. Feed intake (FI), feed conversion ratio (FCR), carcass Characteristics, hematology and serum biochemistry were monitored. Results revealed that fermentation and addition of enzymes reduced theobromine to 0.72 and 0.81 respectively while the highest value was recorded for RCBS (0.85). The FI of broiler chicks fed FCBS was significantly (p<0.05) depressed. The FCR of broilers feed various levels of CBS in the diets differed significantly (p<0.05). However, dressing out percentage was not significantly affected and hematological parameters were similar. 10% dietary level of CBS Enzyme treated Cocoa bean shell effectively replaced up to 10% maize in broiler

Key Words: Cocoa bean shell., enzyme treatment, fermentation, performance, broiler chicks

T123 Effect of a commercial enzyme and dietary nutrients on apparent digestible and endogenous losses of threonine, cysteine, methionine, lysine, leucine, and protein in broiler chicks Sandro Cerbrate1, Karen Vignale1, Ricardo Ekmay2, Judith England1, Craig Coon1 1Department of Poultry Science, University of Arkansas, Fayetteville AR 2Department of Animal Science, Cornell University, Ithaca, NY

An isotope dilution technique using an 15N-enrichment method was utilized to determine endogenous amino acid and protein losses. Chicks were pair-fed isocaloric diets from 1 to 21 d with increasing levels of fat (6, 8, 12, 13%EE), protein (24, 27.5, 31%CP) or fiber (14, 16, 18NDPF) by adding poultry fat, soybean meal, pro-plus, or barley. Each of the test diets were fed with and without the addition of 0.05% Rovabio1 Max (Xylanase, B-glucanase, and phytase). Chicks were orally infused with five labeled amino acids for five days from 17 to 21 days of age. 15N-threonine, 15N-cysteine, 15N-methionine, 15N-lysine, and 15N-leucine were infused orally each day at a level of 2% of daily requirement (grams per day) for threonine, cysteine, methionine, lysine, and leucine. Endogenous flow rate (EFR) is defined as APEfinal / APEfinal where APEfinal or plasma (atom percent excess) = APElabeled AA / APEunlabeled AA and endogenous losses (EL, grams / kg DMI) calculated as AA or CP final x EFR x (TiO2final / TiO2initial). An EFR average for protein was obtained from the five labeled amino acids. The apparent ileal amino acid and protein digestibility values of feed ingredients and enzyme were determined by regression method. In general, the apparent ileal digestible amino acids and protein were increased with increasing dietary protein and fat. The apparent ileal digestible threonine, methionine+cysteine, lysine, and protein from the added enzymes were 0.04, 0.03, 0.04, and 0.89%, respectively. The EL of threonine, cysteine, and protein was reduced from 0.838 to 0.544, 1.775 to 1.198, and 33.1 to 24.7, g/kg DMI, respectively, by the added carbohydrases, representing a saving of 4.3, 15, and 4.2% respectively of the broiler grower dietary digestible AA requirements. The largest EL reductions of threonine and cysteine imply that mucin secretions were reduced with the added exogenous carbohydrase enzymes because it is known that threonine and cysteine are 1st and 3rd most abundant AA in mucin respectively. The EL of leucine was influenced by the dietary nutrients in the test diets. The EL of leucine was increased with increasing dietary fat, protein, or fiber. Leucine is known to be the 3rd most abundant AA in endogenous proteins secreted from the pancreas. Thus, it is believed that endogenous losses of AA caused by the additional dietary protein, fat, and fiber are
mainly regulated by pancreatic secretions. Amino acid requirements of the broiler should be adjusted according to the endogenous losses because amino acid digestibility coefficients are not constant.

**Key Words:** endogenous losses, isotope dilution method

**T124 Effect of RONOZYME® ProAct and enzyme combinations in commercial diets on live performance of broilers under a coccidiosis challenge** Leonel Mejia1, Nelson Ward1, Marc de Beer1, Greg Mathis2 1DSM Nutritional Products, Parsippany, NJ 2Southern Poultry Research, Inc., Athens, GA

A randomized complete block design study evaluated the supplementation of RONOZYME ProAct protease with and without carbohydrase enzymes on the performance of broilers exposed to a live coccidia vaccine. Two thousand one hundred and sixty Cobb × Cobb 500 male broilers were allotted to 48 pens of 45 broilers each. The 3-phase diets were composed of corn, soybean meal, meat & bone meal and corn DDGS, with the inclusion of a phytase enzyme, and formulated to simulate commercial nutritional specifications. There were eight blocks with six randomized treatments. Fed across all dietary phases, the treatments were (1) positive control, in which chicks were vaccinated with Coccivac B and fed 60 g of Salinomycin/ton of feed (PC); (2) negative control, in which chicks were vaccinated with Coccivac B (NC); (3) NC plus 200 ppm of RONOZYME ProAct (NC + ProAct); (4) NC plus 200 ppm of RONOZYME ProAct and 200 ppm of RONOZYME AX (NC + ProAct + AX); (5) NC plus 200 ppm of RONOZYME ProAct and 160 ppm of RONOZYME WX (NC + ProAct + WX); and (6) NC plus 200 ppm of RONOZYME ProAct plus 100 ppm of ROXAZYME G2 (NC + ProAct + Roxazyme). All cocci vaccinations were at the same recommended dose. Feed and water were provided ad libitum. Broilers and feed were weighed on d 0, 16, 32, and 42 and body weight (BW) gain, feed consumption, and feed conversion ratio (FCR) were calculated. BW gain was increased (P<0.0002) and FCR was improved (P=0.0001) when RONOZYME ProAct was fed alone or in combination with other enzymes at 32 d of age. At 42 d of age, BW gain was reduced (P=0.0001) in broilers fed the NC diet, which had no enzyme inclusion. In addition, the NC + ProAct + Roxazyme dietary treatment significantly improved (P<0.0001) BW gain at 42 d of age by 4.2% over the NC, with a 4.5% improvement in FCR. Mortality was unaffected (P>0.05) by the dietary treatments. Supplementing commercial diets with RONOZYME ProAct alone or in combination with other enzymes significantly improved live performance in broilers at 32 and 42 d of age. The most effective treatment was the NC + ProAct + Roxazyme (multiple carbohydrase product) which completely overcame the performance depression imposed by coccidia challenge.

**Key Words:** broiler, carbohydrase, coccidiosis, enzymes, protease

**T125 The effect of enzymes and direct-fed-microbial (DFM) supplementation of diets containing 6% and 18% DDGS on the growth performance, gut morphology, and mucin secretion in turkey hens.** Ramon Malheiro1, Ayuub Ayoola, Peter Ferket, Jesse Grimes Department of Poultry Science, North Carolina State University, Raleigh, NC

An experiment was conducted to evaluate the effect of supplementation of an enzyme blend containing xylanase, amylase, and protease (2000 U xylanase/kg, 200 U amylase/kg, and 4000 U protease/kg); (Axtra® XAP, Danisco Animal Nutrition) in conjunction with spores of three strains of Bacillus subtilis direct fed microbial (DFM; Enviva Pro®; Danisco Animal Nutrition) in corn-DDGS-SBM diets in turkeys. Positive (PC) and negative (NC) control diets, differing by 100 kcal ME/kg, were formulated to contain either 6% or 18% DDGS. The NC diets were supplemented with nothing, XAP or XAP+DFM to produce 6 NC diets and 2 PC diets. The 8 dietary treatments were each randomly assigned among 6 replicate pens of 18 female Hybrid Converter turkey hens and fed ad libitum until 12 weeks of age. Body weights (BW) and feed consumption (FI) were recorded at 2, 4, 6, 8, 10, and 12 wks of age. Four birds per treatment were euthanized at 4 and 6 wks to collect jejunal tissue samples for histological assessment. Ileal tissues were also taken to quantify mucin secretion at week 6. DDGS levels did not affect BW through to 10 wks, but 18% DDGS inclusion reduced 12 wk BW (p<0.05) without affecting FCR. Although the PC diets resulted in better 12 wk FCR than the NC diets, there were no differences in BW. Dietary XAP supplementation improved BW throughout the experimental period (p<0.05), but it improved FCR only from 0-2 wks of age. Dietary supplementation of DFM with XAP increased BW and FI (p<0.05) in comparison to the other treatment only at 6 wk. Dietary treatment had minimal effect on mucin secretion, but the addition of XAP to the 18% DDGS NC diet reduced the ileal mucin secretion as compared to the other 18% DDGS treatments. Dietary inclusion of XAP reduced jejunal muscularis thickness, crypt depth, and villous tip width at 6 wks (p<0.05). Dietary supplementation of XAP and DFM may improve early growth performances by benefiting mucosal development and reducing mucin secretion, and help maintain growth performance when dietary ME is reduced by 100 kcal/kg, especially when the diets contain higher levels of DDGS.

**Key Words:** XAP, DDGS, jejunum villi morphology, ileum mucin, turkey
P127 Molecular characteristics of Salmonella enterica serovar Enteritidis isolated from poultry products in Jordan  Saad Gharaibeh*, Aseel Issa, Ahmad Al-Majali  Jordan University of Science and Technology, Faculty of Veterinary Medicine, Irbid, Jordan

The aim of this study was to isolate and type Salmonella enterica serovar Enteritidis from poultry and its products. Three hundred samples have been randomly collected for this investigation. Samples were obtained from whole broiler carcasses (150) and eggs (150). Twenty-four isolates of Salmonella Enteritidis were obtained from the above samples. Four isolates were from eggs and twenty isolates were from broiler meat. These isolates were analyzed by pulsed-field gel electrophoresis after digestion with XbaI according to CDC Pulse Net Protocol. The results demonstrated 2 clusters (JEGX01001 and JEGX01002) with the first pattern being the predominant. The level of overall relatedness, between the two major clusters was 95%. The pattern (JEGX01001) is also the dominant types in Salmonella Enteritidis isolates from human cases in Jordan. In addition, these isolates were phage typed and the prevalent phage type was PT4. Three of these isolates were resistant to nalidixic acid. The remaining isolates were susceptible to 17 different antimicrobial agents. In conclusion, the present study demonstrates the details of 24 Salmonella enterica serovar Enteritidis isolates from poultry and poultry products and their relatedness to isolates obtained from human cases.

Key Words: Salmonella, Jordan, Broiler, PFGE, Phage type

P128 Effect of colorant and lighting on vaccination efficiency of a spray-applied live Mycoplasma gallisepticum vaccine  J. D. Evans*, J. L. Purswell, S. A. Leigh, S. D. Collier, S. L. Branton  USDA-ARS South Central Poultry Research Unit, Mississippi State, MS

Within the table egg sector of the poultry industry, live attenuated vaccines are utilized to reduce economic losses associated with Mycoplasma gallisepticum (MG)-induced disease. These may be applied on an individual basis or via mass vaccination techniques. Although mass vaccination techniques reduce associated time and labor inputs, they are comparatively more inefficient in vaccine delivery. Post-delivery preening may serve as an additive means to increase the uptake of live MG vaccines applied via spray vaccination, a mass vaccination technique. As preening behavior may be manipulated by inclusion of specific light regimens or incorporation of colorants in the delivery solution, these factors were investigated as means to increase the vaccination efficiencies of a live MG vaccine. To this end, Hyline W36 layer hens (n=320) were equally divided among four identical isolated rooms of an egg layer facility and placed individually in layer cages. Two lighting treatments (constant vs. variable) and two vaccine suspension and delivery solutions (transparent Spray-Vac® vs. dye-containing Spray-Vac® Spectrum) were tested in a 2 x 2 factorial design. A live MG vaccine (Poulvac® Myco F) was spray delivered at 13 woa. Preening events were measured following lighting treatments pre- and post-vaccination and vaccination efficiencies were assessed by rates of SPA-related seroconversion at 6 wks post-vaccination. Results associated with pre- and post-vaccination preening demonstrated an increase in preening activity with the variable light treatment, but no difference in post-vaccination preening events associated with delivery solution treatment. However, SPA-related seroconversion rates were 22.5% and 25% for Spray-Vac® Spectrum (dye-containing) treatments for the constant and variable lighting treatments, respectively. While seroconversion rates associated with Spray-Vac® (colorless) treatments were both 8.75% independent of lighting treatment. Overall, results indicated a lighting effect on preening activity, but this additive behavior did not correlate to any increase in vaccination efficiency. However, suspension and spray application of a live MG vaccine in a dye-containing delivery solution (Spray-Vac® Spectrum) did correspond to an increase in vaccination efficiency when compared to that delivered in a transparent solution.

Key Words: Vaccine Delivery, Vaccination, Preening, Table Egg Layer, Mycoplasma gallisepticum

P129 Domestic goose model for West Nile virus vaccine efficiency testing  Mariana Sa e Silva1, Angela Ellis2, Kemal Karaca3, Jules Minke1, Robert Nordgren4, Shixuan Wu5, David Swayne6 1USDA-ARS Southeast Poultry Research Laboratory, Athens, GA 2Veterinary Medical Diagnostic Laboratory, College of Veterinary Medicine, University of Georgia, Athens, GA 3Pfizer Animal Health, Kalamazoo, MI 4Merial Limited, Duluth, GA 5USDA-ARS Arthropod-Borne Animal Diseases Research, Manhattan, KS

West Nile virus (WNV) is an emergent pathogen in the Americas, first reported in New York during 1999, and has since spread across the USA, Central and South America causing neurological disease in humans, horses and some bird species, including domestic geese. No WNV vaccines are licensed in the USA for use in geese. This study reports the development of a domestic goose vaccine efficacy model, based on utilizing multiple parameters to determine protection. To test the model, 47 geese were divided in seven groups: five different vaccine groups and two sham groups (challenged and unchallenged). Based on the broad range of results for individual metrics between the Challenged-Sham and Unchallenged-Sham groups, the best parameters to measure protection were morbidity, Clinical Pathogenicity Index (CPI), plasma virus positive geese on days 1-4 post-inoculation and plasma virus titers, and brain histological lesion rates and severity scores. Compared to the Challenged-Sham group, the fowlpox virus vectored vaccine with inserts of WNV prM and E proteins (vCP2000) provided the best protection with significant differences in all six metrics, followed by the two canarypox virus vectored vaccines with inserts of WNV prM and E proteins (vCP2017 and vCP2018) with four metrics of protection, WNV E protein with two metrics of protection and Oil-emulsion whole WNV with one metric of protection. These data indicate that domestic goose can be used in an efficacy model for vaccine protection studies using clinical, plasma virological and brain histopathological parameters to evaluate protection against WNV challenge.

Key Words: Efficacy, goose, vaccine, West Nile virus

P130 Effects of different prelay Mycoplasma gallisepticum vaccines in combination with an F-strain M. gallisepticum challenge overlay on the blood characteristics of commercial layers  Vanusa de Souza Godoy*, Roy Jacob1, Sharon Womack1, Scott Branton2, E. David Peebles1 1Department of Poultry Science, Mississippi State University, Mississippi State, MS 2USDA/ARS South Central Poultry Research Unit, Mississippi State, MS

Mycoplasma gallisepticum (MG) is a major and economically significant pathogen of avian species. The effects of prelay vaccinations of
from each aliquot was extracted by one of the two methods and the MG commercially available F-strain derived MG vaccines. Pullets each. A randomized control study design was used.

- A Newcastle disease vaccination program for White Leghorn type laying hens should be based on the degree of immunity necessary, the costs involved and the exposure to local field viruses.

Newcastle disease effects on poultry can be reduced by vaccination. We measured the antibody response and productive performance of vaccinated White Leghorn type laying hens challenged with the Chimalhuacan ND strain at 28 weeks old and observed for 5 weeks post challenge (wpc). Four groups of laying hens were vaccinated at one day old as follows: White Marek’s disease; Red Marek’s disease + Newcastle (killed virus); Green recombinant HVT-ND; and Yellow recombinant HVT-ND Vectormune®. Vaccination programs included five live NDV-IBV vaccines; Red group also received twice a NDV-AIV killed vaccine. Serum samples were collected and tested by ELISA (Af firiTech). Red group had the highest antibody titer at challenge which did not increase very much at one wpc, meanwhile all the other groups showed seroconversion. Egg production was variable at challenge (White= 54.17%, Red= 8.7%, Green= 25% and Yellow= 54.17%) due to transportation and housing stress and the Red group was heavily infested with external parasites that were transmitted to all other groups. After challenge, White group did not reach 80% mean production per week; Red group reached 95.65% two wpc and remained above 90% at five wpc; Green group peaked 85.12% at 3 wpc and almost reached 87% the remaining weeks; Yellow group reached 95.83, 92.86 and 95.24% at 3, 4 and 5 wpc. Only one hen from Green group showed nervous symptoms but did not die. All vaccination programs fully protected against mortality. The mean egg production in the 5 wpc was lower in White group (71.25%) than in Green (76.19%), Red (81.49%) and Yellow (85%). Shell-less and broken eggs were higher in White group (5%) than in Red (0.46%), Green (0.47%) and Yellow (0.84%). Three doses of killed and five of live ND virus avoided the drop in egg production and quality. Recombinant HVT Fusion ND vaccine plus live ND virus did not fully protect against drop in egg production and clinical nervous symptoms. Recombinant HVT-NDV plus live ND virus fully protected against clinical symptoms, although broken and shell eggs were almost twice than in Red and Green groups. Vaccination program based only in live ND virus (White group) protected against clinical symptoms, although broken and shell eggs were almost twice than in Red and Green groups. Vaccine program based on live in ND virus (White group) protected against clinical symptoms but not against drop in egg production and lay of shell-less eggs. A Newcastle disease vaccination program for White Leghorn type laying hens should be based on the degree of immunity necessary, the costs involved and the exposure to local field viruses.

Key Words: Newcastle disease, Laying hens, vaccination program, recombinant vaccine, challenge

P133 Development of competitive ELISA for detection of N1 antibodies against avian influenza and is use in a DIVA control strategy Jingyi Li1*,2, Maricarmen García1, Robert Jeff Hogan1 1Poultry Diagnostic and Research Center, University of Georgia, Athens, GA, USA 2Anatomy and Radiology, Department of Population Health, University of Georgia, Athens, GA

Avian influenza viruses (AIV) presents a continuous threat to domestic poultry world-wide. Vaccination has been recommended and used as an effective tool to control avian influenza (AI) outbreaks.
vantage about vaccination with killed virus vaccines is the difficulty to differentiate serologically infected birds from vaccinated birds. In the control of AI in addition to vaccination, monitoring of vaccinated flocks is vital, and the development of assays capable to differentiate infected from vaccinated animals (DIVA) still a need nowadays. The neuraminidase (NA) DIVA strategy requires vaccination with an inactivated vaccine with an homologous hemagglutinin to the circulating field strain and a heterologous neuraminidase subtype an assay that can detect antibodies specific to the NA subtype of the circulating virus.

The objective of this study was to develop a competitive N1-ELISA and determine its sensitivity and specificity to identify N1 virus vaccinated from N1 virus challenge chickens. With the help of baculovirus expression system, the N1 antigen of A/CK/Indonesia/PR7/2003 (H5N1) was generated. The recombinant N1 protein was injected into BALB/c mice, mice spleen cells were fused with myelomas, and 16 hybridomas were generated. Six of the 16 hybridomas lines secreted monoclonal antibodies to high titers, these were purified. We are currently analyzing the ability of these six monoclonal antibodies to compete with known positive and known negative N1 turkey and chicken sera and optimizing the competitive N1 ELISA. Once the competitive ELISA has been optimized, the ability of this assay to detect N1 antibodies in experimentally H1N1 vaccinated/H1N2 challenge, H1N2 vaccinated/ H1N1 challenge turkeys and H6N1 vaccinated/H6N2 challenge layers will be presented.

Key Words: Avian influenza virus, DIVA strategy, ELISA, monoclonal antibody, NA

P134 Recombinant Newcastle disease viruses: risk for reversion to virulence and spread in non-target species Krishna Hamal*, Diego Diel, Claudio L. Afonso, David Suarez, Patti J. Miller SEPRL/ARS/USDA, Athens, GA

The present study is being conducted to determine the risk associated with using live recombinant NDV(rNDV) vaccines in the field. The goals of this study are to 1) determine the risk of rNDV vaccines, containing an attenuated fusion (F) protein cleavage site, to revert back to a virulent virus phenotype; and 2) to assess the ability of rNDV vaccines to infect and spread in non-target species. Infection of 14-day-old embryonating chicken eggs (ECEs) with wild type NDV strains LaSota and Australia or with rNDV strains LaSota (rLaSota), or ZJ1 (rZJ1*Lento) (900 eggs/virus), resulted in the death of 65 (7.2%), 10 (1.1%), 23 (2.5%), and 6 (0.6%) embryos, respectively within 72 h pi. Sequencing of the F gene cleavage site revealed that, under our experimental conditions, all recombinant viruses are stable and did not revert to a virulent phenotype. Experiments to assess the ability of recombinant NDV vaccines to infect and spread in pigeons have shown that rLaSota and rLaSota/AIV-H5 are able to infect and spread in this species. All virus-inoculated birds shed the virus in oral and/or cloacal secretions and at least one out of four contact birds shed the virus for two or more days. These findings suggest that our system is suitable to assess the risk associated with rNDV vaccines.

Key Words: NDV, APMV-1, recombinant vaccines, virulence

P135 Development of a Genotype Specific Live Newcastle Disease Vaccine by replacing the Fusion (F) and Hemagglutinin-Neuraminidase (HN) Genes into a LaSota Vaccine Backbone Sivalis Cardenas Garcia1*, Diego Diel1, Leonardo Susta2, Eduardo Lucio Decanini2, Conrie Brown1, Qingzhong Yu2, Patti Miller3, Claudio Afonso3 1The University of Georgia, Athens, GA 2USDA ARS, Athens, GA 3Investigacion Aplicada, S.A. de C.V., Tehuacan, Puebla, Mexico

All Newcastle disease viruses (NDVs) are part of a single serotype; however, current vaccine strains display between 15 and 18% amino acid differences at the F and HN protein compared with current virulent viruses. Previous studies have shown that increased amino acid similarity between NDV vaccines and field viruses is important to decrease virus shedding after challenge. In the present study, a lentogenic recombinant virus was generated by replacing the F and HN genes from a genotype XIII virus circulating in Pakistan into the Lasota vaccine backbone (genotype II). The pathogenicity of the recombinant virus was attenuated by changing the fusion protein cleavage site. Intracerebral pathogenicity index, clinical signs, and virus shedding were also evaluated to determine if the vaccine virus was capable of replicating or causing disease in chickens. One day old SPF chicks were vaccinated with live virus and 14 days after vaccination were challenged with the homologous virulent virus from Pakistan to test its performance in comparison with the LaSota vaccine strain. Results from this experiments demonstrate that this experimental vaccine replicates in birds and does not cause disease; even more, this vaccine conferred 100% survival, prevented clinical signs, and decreased oropharyngeal virus shedding compared with the LaSota strain. In conclusion, this recombinant virus seems to be a good candidate to be used as live vaccine.

Key Words: NDV, vaccine, genotype XIII, recombinant, shedding

P126 Identifying Coronavirus in wild bird populations in America Brian Jordan*, Mark Jackwood Department of Population Health, University of Georgia, Athens, GA

Coronaviruses are enveloped, positive sense, single stranded RNA viruses that are highly infectious and distributed worldwide. They are difficult to control because of extensive genetic diversity and high mutation rates. Coronaviruses infect many species and were identified as the causative agent of the severe acute respiratory syndrome (SARS-CoV) outbreak in 2002. Native reservoirs for mammalian alpha and beta coronaviruses have been found in bats, but no reservoir for avian gamma coronaviruses has identified. Avian coronavirus Infectious Bronchitis Virus (IBV) is the causative agent of infectious bronchitis and is the most infectious disease of commercial poultry, making identification of natural reservoirs a priority. 700 allantoic fluid samples that were inoculated from HA negative cloacal swabs of wild birds across America were analyzed by qRT-PCR for a consensus sequence in the polymerase gene of coronaviruses. Samples were analyzed in pools of ten, and positive pools were tested individually. Upon individual sample analysis, no positives were detected. Henceforth, 364 primary cloacal swab samples were tested in pools of 5 and positive pools were tested individually. Positive individual sample PCR results were then sequenced to determine the similarity to known coronaviruses. Upon sequence analysis, no positive samples matched known coronaviruses, but rather aligned to bacterial genome contaminants in the primary sample material. From our testing, no coronaviruses were identified in wild birds across America.

Key Words: Coronavirus, Wild bird, Infectious bronchitis virus

P136 Circulating mononuclear cells from autoimmune vitiligo-prone Smyth line chickens exhibit altered innate immune responsiveness before onset of autoimmune vitiligo Kristen Byrnesc, Robert Dinglewicz, Gisela Erf Department of Poultry Science, University of Arkansas, Fayetteville, AR

Innate immunity, while not self-reactive, has been shown to play a role in the development of autoimmune diseases. The Smyth line (SL) chicken is an animal model for human autoimmune vitiligo. This pigmentation disorder results in post-natal development of white areas of the skin due to autoimmune destruction of melanin producing pigment cells (melanocytes). To compare innate immune activity in SL chickens that developed vitiligo (SLV) to those that did not (non-SLV), blood

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was collected from SLV and non-SLV chickens at 6 wks of age, when none of the chickens exhibited signs of vitiligo, and again at 14 weeks of age when half (n = 6) of the chickens had developed SLV. Peripheral blood mononuclear cells (PBMC) were isolated and cultured with and without lipopolysaccharide (LPS) stimulation to examine production of nitric oxide (NO) and reactive oxidative species (ROS), as well as, cytokine expression at the transcriptome-level by quantitative RT-PCR. Compared to PBMC from non-SLV chickens, SLV-PBMC contained higher proportions of monocytes and exhibited increased responsiveness to LPS-stimulation (i.e., higher NO production as well as increased iNOS, IL-1, IL-8, and IL-10 expression), particularly at 6 weeks of age. The elevated expression of IL-8 in unstimulated SLV-PBMC at 6 weeks suggests an activated state of circulating PBMC prior to SLV development. Independent of age and LPS-stimulation, ROS production and relative expression of IL-6 were similar in PBMC from SLV and non-SLV chickens (P > 0.10). The heightened innate immune responsiveness observed in SL chickens that eventually developed vitiligo suggests a role of innate immunity in vitiligo onset in this chicken model. Further research is under way to determine SLV responsiveness to other pathogens associated molecular patterns (e.g. peptidoglycan), both in the target tissue and blood.

Key Words: Innate Immunity, Vitiligo, Smyth line, Lipopolysaccharide, Autoimmune Disease

P137 Evaluation of intestinal absorption and skin deposition of xanthophylls in broilers challenged with Eimeria acervulina, E. tenella, and E. maxima

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Skin yellowness is one of the most important aspects considered in the broiler Mexican-market because it is related with a good healthy status of the flocks. Coccidiosis causes a decrease in integumentary oxy- carotenoids and in perceived color. An experiment was conducted to evaluate the effect of three different levels of spolulated oocyst (SO) inocula of Eimeria acervulina, E. tenella, and E. maxima on skin pigment deposition and bird performance in male and female broilers. Four hundred thirty two (216 females and 216 males) 21-d-old Ross 308 broiler chickens were randomly allotted to 4 treatments with 4 replicates or pens (2 males and 2 females) of 27 birds each. A 4 by 2 factorial was used (4 treatments & 2 sexes, male/female): 1) control, 2) Eimeria challenge (83,200 SO), 3) E. challenge (249,600 SO), and 4) E. challenge (499,200 SO). Diets were based on sorghum + soybean meal, and were added with 85ppm of xanthophylls of Aztec marigold flower. All nutrients were formulated according to recommendations of the primary breeder. Feed and water were provided ad libitum. At day 21, chicks of groups 2, 3, and 4 were orally gavaged with 1ml of the Eimeria inoculum that included E. acervulina (58%), E. tenella (22%), and E. maxima (20%). At 21 d of age and weekly, feed intake, pigment consumption, and feed conversion ratio were calculated in all the treatments. All birds were weighed at 21 and at the end of the experiment (49 d of age). Each week, skin pigment deposition was measured of 10 randomly selected birds from each of four pens per treatment. Data were analyzed using ANOVA and means were compared by Turkey test. At 49 days of age, weight gain was significantly different (P<0.05) among the control group and the other groups. Feed consumption was not significantly (P>0.05) different between treatments. However, FCR was significantly (P<0.05) better in the control group (1.9:1 and the treatment 4 had the higher (2.22:1) FCR. The lowest plasmatic levels of yellow xanthophylls corresponded to the control group (17.2µg/ml) compared to the treatments 2, 3 and 4 (19.4, 18.7, 20.1µg/ml respectively) (P<0.05). Skin pigmentation at 49 d of age was significantly better in females (20 b+) than males (18 b+) (P<0.01). There was not interaction between factors (P>0.05). According to the results of the experiments reported herein, skin yellowness and weight gain were significantly depressed by Eimeria infection. A mean reduction of 5.7 yellowness units (b+) and 188g of weight gain were found in all the infected treatments.

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Key Words: skin yellowness, coccidiosis, broiler, Aztec marigold flower

P138 Actigen® (a yeast cell wall derivative), an Antibiotic Growth Promoter program, or combination of both on performance of broiler chickens

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Actigen® is a yeast cell wall derivative, developed through the use nutrigenomics (changes in gene expression in intestinal cells) to be used as a broiler growth promoter. Three floor pen trials were conducted to compare the effects of Actigen to an AGP program on the live performance of broilers. All studies used commercial male broilers, which were reared on built-up litter. For coccidiosis control and to have a commercial type coccidiosis challenge, a coccidial vaccination or low level ionophore anticoccidial program were used. A randomized complete block design was used (LSD P<0.05) for each trial. There were three overlapping treatments across all 3 trials: 1. no additive control (CON); 2. Actigen® (ACT); and 3. AGP program. Two of the studies also compared these treatments to a combination program of ACT and AGP. The results from the studies were then averaged. At D 42, the birds fed the ACT or AGP programs compared to the Con fed birds had an increased body weight gain (BWG) of 88 and 90 g, respectively. Additionally, the adjusted feed conversion (FCR) was improved when birds were fed either the ACT (4.8 points) or AGP (6.0 points) programs compared to the birds on the CON treatment at D 42. The combination of ACT with AGP significantly improved both BW (110g) and FCR (9.9 point) over the CON. This combination treatment was also significantly better than ACT or AGP alone. Actigen® or the AGP programs were significantly beneficial in improving BWG and FCR. However, the combination program of Actigen® with AGP was the most effective treatment in enhancing live performance.

Key Words: Actigen, Yeast cell wall, Broiler, antibiotic, performance

P139 Effects of feeding diets naturally contaminated with deoxynivalenol (DON), aflatoxin B1 (AFB1), and/or fumonisin (FUM) on parameters of mycotoxicosis evaluated at necropsy

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The effect of feeding pre-peak production laying hens diets formulated using corn naturally contaminated with DON, AFB1, or FUM on indices of mycotoxicosis or reproductive development were evaluated in a 10 week feeding trial. Relative weights of liver, kidney, ovary, and ovitut, in addition to numbers of large yellow follicles (LYF) and small yellow follicles (SYF) were recorded during necropsy at 4 and 10 weeks.
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 x 2 factorial with 4 mycotoxin diets with or without a commercially available deactivating compound (DC). Mycotoxin challenge diets with 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. Relative liver weights were increased (P<0.05) in AFB1/FUM challenge, but not in other (P>0.05) groups at both necropsy time points. At week 4, AFB1/FUM challenge relative kidney weight was increased (P<0.05) compared to controls and increased (P<0.05) compared to both control and DON challenge groups on week 10. There was an increased (P<0.05) number of SYF observed in AFB1+FUM challenge compared to DON challenge on week 10. Relative weights of ovaries or oviduct were not affected. An interaction with DC inclusion was not observed in these parameters.

Key Words: aflatoxin, deoxynivalenol, fumonisin, organ weights, necropsy

P140 Evaluation of tibial dyschondroplasia development in broiler chickens fed diets containing 25 hydroxilocalciferol – ultrastructural characteristics
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This research was carried out to evaluate the performance and the development of tibial dyschondroplasia (TD) in broilers from 1 to 21 days. Four hundred forty day-old male chickens, from broiler breeders aged 60-62 weeks, were randomly distributed in a 3x3 factorial arrangement, resulting in 11 treatments with four replicates of 10 birds each. The factors evaluated were: bird strains (Ross 308, Cobb 500, and Hybr), levels and sources of vitamin D (D3/kg without 25-(OH)D3; 1250UI D3/kg with 69mg 25-(OH)D3/t, and 3000UI D3/kg with 69mg 25-(OH)D3/kg), and two control treatments containing calcium and phosphorus levels according to Rostagno et al. (2005) with 3000UI D3/kg with 25-(OH)D3 and 3000UI D3/kg with 69mg 25-(OH)D3/kg of feed. Performance and bone characteristics were evaluated. From 1 to 21 days, the results showed that weight gain, feed conversion, and bone calcium and phosphorus concentrations were not affected by the treatments, however, feed intake was higher for factorial than control treatments. Bone breaking resistance was not influenced by the treatments and there were no typical lesions of TD. In conclusion, it was not observed TD development in broilers from 1 to 21 days according to experimental procedures of this research.

Key Words: Tibial dyschondroplasia, broiler chickens, growth plate

P141 Bone evaluation in broilers undergoing diet with 25 hydroxilocalciferol
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The success of poultry production is partially due to nutrition, and in recent decades, the average daily weight gain has been increased, promoting the incidence of locomotor disorders. The use of vitamin D has been widely studied in poultry in an attempt to reduce the losses caused by locomotion problems. Thus, the objective of the present work was to evaluate morphologic aspects of bone tissue of broilers and the development of tibial dyschondroplasia through scanning electron microscopy examination. For this purpose we used 468 male young chicken with one day of age, from commercial strains and raised in metal battery cages. The animals were distributed in a completely randomized design, placed in a 3x3 factorial scheme (three strains: Ross, Cobb and Hybro; three levels of vitamin D3 included in the diet: 1250UI D3/kg without 25-(OH)D3; 1250 UI D3/kg with 69 mg of 25-(OH)D3/t and 3000 UI D3/kg with 69 mg of 25-(OH)D3/t). Morphological analysis showed that the treatments did not influence the development of tibial dyschondroplasia, since the birds did not presented the disorder. It was concluded that, despite the broilers were raised in metal cages, their bones were ranged within normal patterns, regardless the levels of vitamin D3 in the diet and the studied strains.

Key Words: bone tissue, chondrocytes, locomotor disorders, morphol-
P143 Interactive effects of a pre-lay F-strain Mycoplasma gallisepticum inoculation with those of a 24 h fast during lay on the performance and blood characteristics of commercial egg laying hens

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The interactive effects of an F-strain Mycoplasma gallisepticum (FMG) inoculation at 12 wk of age with those of a 24 h fast during lay on the BW, mortality, egg production (EP, % hen day), and blood characteristics of commercial egg laying hens at 34 and 46 wk of age were investigated. Blood parameters measured were whole blood hemato-crit; plasma protein concentration (PP); serum total cholesterol, triglycerides, and calcium concentrations; and percentage serum cholesterol recovered in very low, low, and high density lipoprotein fractions. In the 4 d period following the 24 h fast during lay, significantly reduced EP across wk 34 and 46. The EP of the unfasted and fasted birds was 85.3 ± 3.72 and 73.3 ± 4.10 %, respectively. Also, at the time of bleeding subsequent to the fast, bird BW in the unfasted and fasted groups was 1,511 ± 24.8 and 1,426 ± 24.8 g, respectively. However, there were no significant interactive effects involving FMG inoculation and fasting (inoculation × fasting or age × inoculation × fasting) on any of the parameters investigated including the blood characteristics of the hens. These results suggest that a pre-lay (12 wk of age) FMG inoculation does not influence the effects of a 24 h fast during lay (34 and 46 wk of age) on the performance and blood characteristics of commercial layers.

Key Words: blood, fasting, layer, lipid, Mycoplasma gallisepticum

P144 Egg storage and incubational temperatures impact parthenogenetic development in Chinese Painted quail eggs

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Parthenogenesis, embryonic development of an unfertilized egg, has been documented in a few avian species. Also at standard incubational conditions, parthenogenetic development has been shown to alter pH, ion concentration, and gas exchange within the egg albumen as incubation progresses each day. Additionally, parthenogens often exhibit delayed embryonic development at the moment the egg is laid and throughout incubation. It is possible that parthenogenetic development may be accelerated by increasing egg storage or incubational temperatures. Therefore, the objective of this study was to determine if storage and incubational temperatures impact the incidence and size of parthenogenetic development in Chinese Painted quail eggs. Virgin quail hens were individually caged, and eggs were collected and labeled daily. Eggs were divided among 3 different storage temperatures (20, 30 or 40ºC). After storage, eggs from each storage temperature were divided between 2 incubational temperatures. One half of the eggs were incubated at 37ºC for 10 d, and the other half of the eggs were incubated at 42ºC for 48h then returned to the standard incubational temperature of 37ºC for the remaining 8 d of incubation. After 10 d of incubation, albumen PH was measured for each egg, and embryo size was determined for eggs exhibiting parthenogenesis. At an incubational temperature of 42ºC, eggs stored at 30ºC yielded a lower percentage of parthenogens than eggs stored at 20ºC. However when eggs were stored at 20ºC, incubation at 37ºC yielded a higher albumen pH than incubation at 42ºC. As storage temperature increased, parthenogen size increased when eggs were incubated at 37ºC. Also when eggs were stored at 30ºC, embryo size was larger with incubation at 42ºC as compared to incubation at 37ºC. In conclusion, both egg storage temperature and incubational temperature impact the incidence of parthenogenesis and the size of the parthenogenetic embryo.

Key Words: parthenogenesis, egg storage, incubation, embryo

P145 Effects of Actigen® on the performance, carcass traits and immune response of broilers reared under sanitary stress conditions

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In an environment highly contaminated by pathogenic bacteria the challenge caused by these microorganisms can cause significant changes to the balance of intestinal microbiota and can promote bacterial proliferation in the intestine, which often causes inflammatory responses leading to productivity losses and increased mortality. A total of 1,440 Cobb 500 one-day-old male chicks reared on re-used poultry litter were used to evaluate the effects of supplementing Actigen® (Alltech Inc.) on performance, carcass traits and immune response. The birds were vaccinated against Marek’s disease and avian Bolha. A completely randomized experimental design was used, with 6 treatments, 8 replicates and 30 birds per replicate (boxes). The treatments consisted of a negative control without antibiotics and Actigen® from 1-42 days of age; a positive control with antibiotic (avilamycin) from 1-21 and 22-42 days of age; Actigen® from 1-21 and 22-42 days of age (without antibiotics); Actigen® + avilamycin from 1-21 and 22-42 days of age; Actigen® + avilamycin + halquinol from 1-21 and 22-42 days of age; and Actigen® + avilamycin + halquinol from 1-21 and 22-42 days of age. The birds fed the diet without growth promoters showed lower weight gain (P<0.05) from 1-21 and 1-42 days of age compared with birds fed diets containing antibiotics, Actigen® and/or the combination of growth promoters. Feed conversion from 1-21 days was better (P<0.05) in the birds fed growth promoters, while from 1-42 days the combination Actigen® + avilamycin numerically improved feed conversion (P=0.05) compared with the other treatments. There were no treatment effects (P>0.05) on carcass yield and antibody titers. These results indicate that dietary inclusion of any of the growth promoters studied resulted in higher weight gain and better feed conversion ratios from 1-21 days of age. The use of avilamycin + Actigen® from 1-42 days tended to improve feed conversion. The combination of avilamycin and Actigen® offers an alternative for reducing the inclusion of AGPs without loss of performance.

Key Words: Antibiotics, growth promoter, antibiotics, challenge

P146 Aqueous extract of lemon grass on the loss by exudate quantity of broilers breast fillets on pre slaughter stress

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The research was carried out on Experimental Aviary of the Agrarian Sciences Faculty, in University of Grande Dourados, Brazil. Were used 2594 broilers of lineages Ross® and Cobb®, distributed in randomized design assigned in factorial arrangement of 3x2x2, with three different concentrations of effusion of Lemon Balm Grass (Cymbopogon citratus Stapf) (0, 1 and 5 g/mL), both sexes and two lineages. The broilers were subjected to fasting food pre slaughter of six hours, when they received in the water diet with effusion of lemon balm grass. Later the animals were slaughtered conventionally and carried out sampling to qualitative analyses of meat indicative of stress pre slaughter and...
PSE syndrome. Were held analyses of loss by exudates with 48 and 72 hours post mortem, and the results were influenced to variable research. There was a significant difference between treatments (P<0.05), when males of the lineage Ross® obtained less loss by exudate when compared the lineage Cobb®. When compared the levels of lemon balm grass grass effusion, obtained less loss by exudate for the level of 5 g/mL for males and females of the lineage Ross®. The lemon balm grass demonstrated influence about the characteristic of quality meat related the PSE syndrome, reducing the loss by exudate the broilers breast under pre slaughter stress.

**Key Words:** phytotherapy, stress, slaughter

**P147 Broilers welfare with water diet at effusion of Lemon Balm Grass (Cymbopogon citratus Stapf)** Rodrigo Garófallo Garcia¹, Ana Flávia Basso Royer, Mayara Rodrigues de Santana, Rodrigo Borille, Irenilza de Alencar Nãis, Ibiara Correia Lima Almeida Paz, Fabiana Ribeiro Calda, Marília Carvalho Figueiredo Alves, Roselaine Ponso, Nílsa Duarte Silva Lima, Marta Moi, Bruna Barreto, Luiz Fernando de Souza Alves Universidade Federal da Grande Dourados, Dourados, Brazil

The research was carried out on Experimental Aviary of the Agrarian Sciences Faculty, in University of Grande Dourados, Brazil. Were used 2594 broilers of lineages Ross® and Cobb®, distributed in randomized design assigned in factorial arrangement of 3x2x2, with three different concentrations of effusion of Lemon Balm Grass (Cymbopogon citratus Stapf) (0, 1 and 5 g/mL), both sexes and two lineages. The broilers were subjected to fasting food pre slaughter of six hours, when they received in the water diet with effusion of lemon balm grass. Later the animals were slaughtered conventionally and carried out sampling to qualitative analyses of meat indicative of stress pre slaughter and PSE syndrome. Indicative characteristics were assessed pre slaughter stress, such as the loss by exudate, water holding capacity, loss by cooking and shear strength. The results were analyzed from the comparison of averages with Tukey test of 5%. There was a significant difference between treatments on the variables analyzed (P<0.05). The lemon balm grass under 5 g concentration in drinking water of broiler line Ross demonstrated a reduction over the loss by exudate and loss by cooking. For males the level of 5 g got less capacity water retention with post mortem 72 hours. The inclusion of vegetable extract lemon grass in the form of outpouring water diet of broiler during the fast food proved to be efficient in the improvement of meat quality parameters stress linked to pre slaughter the lineage Ross.

**Key Words:** phytotherapy, stress, welfare, stress, slaughter

**P148 Surface temperature of broilers with Water Diet at Lemon Balm Grass (Cymbopogon citratus Stapf)** Rodrigo Garófallo García¹, Ana Flávia Basso Royer, Mayara Rodrigues de Santana, Rodrigo Borille, Irenilza de Alencar Nãis, Ibiara Correia Lima Almeida Paz, Fabiana Ribeiro Calda, Marília Carvalho Figueiredo Alves, Roselaine Ponso, Nílsa Duarte Silva Lima, Marta Moi, Eclêdia da Silva Cabral, Estefânia Victoria Chiarelli Mattana, Luiz Fernando de Souza Alves Universidade Federal da Grande Dourados, Dourados, Brazil

The research was carried out on Experimental Aviary of the Agrarian Sciences Faculty, in University of Grande Dourados, Brazil. Were used 2594 broilers of lineages Ross® and Cobb®, distributed in randomized design assigned in factorial arrangement of 3x2x2, with three different concentrations of effusion of Lemon Balm Grass (Cymbopogon citratus Stapf) (0, 1 and 5 g/mL), both sexes and two lineages. The broilers were subjected to fasting food pre slaughter of six hours, when they received in the water diet with effusion of lemon balm grass. To infrared thermography collected of the broilers with 42 days of age, with the two collected being in the group and individually in rich treatment. The results analyzed by infrared thermography showed different surface temperatures, and the higher temperatures that are located in areas devoid of feathers and the results of the infusion of lemon grass (Cymbopogon citratus Stapf) in drinking water do not exerted influence to reduce the surface temperature of the broilers during the pre-slaughter period.

**Key Words:** phytotherapy, birds, welfare, stress, slaughter

**P149 Comparison of locomotor capacity of broilers reared on environments with different light sources** Rodrigo Garófallo Garcia¹, Karla Andrea Oliveira de Lima, Irenilza de Alencar Nãis, Rodrigo Borille, Ibiara Correia Lima Almeida Paz, Fabiana Ribeiro Calda, Mayara Rodrigues de Santana, Marta Moi, Ana Flávia Basso Royer Universidade Federal da Grande Dourados, Dourados, Brazil

For meeting the need of reducing the electric energy expenses, different types of light lamps has been produced nowadays being more efficient than usual incandescent light bulbs which are still used in broiler production. However, there is a lack of research about the use of different types of lamps and their influence on the housing and welfare of broilers. This study aimed to evaluate and compare the locomotor capacity of broilers reared under environments with different light sources, incandescent, sodium vapor and fluorescent, treatments G1, G2 and G3, respectively. The houses were divided into nine equidistant points, and in each of them, 15 birds had their locomotion capacity evaluated at 35 days of age. The evaluation of the gait score was applied according to the methodology described in Nãis et al. (2008). Statistical analysis were performed in a factorial design 2x3x3 (2 flocks, 3 types of lamps and 3 scores) using the software SigmaPlot 12.0. The incidence of gait score 1 and 2 was low, and there was no interaction between factors (p>0.05). No influence of different light sources on birds’ locomotion was found under this specific experimental trial.

**Key Words:** gait score, poultry meat industry, light bulbs

**P150 Inside environment in broiler housing with used and reused bedding** Rodrigo Garófallo García¹, Irenilza de Alencar Nãis², Marta dos Santos Baracho², Juliano de Araújo Cassiano², Gabriela Sanz Tononi³, Ana Flávia Basso Royer¹ ¹Universidade Federal da Grande Dourados, Dourados, Brazil ²Universidade Estadual de Campinas, Campinas, Brazil

The increasing of Brazilian poultry farming requires the improvement of the shelter for upgrade the system productivity. The thermo neutral area is related to an ideal thermal environment where birds have perfect conditions to express their productive characteristics. The goals of this work are the analysis of the internal microclimatic conditions in two broilers house production with the same system type but with different type of litter: new litter and reused litter, in order to understand how it affects the dynamics of the thermal environment. The evaluation was based on environmental variables measures such as: air temperature, wet bulb temperature, litter temperature, black globe temperature, relative humidity, wind speed and intensity of light. With collected data were calculated the temperature and humidity index (THI), the black globe temperature and humidity index (BGHI) and radiant heat load (RHL) of each broiler house. In the two houses the air temperature is high that the recommended. The relative humidity was higher in house 2 and the air velocity was smaller than in house 1. In all systems the comfort indices varied, but the worst stress thermal conditions to birds were found in house 2 (THI =25.31 and ITGU = 78.21%).

**Key Words:** poultry house, thermal comfort, animal welfare

**P151 Effectiveness of Actigen® against E.Coli spp. and Salmonella**
spp. in the hen in cage free and caged systems Dana Didde
tSC, Sheila Purdum, Kathryn Hanford, Samodha Fernando Department of Animal Science, University of Nebraska-Lincoln, Lincoln, NE

A study was conducted to test a mannanoligosaccharide (Actigen, Alltech) product to reduce E. Coli and Salmonella presence in the environment and egg shell of laying hens in conventional and cage free systems. Two dietary treatments were fed to Bovan Robust White Laying Hens (n=96) from 72 - 77 wks of age. Diets consisted of a basal corn/soy diet, the experimental diet contained 800g/ton Actigen. Measurements included daily egg production, weekly feed intake and egg wt, biweekly environmental and egg shell crush for Salmonella and E. Coli testing. Environmental samples were collected, weighed and placed in a 1:10 solution. Salmonella samples were placed into Buffered Peptone Water, incubated for 24 hrs at 37°C; 1 mL was placed into 9 mL of Rappaport-Vassiliadis R10 broth and incubated at 42°C for 24 hrs; 1 mL was streaked onto Chromagar Salmonella and incubated for 24 - 48 hrs at 37°C. E. Coli environmental samples were weighed and placed into a 1:10 solution with .85% saline and serial dilutions to 10² and streaked onto Chromagar ECC and incubated at 44°C for 24 - 48 hrs. Egg shell crush was conducted by aseptically separating egg contents from the shell and crushing the shell in a 50 mL tube and placing it in a 1:10 dilution. Plating procedure for egg shell crush was the same as environmental samples. There were no significant differences in egg production, feed intake and egg wt (P>0.05). There was no change in Salmonella presence in the environment due to diet. E. Coli environmental counts showed a treatment, cage type and time interaction approaching significance (P≤0.08); cage free had lower counts over time. Cage type and time showed a significant interaction (P≤0.03), cage free and Actigen diets had lower counts over time. Treatment effect was not significant (P>0.05), however there was a decrease in E. Coli environmental counts for Actigen. Actigen in cage free environments trended towards lower environmental E. Coli counts.

Key Words: prebiotic, Actigen, laying hen, cage free, cage

P152 The Efficacy of Cecure® and Citrilow™ on the reduction of Salmonella and Aerobic Plate Count Bacteria on whole poultry parts and ground poultry products Karen Beers1, Peggy Cook Safe Foods Corporation, Rogers, AR

The United States poultry processors have long been regulated on the presence of Salmonella on whole carcasses immediately after chilling. The poultry industry has achieved success in this area with the use of antimicrobial interventions. Poultry carcasses subjected to further processing and cut-up into parts have not been regulated but are currently being evaluated.

Two Salmonella inoculation studies were conducted on turkey parts and broiler parts (skin-on and skin-off) to determine the effectiveness of two antimicrobials for the reduction of Salmonella and Aerobic Plate Counts (APC) on the whole part as well as ground product. After inoculation and attachment of Salmonella inoculum (log 10⁶ for broiler parts and log 10⁷ for turkey parts), the samples were treated with either an acid solution (Citrilow™) at a pH of 1.2 or cetylpyridinium chloride (Cecure®) at a concentration of 0.6% and were not treated on a control group. Samples were tested as whole parts or ground product and plated on APC Petrifilm and XLT-4 agar for quantifying the results.

The turkey skin-off and skin-on parts treated with Citrilow™ or Cecure® showed reductions of greater than 1 log of APC and Salmonella. Ground product showed a 1 log reduction of APC and 0.75 log reduction of Salmonella. The broiler skin-off and skin-on parts treated with Citrilow™ or Cecure® showed a reduction of greater than 1 log of APC and no recovery of Salmonella. Ground product showed a 1 log reduction of APC and approximately a 1.5 log reduction of Salmonella. All results showed significant reductions in both APC and Salmonella as compared to the control samples. As demonstrated by these results, the use of an antimicrobial intervention on poultry parts for use as whole parts or ground product will reduce pathogens and improve the safety of food products.

Key Words: Salmonella, poultry parts, ground poultry, antimicrobials, food safety

P153 Genotypic and phenotypic characterization of Salmonella Heidelberg and Kentucky isolates recovered from broiler chicks Douglas Cosby1, Paula Fedorka-Cray1, Mark Harrison2, Nelson Cox3, R. Jeff Buhr3, Richard Meinersmann1, Mark Berrang1, Jeanna Wilson1 1USDA-ARS, BEAR Research Unit, Athens, GA 2Department of Food Science and Technology, University of Georgia, Athens, GA 3USDA-ARS, PMS Research Unit, Athens, GA

Foodborne pathogens are constantly adapting to circumvent intervention strategies. The ability to detect and overcome these adaptations are critical to ensure a safe food supply. We determined genotypic and/ or phenotypic differences between Salmonella recovered from broiler chicks after comingling with seeder chicks gavaged with a cocktail of two Salmonella serovars (Kentucky and Heidelberg) resistant to either tetracycline (Kentucky: tetR; K:tetR) or streptomycin (Heidelberg: tetR; H:tetR) with known antimicrobial resistance profiles. Twenty Salmonella Heidelberg (H:tetR) and 21 S. Kentucky (K:tetR) isolates were selected for further characterization. Two strains each of H:K and K:K, parent and inoculum, were included as reference strains. Pulsed-field gel electrophoresis (PFGE) profiles using XbaI revealed a 100% genetic similarity between the H:K parent and inoculum isolates and 19/20 recovered isolates; one isolate exhibited 96.6% similarity. Genetic similarity between the parent and inoculum K:K isolates and 17/21 recovered isolates was 100%; four other isolates exhibited at least 97.2% similarity. An additional PFGE analysis using blnl restriction revealed two clusters; one with 18 isolates demonstrating greater than 95% similarity to the H:K inoculum strain and one with two isolates showing greater than 95% similarity to the H:K parent strain and greater than 89% similarity between the two clusters. Two clusters were detected from the K:K isolates; one with 19 isolates showing greater than 92% similarity to the K:K inoculum strain and one with two isolates showing greater than 88% similarity to the K:K parent strain with one outlying isolate and greater than 82% similarity overall. Antimicrobial resistance profiles ranged from three pan-susceptible isolates (two H:K and one K:K) to 11 multidrug resistant MDR profiles. The most common MDR profile was resistance to amoxicillin/clavulanic acid, ampicillin, cefoxitin, ceftiofur, streptomycin and tetracycline. PCR was used to probe for four resistance genes, two tetracycline (tetA and tetB) and two aminoglycoside genes (strA and aadA1). The resistance genes tetA, tetB, strA, and aadA1 were detected in 11, 10, 15 and 20 out of the 20 recovered H:K strains, respectively and in 19, 21, 15 and 13 out of the 21 recovered K:K strains, respectively. Although there was a high degree of similarity in PFGE profiles, the variability in the isolation of resistance genes coupled with variability in resistance profiles warrants further research to determine the source of isolates exhibiting resistance profiles different from those used for the inoculum.

Key Words: Salmonella, genotype, phenotype, antimicrobial resistance, broilers

P154 Effects of eggshell conductance and incubation temperatures on duck footpad development Manuel João Da Costa1, Edgar O. Oviedo-Rondón1, Michael J. Wineland1, Wedson Carlos Lima Nogueira1, José Guilherme Morschel Barbosa1, Debbie Jeffrey1 1Department of Poultry Science, North Carolina State University, Raleigh, NC

Footpad development studies were conducted on turkey parts and broiler parts (skin-on and skin-off) to determine the effectiveness of two antimicrobials for the reduction of Salmonella and Aerobic Plate Counts (APC) on the whole part as well as ground product. After inoculation and attachment of Salmonella inoculum, the samples were treated with either an acid solution (Citrilow™) at a pH of 1.2 or cetylpyridinium chloride (Cecure®) at a concentration of 0.6% and were not treated on a control group. Samples were tested as whole parts or ground product and plated on APC Petrifilm and XLT-4 agar for quantifying the results.

The turkey skin-off and skin-on parts treated with Citrilow™ or Cecure® showed reductions of greater than 1 log of APC and Salmonella. Ground product showed a 1 log reduction of APC and 0.75 log reduction of Salmonella. The broiler skin-off and skin-on parts treated with Citrilow™ or Cecure® showed a reduction of greater than 1 log of APC and no recovery of Salmonella. Ground product showed a 1 log reduction of APC and approximately a 1.5 log reduction of Salmonella. All results showed significant reductions in both APC and Salmonella as compared to the control samples. As demonstrated by these results, the use of an antimicrobial intervention on poultry parts for use as whole parts or ground product will reduce pathogens and improve the safety of food products.

Key Words: Salmonella, poultry parts, ground poultry, antimicrobials, food safety

Po-12 92 (E-Suppl. 1)
One experiment was conducted to evaluate the effects of eggshell conductance (G) and temperature during incubation on duck footpad development. 10,000 Pekin duck eggs from a commercial line of Maple Leaf Farms were randomly sorted, equally distributed into four groups, and placed in 2 single stage incubators. Treatments consisted of two G, reduced and normal, and two incubation temperature profiles (T), elevated and normal, after day 12. Eggshell conductance was reduced by dipping eggs in wax at 14 days of incubation. At hatch, 6 ducklings from each treatment were sampled. Body and residual yolk were weighed. Additionally, footpad skin samples were collected and stored in 10% formalin solution 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. Data were analyzed as a 2x2 factorial design with T and G as main factors. No significant (P>0.05) pairwise correlations were observed between body weight and yolk retention with any histological skin parameter evaluated. Results indicated no effect (P>0.05) of treatments on body weight without yolk. High levels of residual yolk were observed on ducklings coming from reduced G. Same effect was observed on ducklings subjected to elevated T. Both SC and epidermis lengths and areas were not affected (P>0.05) by treatments. An interaction effect (P<0.01) was observed on dermis length and area. When eggs were incubated with normal T, reduced G induced lower values of dermis length and area comparing with eggs with normal G. Total papillae height was also affected by treatment interaction (P<0.01). Shorter papillae were observed on eggs with reduced G when incubated under normal T. No effects (P>0.05) were observed on papillae width. It was concluded that G and incubation T profiles have an effect on yolk utilization and influence the development of the footpad skin dermis layer on ducklings at hatch. It will be important to investigate these factors as possible contributors to footpad dermatitis susceptibility.

Key Words: footpad development, ducks, welfare, incubation, eggshell conductance

However, semen exposed to increasing bacterial concentrations exhibited decreasing sperm quality index values. For fertility, embryonic livability, and hatchability, treatment 1 and 7 were lower than all other treatments. Less Lactobacillus was detected in the meconium from treatment 3 as compared to treatments 2, 4 and 6. Body weight at 7d was also reduced in treatment 3 compared to treatments 2, 4 and 5. Additionally, body weight gain was reduced in treatment 3 as compared to treatment 4. In conclusion, exposure of semen to Lactobacillus reduced reproductive performance. The possible transfer of Lactobacillus to the offspring may increase body weight and body weight gain.

Key Words: Lactobacillus, Fertility, Body Weight, Meconium, Bacteria

P155 Lactobacillus in semen alters fertility, hatchability, and offspring performance Roberta Silva*1, Melissa Haines, Holly Parker, Chris McDaniel, Aaron Kiess Department of Poultry Science, Mississippi State University, Mississippi State, MS

The supplementation of probiotics affects the host animal by improving their intestinal microflora. Most probiotics currently on the market contain Lactobacillus that can be found in the gastrointestinal tract, vagina, and cloaca of hens. Therefore, the objective of this study was to evaluate the effect Lactobacillus in semen has on sperm quality, fertility, hatchability and overall chick performance. A total of 40 roosters and 420 hens were used. Semen obtained from the roosters was used to create 7 different treatments; 1) no semen or bacteria, 2) semen exposed to saline, 3) semen exposed to sterile broth, 4) semen exposed to 10^6 cfu Lactobacillus, 5) semen exposed to 10^7 cfu Lactobacillus, 6) semen exposed to 10^8 cfu Lactobacillus, and 7) semen exposed to 10^9 cfu Lactobacillus. Each treatment was diluted 1:1 (semen:diluent or bacterial culture), and then 50 µl of the respective treatment was inseminated into each hen. Eggs were collected from day 2 to 8 post insemination and incubated for 21 d. After incubation, all eggs were examined for fertility, embryonic livability, and hatchability. At hatch, 10 chicks from each treatment group was weighed, wing banded, and used to obtain meconium for bacterial analysis. After 7d of growth, the same chicks were re-examined to obtain 7d body weight, body weight gain, and levels of bacteria in the ileum. The results from this study indicated no differences among treatments for aerobic bacteria or Lactobacillus in the ileum, aerobic bacteria in the meconium, or body weight at hatch.

Key Words: Chick quality, incubation, discards of eggs

P157 Estimating the most important criteria for hatching eggs as function of broiler breeders' age Irenila de Alencar Nääs1, Marta dos Santos Baracho1, Juliano Araújo Cassiano1, Guilherme Rodrigues do Nascimento1, Rodrigo Garófallo Garcia2 1Universidade Estadual de Campinas, Campinas, Brazil 2Universidade Federal da Grande Dourados, Dourados, Brazil

Brazil is a country where poultry technology more advanced in the last decades. The aim of this study was to correlate data from temperature and relative humidity which eggs were subjected, to the final discard data by using a multivariate analysis of the same. Data of temperature and relative humidity were monitored. Ambient data and eggs’ surface temperature were registered in six distinct sectors, at three heights from the floor (A=0.10 m, B=1.0 m, C=2.0 m). Were analyzed and classified the loss of eggs in three different days and at 14 days of incubation, the transfer of eggs from the incubator to the hatchery (18 days) and the birth of the pullets (day 21). Average temperatures and relative humidity for each quadrant and for each height were calculated and ANOVA was applied using the Mininet ® software. Tukey test was used and significance was adopted at p-value ≤0.05. Mean surface temperature at the lower trays (A) was higher than those at B and C. The results indicate an influence of thermal environment in the disposal of fertile eggs in the incubation process.

Key Words: Multi-stage incubator, Multi criteria analysis, broiler breeders’ production

P158 Effect of dietary feed additives for extending egg production by hens raised without forced molting in welfare aviary Sang Jip Oh1, Ahamed Musabbir2, Jun Yeop Lee1, Dong. M Kim*1 1Kangwon
ABSTRACT OF PAPERS

P159 Effect of brooding temperatures under commercial conditions on broiler leg health and locomotion Edgar Oviedo-Rondón*, Michael Wineland, Heather Cutchin Evans, John Small Department of Poultry Science, North Carolina State University; Raleigh, NC

Brooding temperatures influence broiler bone development during the fastest growing phase. Three experiments were conducted in a commercial farm to evaluate the effects of two brooding temperature profiles on leg health, locomotion, and footpad dermatitis incidence at 56 days of age. The standard house target temperature recommendations of the integrator company (CON) were compared with house temperatures managed according to daily chicken body temperatures (CBT). Two paired houses with a comparable composition of day old broilers were used. Treatments were assigned to different houses in each experiment. All houses had the same dimensions, reused litter, side wall heaters, and similar equipment. In all experiments, 20,800 male Heritage chickens were placed in each house. Broilers received the same diets and similar management. Body temperatures of at least 50 chickens per house were taken daily for the first two weeks and once a week until 35 days of age. In the CBT treatment, house target temperatures were slowly reduced to avoid flock average body temperatures increasing above 107.5°F (41.9°C) during the first 5 days. After the first week, house target temperatures were adjusted to avoid average body temperatures rising above 107.5°F (41.9°C). At 56 days of age, 40 chickens were randomly selected in each of five different locations within each house to obtain body weights, evaluate gait scores (GS), according to the Bristol system, and observe presence of leg problems. Valgus/varus, twisted legs, footpad dermatitis, crooked toes and hock burns were evaluated in 200 chickens per house. The GLIMMIX procedure of SAS was used to evaluate treatment effects on probabilities of observing each leg condition or GS. In the first experiment, chickens under CBT had (P<0.05) better GS and lower incidence of valgus (Probability 0.29) than chickens in CON treatment (Probability 0.38). No significant effects were observed in the second experiment. In the third experiment, GS were also affected (P<0.05), but CBT had more locomotion issues than CON chickens. No other effects (P>0.05) were observed on leg health issues or foot pad dermatitis. It was concluded that brooding temperatures did not consistently affect the incidence of footpad dermatitis and leg health problems such as varus, valgus and twisted legs, but may influence some locomotion issues in broilers.

Key Words: alternatives to forced melting, laying hen welfare, aviary, egg production

P160 Association between locomotion problems and balance condition in female broilers of two commercial strains Fabiana Ribeiro Caldara1, Marilinha Carvalho Figueiredo Alves1, Ibiai Lima Almeida Paz1, Irenilza de Alencar Nääs1, Guilherme Rodrigues do Nascimento2, Rodrigo Garófallo Garcia1, Grace Alessandra de Araujo Baldo1, Mayara Rodrigues de Santana1, Keni Eduardo Zanoni Nubiato1, Rodrigo Borille1, Ana Flavia Basso Royer1, Roselaine Ponso1, Fabiana Cavichiolo1, Leonardo de Oliveira Seno2, Marta Moi2, Nilsa da Silva Lima1 1Universidade Federal da Grande Dourados, Dourados, Brazil 2Universidade Estadual de Maringá, Maringá, Brazil

This experiment was conducted with the objective to evaluate the association between locomotion problems, the bird’s ability to walk and balance condition of females of two commercial strains. The study was conducted in experimental poultry house Faculty of Agrarian Sciences, Federal University of Grande Dourados, Dourados, Brazil and used 530 day old hens, females of Cobb 500 and Ross 308 strains. The experimental design was completely randomized with two treatments and 5 replicates of 53 birds each. For the assessment of gait score (GS), the animals were placed for walking, by one meter in surface covered by litter, when has allocated up notes as the ability of the birds walk. To estimate the balance condition (BC) and body angulation (BA) took up the side view photographic images of birds, considering the body of chickens as a spherical cap, so we can estimate the animal BC to the ground and the angle formed between the chest and the your footpad center. Even in the poultry house, the birds were evaluated for Varus and Valgus deformities. Posteriorly these chickens were slaughtered and has measured up the carcass weight and locomotors diseases such as tibial dyschondroplasia (TD), femoral degeneration joint lesion (FDJL) and spondylolisthesis (SPO). By using the tool association vectors, performed using Minitab software, it was found that BC, BA and SG behaved high association with each other, confirming the hypothesis that BA directly affects the balance of birds, providing difficulty walking. The SPO had a mean association with GS, which showed that animals affected with the disease have trouble walking. Also it was found that the deformities Valgus and Varus not associated, because the birds with these deformities have legs usually with the angle turned outwards or inwards, respectively. Obtained high association between Varus and FDJL, probably why the appearance of Varus overload the femoral articulation. The characteristics TD and live weight did not showed relation with any anomalies. The ratio of vectors to determine the association among the measured characteristics showed that animals with affected angulation (prostrate birds) have their balance condition as well as how to walk compromised.

Key Words: Gait Score, body angulation

This experiment was conducted with the objective to evaluate the association between locomotion problems, the bird’s ability to walk and balance condition of males of two commercial strains. The study was conducted in experimental poultry house Faculty of Agrarian Sciences, Federal University of Grande Dorados, Brazil and used 530 day old chicks, males of Cobb 500 and Ross 308 strains. The experimental design was completely randomized with two treatments and 5 replicates of 53 birds each. For the assessment of gait score (GS), the animals were placed for walking, by one meter in surface covered by litter, when has allocated up notes as the ability of the birds walk. To estimate the balance condition (BC) and body angulation (BA) took up the side view photographic images of birds, considering the body of chickens as a spherical cap. Even in the poultry house, the birds were evaluated for *Varus* and *Valgus* deformities and individually weighed. Posteriorly these chickens were slaughtered and has measured up the carcass weight and locomotors diseases such as tibial dyschondroplasia (TD), femoral degeneration joint lesion (FDJL). Subsequently, these birds were slaughtered and their spines were sawn sagittally attributing the absence or presence of spondylolisthesis (SPO). Data analysis was performed using the Minitab software, through the use of the tool association vector, it was found that BC, BA, GS and SPO behaved high association with each other, confirming the hypothesis that BC, BA SPO and directly affect the behavior of birds when walking. The method of association vectors demonstrated that the other parameters were not associated with each other. It was concluded that animals with spinal problems (SPO) have the BA affected (prostrate birds) and have your BC compromised and that these features greatly affect the GS.

**Key Words:** femoral degeneration joint lesion, spondylolisthesis

**P162 Influence of artificial lighting with LED in the performance of broilers** Fabiana Ribeiro Caldara*, Mayara Rodrigues de Santana, Rodrigo Garófallo Garcia, Rodrigo Borille, Ana Flavia Basso Royer, Irenilza Alencar Nääs, Ibiara Correia Lima Almeida Paz, Marilia Carvalho Figueiredo Alves, Keni Eduardo Zanoni Nubiato, Roselaine Ponso, Nilsa Duarte Silva Lima, Bruna Barreto, Marta Moi, Vivian Aparecida Rios Castilho *Universidade Federal da Grande Dourados, Dourados, Brazil*

The constant search for technologies aimed at increased productivity and profitability is gaining space among the research, and currently is being utilized lighting systems with LED lamps (LED), which feature high luminous efficiency, lower power consumption and longer useful life compared with the generally used lamps. The work was developed in the poultry house belonging to Experimental poultry Sector, Federal University of Grande Dourados (FCA/UFGD). 1296 chicks were used males and females of Cobb® lineage, distributed in completely randomized design and factorial 2x3 (sex x lamp type). Three lamps were tested: red LED, blue LED, compact fluorescent, and two genders (male and female), with four replicates. Weekly were collected performance data and at the end of 42 days were made evaluations as to cumulative weight gain, feed conversion and feed intake. The means obtained were compared by Tukey test the probability 5%. There were no statistical differences (p>0.05) between the lamp type factor on the bird performance. There was significance to the gender factor (p<0.05), males had higher cumulative weight gain and bigger feed intake. For the feed conversion there was no significant difference in any treatment. Through the results, it was observed that the red and blue LED lamps can replace the fluorescent lamp without damaging the productive performance of broiler.

**Key Words:** colors on artificial lighting, luminous efficiency, weight gain, feed conversion

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**P163 Lighting using LED for laying hens: productive parameters** Rodrigo Garófallo Garcia*, Rodrigo Borille, Ibiara Lima Almeida Paz, Fabiana Ribeiro Caldara, Ana Flávia Basso Royer, Mayara Rodrigues de Santana, Sandro Colet, Marilia Carvalho Figueiredo Alves, Irenilza de Alencar Naas, Keni Eduardo Zanoni Nubiato, Marta Moi, Roselaine Ponso, Nilsa Duarte Silva Lima *Universidade Federal of Grande Dourados – UFGD, Dourados, Brazil*

The use of artificial lighting for commercial laying hens is one of the most powerful management tools available to the poultry producer. The beginning of lay can be reduced or slowed, the rate of laying can be influenced and changed, the shell quality can be improved, the egg size can be increased and the optimized feed efficiency, providing a appropriate light regime. The objective of this experiment was to evaluate the influence of different colors of LEDs in the artificial lighting of commercial laying hens compared to conventional incandescent lamp. The study was conducted in a shed of UFGD, where it was divided into different environments, so that the colors of each treatment did not affect the others. A total of 360 hens of Isa Brown lineage, with initial age of 58 weeks were used. The light sources used were: Blue LED, Yellow LED, Green LED, Red LED, White LED, and incandescent lamp 40W. All treatments received continuous lighting program of 17 hours per day and a ration based on corn and soybean meal. Were used a completely randomized design with split plots totaling 24 treatments and 3 replications (6 light sources and 4 periods). The egg production (%) showed statistical differences (p < 0.05), with the best results seen in the light sources Red LED, White LED and Incandescent lamp. The egg weight and feed intake were not affected (p > 0.05) significantly by the light colors.

**Key Words:** artificial lighting, colors, Egg production

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**P164 Haugh unit and specific gravity of eggs produced under artificial lighting using LED** Rodrigo Garófallo Garcia*, Rodrigo Borille, Irenilza de Alencar Naas, Ibiara Lima Almeida Paz, Fabiana Ribeiro Caldara, Ana Flávia Basso Royer, Mayara Rodrigues de Santana, Sandro Colet, Marilia Carvalho Figueiredo Alves, Keni Eduardo Zanoni Nubiato, Marta Moi, Roselaine Ponso, Nilsa Duarte Silva Lima *Universidade Federal of Grande Dourados – UFGD, Dourados, Brazil*

By providing a appropriate light regime, the beginning of lay can be reduced or slowed, the rate of laying can be influenced and changed, the shell quality can be improved, the egg size can be increased and optimized feed efficiency. The objective of this experiment was to evaluate the influence of different colors of LEDs in artificial lighting of commercial laying hens compared to conventional incandescent lamp about the internal egg quality. The study was conducted in a shed of UFGD, where it was divided into different environments, so that the colors of each treatment did not affect the others. A total of 360 hens of Isa Brown lineage, with initial age 58 weeks were used. The light sources used were: Blue LED, Yellow LED, Green LED, Red LED, White LED and incandescent lamp 40W. All treatments received continuous lighting program of 17 hours per day and a ration based on corn and soybean meal. Were used a completely randomized design with split plots totaling 24 treatments and 3 replications (6 light sources and 4 periods). The internal egg quality (as measured by the ratios of specific gravity, and Haugh unit) were not affected (p> 0.05) significantly by different light sources.

**Key Words:** Artificial lighting, Colors, Egg production

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**P165 Interactive effects of strain and light intensity on growth performance and carcass characteristics of broilers grown to heavy weights** Hammed Olanrewaju*, Joseph Purswell, Stephanie Collier, Scott Branton *USDA-ARS South Central Poultry Research Unit, Mississippi State,*

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The interactive effects of genetic strain and light intensity on growth performance and carcass characteristics of broiler chickens grown to heavy weights were investigated. The experimental design was a randomized complete block design. Treatment structure was a $2 \times 5$ factorial arrangement with the main factors being strain source (Ross x Ross 308; Ross x Ross 708) and light intensity (25, 10, 5, 2.5, 0.2 lx) with trial as replicates. In each trial, chicks of 2 different strains from the same commercial hatchery were equally and randomly distributed into environmentally-controlled rooms at 1 d of age at 50% RH. Each room was randomly assigned one of five light intensities from 22 to 56 d of age. Feed and water were provided ad libitum. Birds were provided a four phase-feeding program (starter, grower, finisher, withdrawal). Birds and feed were weighed on 0, 14, 28, 42, and 56 d of age for growth performance. On d 56, 20 (10 males and 10 females) birds/strain from each room were processed to determine weights and yields. Although, there was no main effect of light intensity on growth performance and meat yield, results indicated that birds under 10 and 5 lx intensities showed slightly better growth performance and meat yield compared to birds under 25, 2.5 and 0.2 lx in both strains. In addition, genetic strain was significant ($P \leq 0.05$) for most of the examined variables, indicating that Ross x Ross 308 had better growth performance and meat yield than Ross x Ross 708. There was no effect of strain, light intensity or their interactions on mortality and plasma corticosterone levels. This study shows the positive impact on profits to commercial poultry facilities that are using low lighting environment to reduce energy utilization costs, hyperactivity, and pecking damage without physiological stress effects on broiler health.

Key Words: Genetic-strain, light-intensity, growth, meat yield, broiler

P166 Broiler chick feed color preference under different housing light colors Nichole Graham, Rusty Rierson, R. Scott Beyer, Christopher Hancock Department of Animal Science, Kansas State University, Manhattan, KS

Rapid changes in lighting types designed to reduce energy usage have increased the options available for animal producers. Recent research indicates a positive correlation in broiler growth and welfare regarding light preference. Research was conducted to investigate feed and light color preference among production poultry. Fifty-day-old Cobb 500 male broiler chicks were housed in pens under different incandescent lights illuminated at 50 lux. Red, blue, green, yellow, and a control white light were tested. Under each light, broilers were offered red, blue, green, yellow, and a control brown colored feed. Feed was colored using commercial food coloring. Chick color preference was recorded after at least two attempts to obtain feed crumbs; an undecided was recorded for chicks that took longer than five minutes to try feed. Analyzed results showed a significant difference in light and color preference between chicks. Evaluation of housing light colors alone showed a difference between green and yellow light colors. Under yellow housing lights, 27.5% of chicks showed a preference for green feed and the lowest percentage at 2.5% of undecided feed color preference ($P<0.05$). Green light also showed a significant difference when compared to blue light ($P<0.05$). House under blue light, chicks displayed a significant preference for red feed ($P<0.05$). When housed under green light, the highest percentage of undecided was recorded at 27.5%. Under red house lighting, 32.5% of chicks showed a preference for the control brown feed. We observed a trend that 95% of chicks did not prefer blue feed under green light. It was concluded that chicks display a color preference for both housing and feed. Future research needs to be conducted to determine effects of housing light and feed color in older production flocks.

Key Words: Broiler, Color, Feed, Light, House

P167 WITHDRAWN

P168 BACTERIOCINS AND BACTERIOPHAGE LYTIC PROTEINS FROM RUSSIAN FEDERATION AND USA COLLABORATIONS TO CONTROL ANTIBIOTIC RESISTANT BACTERIAL PATHOGENS Bruce Seal1, Nikolay Volozhmatsev2, J. Eric Line1, Edward Svetoch1, Norman Stern1 1USDA-ARS, Russell Research Center, Athens, GA 2State Research Center for Applied Microbiology and Biotechnology Obolensk, Russian Federation 3USDA-ARS Poultry Microbiological Safety Research Unit, Athens, GA

Antibiotic resistant bacteria are becoming a problem for agricultural and human medical use worldwide. Consequently, novel antimicrobials were isolated and characterized in collaborative research between PM-SRU, ARS-USDA scientists and representatives of the State Research Center for Applied Microbiology and Biotechnology (SRCAMB) in Obolensk, Russian Federation. The antimiicrobial peptide bacteriocins produced by lactic acid bacteria are effective against several bacterial and food-borne pathogens. Treatment of chickens by feeding bacteriocins consistently reduced Campylobacter levels in their gastrointestinal system as compared with levels found in untreated birds. Bacteriocins could be an effective means to lower C. jejuni in poultry prior to processing and reduce food-borne bacterial disease. Screening of bacteriophages lytic for Clostridium perfringens was completed utilizing filtered samples obtained from poultry (intestinal material), soil, sewage and poultry processing drainage water. From the collections highly lytic viruses were isolated and the double-stranded deoxyribonucleic acid (DNA) genomes of the bacteriophages were sequenced to completion. DNA sequencing of six bacteriophage genomes completed at PMSRU and four genomes in collaboration with Russian investigators resulted in identification of unique amidases as well as phage encoded proteins that potentially contain lysozyme and endopeptidase activities. Three recombinant bacteriophage lytic enzyme genes encoding putative amidases have been cloned, their proteins expressed as recombinants and isolated to homogeneity, then demonstrated to lyse C. perfringens. These bacteriocins and phage lytic enzymes may have possibilities for use in agriculture and medical applications as potential replacements for current antibiotics that may have diminished activity.

Key Words: enzybiotic, antimicrobials, bacteriophage, food safety, animal health

P169 Impacts of stocking density on the performance and welfare of broiler chickens Alaeldein Abudabos1, Edward Svetoch2, Norman Stern3 1USDA-ARS, Russell Research Center, King Saud University, Riyadh, Saudi Arabia

The current study was performed to investigate the influence of different stocking density rates on the performance, thermophysiological measurements as well as blood parameters of 0 to 30 d of age female Ross broiler. Three stocking density rates were applied; low (28.0 kg/m²), medium (37.0 kg/m²) and high (40.0 kg/m²). Results revealed that cumulative body weight gain (BWG) and feed intake (FI) were influenced ($P<0.01$) by the rate of stocking density, while no effect ($P>0.05$) were observed for broilers’ feed conversion ratio (FCR). Higher BWG ($P<0.01$) and FI ($P<0.05$) were reported for low and medium density rates broilers in comparison to the high density rate broilers. Overall means of body temperature as well as head, neck, wing, body and shank surface temperatures have displayed ($P<0.05$) higher values in medium and high density rates broilers compared to the low density rate broilers. Furthermore, increasing the stocking density from 28 to 40 kg/m² induced a state of hemodilution in higher density rate broilers, which might explain the noticeable decrease in some of the measured
parameters (packed cell volume (PCV), total protein, and glucose). Meanwhile, an increase in serum aspartate aminotransferase (AST) was observed in the higher density rates broilers, which might indicate hepatocellular injuries. It can be concluded that increasing the stocking density rate from 28 to 40 kg of BW/m² had evident impairment effects on the performance of broiler chicken and could jeopardize their welfare.

**Key Words:** Stocking density, Broiler performance, Body and surface temperatures, Hematological and biochemical parameters

**P170 A three-year survey on mycotoxin contamination and occurrence in feeds and ingredients** Karin Nahrer¹, Inès Rodrigue² ¹Biomin Holding GmbH, Herzogenburg, Austria ²BIOMIN Singapore Pte Ltd, Singapore, Singapore

A worldwide survey about the most important mycotoxins in feedstuffs was initiated to gather information on the presence of mycotoxins in commodities most commonly used for feed production. Since January 2009 until December 2011 a total of 7,049 samples (corn, soybean/soybean meal, wheat, dried distillers grains with solubles and finished feed) sourced in Americas, Europe and Asia were analyzed for the presence of mycotoxins including aflatoxins (Afla), zearalenone (ZEN), deoxynivalenol (DON), fumonisins (FUM) and ochratoxin A (OTA).

Samples were analyzed by high performance liquid chromatography (HPLC) (80%) and Enzyme-Linked Immunosorbent Assay (ELISA) (20%). Only single commodities were analyzed by ELISA. More complex matrixes which could interfere with the ELISA method such as DDGS and finished feed were analyzed by HPLC. For the purpose of data analysis, non-detect levels are based on the quantification limits (LOQ) of the test method for each toxin.

Afla were present in 33%, ZEN in 45%, DON in 59% and OTA in 28% of all analyzed samples. Average contamination levels of samples above the LOQ were 63 ppb for Afla, 233 ppb for ZEN, 1,104 ppb for DON, 1,965 ppb for FUM and 11 ppb for OTA. Data were presented by calendar year, but values on mycotoxin occurrence do not greatly differ separated by years. From all 7,049 samples 19% were tested negative for the presence of five investigated mycotoxins. Thirty three percent showed presence of one of them and two or more of the tested mycotoxins were present in 48% of the commodities. The results of this three-year period underline the necessity of constant mycotoxin monitoring in feedstuffs.

**Key Words:** Mycotoxins, Occurrence, Survey

**P171 37+ Mycotoxin Analysis on 2012-2013 Asia-Pacific Poultry Feeds and Feedstuffs** H.V.L.N. Swamy¹, A. Shuaib², A. Bhat³, G. Bromfman¹ ¹Alltech India, Bangalore, India ²Department of Pharmacology and Toxicology, Bangalore Veterinary College, Bangalore, India ³Alltech USA, Raleigh, NC

There is a need for testing Asia-Pacific poultry feeds and feedstuffs for several Fusarium mycotoxins, including DON (vomitoxin), T-2 toxin, zearalenone and fumonisins, along with aflatoxins and ochratoxins. In order to do so, Alltech India collaborated with Bangalore Veterinary College, KVAFS University to analyze 17 mycotoxins using LC-MS/MS equipment. For the ease of understanding of the total toxicity to animals, the toxins of similar structure and effects were further clubbed into groups. Only three samples out of 321 tested were negative for all the mycotoxins tested giving 99% as level of contamination. Aflatoxins were detected in 81% of the samples followed by citrinin (77%), fumonisins (75%), zearalenone (64%) and Type B trichothecenes (DON-Group; 62%). Beauvericin, Type A trichothecenes (T-2 Group) and ochratoxin A were detected between 56 and 36% of samples. On an average, fumonisins were present at the highest concentrations (157ppb) followed by Type B mycotoxins (87ppb) and beauvericin (41ppb). A maximum concentration for an individual sample was recorded for Type B trichothecene mycotoxins (3254ppb) followed by fumonisins (2910ppb) and beauvericin (1900ppb). Only 5% of the samples tested contained one mycotoxin. The highest percentage of samples, 56, contained 5 to 10 mycotoxins followed by 31% containing 2 to 5 mycotoxins. 7% samples contained more than 10 mycotoxins. The detection levels of aflatoxins, citrinin and ochratoxin A were expected due to tropical weather and poor storage conditions in Asia-Pacific region. The key findings of this survey are the higher incidences of Type B trichothecene mycotoxins (DON) and fumonisins in Asia-Pacific poultry feeds and feed ingredients. It can be concluded that Asia-Pacific poultry feedstuffs should be analyzed for various Fusarium mycotoxins (DON, T-2 toxin, 15-Acetyl DON, fumonisins B1 and B2, zearalenone etc) along with aflatoxins and ochratoxins and the mycotoxin prevention strategies should cover wide range of mycotoxins.

**Key Words:** Fusarium, Mycotoxins, Poultry, Fumonisins, Aflatoxins

**P172 Importance of total sulfur amino acid level in the starter diet for early broiler performance following coccidiosis vaccination** Kevin Perry¹,², Jason Lee, Rocky Latham, Stephanie Iselt, Javier Garcia, David Caldwell Department of Poultry Science, Texas A&M University, College Station, TX

Previous research in our laboratories has identified starter diet protein level as being important in broiler performance following day-of-hatch coccidiosis vaccination. The objective of the current trial was to specifically focus on the influence of varying starter diet calculated total sulfur amino acid levels on non-vaccinated or vaccinated broiler performance through 18 days of rearing. The experimental design was a 5 x 2 factorial with 5 diets varying in TSAA level (0.75%, 0.85%, 0.95%, 1.00%, or 1.05%) fed to either non-vaccinated or coccidiosis vaccinated broilers. Performance parameters measured included average body weight and feed conversion ratio (FCR). On day of hatch, male Cobb 500 broiler chicks were obtained from a commercial hatchery and randomly placed for rearing in electrically heated brooder batteries. Average bird weights and feed conversion ratio (FCR) were determined on days 6, 13, and 18 of the trial. Following factorial ANOVA, an interaction (P<0.05) was observed between vaccination and TSAA concentration for broiler body weight, but not (P>0.05) for FCR. Observed body weight measurements on days 6, 13, and 18 suggest no added benefit (P<0.05) of feeding a TSAA level greater than 0.93% in non-vaccinated broilers. Observed body weights of vaccinated broilers on days 6 and 13 indicate feeding a TSAA concentration of 1.05% is necessary (P<0.05) to achieve body weights similar to non-vaccinated broilers. Additional investigation into the interaction between starter diet TSAA level and coccidiosis vaccination is currently ongoing. These data suggest broiler performance during coccidiosis vaccination may be linked to TSAA level in the starter phase of grow-out.

**Key Words:** TSAA, coccidiosis vaccination, broiler performance

**P173 Effects of in ovo dextrin-iodinated casein treatment on hatchability and hatch weight in broilers.** Shaymaa Abou-Saad¹,², Karen Christensen², Katrina Stripling², Brad Brewer², Kentu Lassiter¹, Alissa Piekariski¹, Billy M. Hargis², Lisa Bielke¹, Guillermo Tellez¹, Walter Bottje¹ ¹Department of Poultry Science, University of Arkansas, Fayetteville, AR ²OK Foods, Inc., Fort Smith, AR

An in ovo injection of dextrin (Dex) and iodinated casein (IC) improved hatchability and early growth rate in turkey pouls. The Dex component provides an available source of carbohydrate while the IC presumably acts as a thymomimetic in the late term embryo. Thus, this
study was conducted to determine if a similar effect on hatchability and hatch weights would be observed in broiler chicks in response to in ovo treatment of Dex-IC over a broad range of IC levels. The experiment was conducted with a local commercial integrator and in ovo injection system. The dextrin solution consisted of a mixture of 18% potato starch dextrin and 10% maltodextrin. Iodinated casein was added to the Dex solution at 0, 80, 240, 720, 2,160 µg/mL. A commercial buffered solution was used as the control and all treatments contained a commercial Mareks vaccine. A maximum of 2,520 eggs were injected per treatment (168 eggs/basket x 15 hatching baskets) at the time of transfer from the incubator to hatchery unit (18.5 d of embryonic development) and all baskets were placed in a single hatchery unit. Hatch diagnosis was carried out on 4 baskets (on levels 1, 7, 8, and 15) whereas percent hatch and average hatch weights per basket were determined for all 15 hatching baskets/treatment. Although there were no differences in hatchability (> 0.1), chicks in the 240 and 720 µg/mL Dex-IC treatments weighed ~ 1 g more (P < 0.05) at hatch compared to chicks in the other treatment groups. Studies are planned to further optimize the IC dosage and to determine the effect of Dex-IC on growth performance in broilers.

Key Words: broilers, in ovo treatment, dextrin, iodinated casein

P174 Effect of an organic acid product on body weight loss during pre-slaughter feed withdrawal and transportation under commercial conditions in Brazil. Anita Menconi1, Tiago Urbano2, Lisa Bielke1, Billy Hargis1, Guillermo Tellez1 1JKS Poultry Health Laboratory, University of Arkansas, Fayetteville, AR 2Vetanco do Brasil, Chapeco, Brazil

For broilers, feed withdrawal (FW) prior to processing has been shown to reduce ingesta contamination of carcasses during processing, but paradoxically increased contamination with food-borne pathogens due to increased ingestion of feces prior to live haul. Acidification of the water during FW with some organic acid (OA) blends has significantly reduced pathogens such as Salmonella on carcasses by antemortem disinfection of the crops. However, some OAs have notoriously resulted in reduced water consumption when compounded by transportation, resulting in increased body weight loss (BWL). Thus, BWL during FW and transport must be considered when evaluating OA products for FW application. In the present study, we evaluated the effect of a commercially available OA-mix (Optimizer™) on body weight of broilers at the processing facility from seven commercial farms in Brazil. In all farms, houses were paired with the control house receiving regular water and the treated house receiving OA + water at the recommended concentration. Water treatment was applied for 8-12 h prior to transport and the average FW period was 8 h. At each farm, 35 tagged broilers per treatment were individually weighed before FW period and at the time of arrival to the processing facility. Total BWL was calculated as the difference between weight prior to FW and weight at arrival to the processing facility. Controls consistently experienced higher BWL than treated groups, by 31.8%, 39.2%, 28%, 45.2%, 55.7%, 35.5%, and 25.2% less than OA-mix treated flocks. By reducing BWL during feed withdrawal and transportation to the processing plant of broilers under commercial conditions, this OA product proved to be a useful tool for reducing BWL during pre-slaughter conditions.

Key Words: organic acids, broilers, feed withdrawal, transportation, body weight loss

P175 The Effect of Different Management Factors on the Incidence of Pendulous Crops (PC) in Commercial Female Turkeys Corissa A. Steimling1, R. Michael Hulet1, Terri L. Cravener1, Ben Wood2, Nico Buddiger1 1Department of Poultry Science, Penn State University, University Park, PA 2Hybrid Turkeys, Kitchener, Canada

The incidence of Pendulous Crop (PC) in domesticated turkeys is a long standing issue in turkey production. A study was conducted to evaluate the incidence of PC under different management practices. The experiment used 2592 female Converterm poults (Hybrid Turkeys), and was carried out over a period of 6 weeks. The poults were randomized into 4 separate rooms each with 12 equal pens (5 m²) containing 54 birds. The factors evaluated for their ability to induce PC lesions were ambient temperature, water space per bird, and dietary energy. The room temperature was varied with two rooms following the typical temperature profile that decreased from 31° to 20°C (decrease of 2.8 °C/week) for the control group. The other two rooms were held at a higher ambient temperature that was 31 to 29°C for the six weeks. Water was supplied with half of the pens containing a red dome drinker; the other half of the pens used the same drinker with half of the drinking area blocked from poult access (424 versus 212 cm²/bird, respectively). Finally, the energy contained in the diets was considered. Pre-starter and starter feed were each fed for 3 weeks; the pre-starter and starter feed contained two different levels of energy (2895 versus 3073 kcal/kg). The birds were weighed upon arrival, and then in three-week intervals following placement. Each bird showing symptoms of PC was tagged, and examined for severity of the lesion at the end of the experiment. No significant differences were found for water intake, body weight, feed intake, feed conversion, percent mortality, or incidence of pendulous crop. However, water intake (at all days measured) and incidence of pendulous crop (% of hen housed and % of remaining birds) were significantly greater (P < 0.01) for the birds reared on the higher temperature profile when compared to those on the control temperature profile. From these results, we can conclude that ambient temperature during brooding and/or increased water consumption increases the incidence of pendulous crops in female pouls (1.51 % vs 0.31 %, P < 0.01).

Key Words: Pendulous Crop, Turkey Hens, Ambient Temperature, Water Consumption

P176 Fluorescence in-situ hybridization (FISH) as a tool for visualization and enumeration of Campylobacter in broiler ceca Brian Oakley1, Seung-Chul Yoon, J. Eric Line, Mark Berrang, R. Jeff Buhr, Nelson Cox, Bruce Seal USDA-ARS, Athens, GA

Food-borne human pathogens are typically detected and enumerated by either cultural methods or PCR-based approaches. Fluorescence in-situ hybridization (FISH) is a standard microscopy tool for microbial ecology but has not been widely used for food safety applications despite important advantages over existing methods. The main strengths of FISH are the ability to design fluorescent probes to visually detect individual bacterial cells with almost any level of taxonomic resolution, and the ability to rapidly enumerate these cells of interest while maintaining information about their spatial context in the original sample. In this study, we have designed and validated several new FISH probes targeting Campylobacter and have written a new image-processing algorithm to rapidly enumerate cells from acquired images. Validations of the new algorithm show it outperforms existing ‘industry-standard’ software. Newly designed probes successfully targeted either the entire genus or different strains of C. jejuni on the basis of a single basepair mismatch in the small subunit of the ribosomal RNA. Hybridization conditions were optimized to distinguish among C. jejuni strains ATCC49943, 33250, 81-176, and 11168 grown in co-culture. Additionally, sample preparation protocols were optimized to perform FISH directly from chicken cecal contents and are currently being used to investigate the effects of various anti-microbial feed additives on Campylobacter populations in the cecum.

Key Words: pathogens, detection, diagnostics, fluorescence microscopy, FISH
P177 Comparison of 1950s broilers to the modern high yielding broiler  Katie Collins', Brian Kiepper, Casey Ritz, Beverly McLendon, Jeanna Wilson  Department of Poultry Science, University of Georgia, Athens, GA

The University of Georgia maintains a 1950s meat-type chicken control strain known as the Athens Canadian Random bred (ACRB). This strain is a subpopulation of the Ottawa Meat control strain developed in 1955. ACRB performance was compared to the 2012 Cobb 500 high yielding broiler to determine selection changes over the past 55+ years. All birds were reared under management practices appropriate for the Cobb 500. Birds were weighed weekly and processed at 6, 8, and 10 weeks. Only ACRB females were processed at 12 weeks. Whole carcass, carcass parts, and organs were weighed. Mortality from 2-10 weeks was 0% for the ACRB and 9.3% for the Cobb. Modern broilers outweighed ACRBs at every age ranging from 3.6-4.8 times the size of the ACRB. All parts and organs were compared as a percentage of live fasted body weight. The ACRB had significantly heavier feet, wings, internal organs, and feathers. The smaller ACRB had a greater water uptake in the chiller which is thought to be due their greater surface to volume ratio. The modern Cobb broiler had double the breast and larger leg muscles and had a significantly greater fat pad. Despite the larger muscle mass, the supply organs, the heart and lungs, were significantly smaller in the Cobb broiler than the ACRB as a percentage of body weight. These smaller percentage supply organs could be a reason for the differential mortality values during rearing. Relative size of supply organs should be given consideration for genetic selection of the future broiler.

**Key Words:** broiler, Athens Canadian Random Bred, process, heart, lungs

P178 Quality of egg yolks after oxycarotenoids supplementation in hens’ diets  Elisa Helena Giglio Ponsano’, Alstyn Wesley Momette da Costa, Thiago Luis Magnani Grassi, Luiz Fernando Corona Cintra, Olivia Campos de Moraes, Manoel Garcia-Neto, Marcos Franke Pinto  Unesp Univ Estadual Paulista, Aracatuba, Brazil

Oxycarotenoids concentration in layer hens’ feed may be increased whenever the consumer market demands for more pigmented egg yolks. Oxycarotenoids present in Rubrivivax gelatinosus biomass grown in industrial wastewater have already proved their ability on enhancing yolk color. Moreover, there is a current interest on the antioxidant properties that some carotenoids may provide to food and health. So, in this experiment, we investigated the effects of oxycarotenoids supplementation in hens’ diets on yolk composition and stability to rancidity. Hy line hens aging 19 weeks were individually housed in wire cages equipped with feeders and drinkers. After 15 days receiving a corn basal diet nutritionally balanced, they were assigned to four different treatments, with six replicates, that lasted for 28 days: T1 – basal diet (control), T2 – basal diet + 1.5 mg/kg canthaxanthin, T3 – basal diet + 4.5 g/kg freeze dried R. gelatinosus biomass and T4 - basal diet + 4.5 g/kg spray dried R. gelatinosus biomass. Eggs laid on the last 5 days of rearing were collected; the yolks were separated, analyzed for pH and then freeze dried for the further analyses. Proximate composition was determined after drying and the rancidity (TBRAS method) was investigated at 0, 30 and 60 days of storage at room temperature/dark conditions. Yolks that received the oxycarotenoids had the lowest moisture content and the highest protein contents ($P < 0.05$). Lipids and pH were the same for all treatments ($P > 0.05$) and ashes only were higher for T2 ($P < 0.05$). All treatments that received oxycarotenoids had lower TBARS than control group and, among them, oxycarotenoids from spray dried R. gelatinosus biomass were the most effective to prevent rancidity ($P < 0.05$). So, we concluded that the use of R. gelatinosus biomass in hens feed brings positive effects to the yolk quality, since protein content is increased and conservation is increased due to decreased water content and lipid oxidation.

**Key Words:** Rubrivivax gelatinosus, biomass, proximate composition, lipid oxidation, pH.

P179 Chicken meat consumer profile in northwestern São Paulo State, Brazil  Marcos Franke Pinto’, Idelipes Bossolani, Angélica Cardoso, Elisa Helena Ponsano, Manoel Garcia Neto, Silvia Helena Perri  Univ Estadual Paulista, Aracatuba, Brazil

Brazil is the world’s first chicken meat exporter nowadays. The maintenance of this position requires a constant quality attributes evolution. This work evaluated the chicken meat consumer profile in the northwest region of São Paulo state, the most important Brazilian poultry meat consumer market, in order to provide information to the productive sector. The data were collected using 482 interviews and questionnaires that were answered by e-mail. The questionnaires involved questions related to the consumer identification, habits and preferences and their knowledge about food safety, production system, sustainability and animal welfare. Most of the consumers, 62%, were female, with ages ranging from 20 to 50 years. Beef was preferred by the majority of the answerers and chicken and pork meat were together the second choice. Only 2% of the interviewed consumers mentioned not enjoying poultry meat. The main part of consumers, 67%, prefer to buy breast and legs and only 11% are used to buy the whole poultry carcass. More than 60% of the interviewed have already eaten free range chicken meat, but the majority of them, 89%, are used to consume regular industrialized poultry. About 75% of the consumers believe hormones are used to grow the birds. Over 80% of people observe the expiration date before buying the product, but only 55% check if it has the stamp of the official inspection service. Color and appearance of meat are the most important factors that influence the consumer’s choice. The amount of water that drips on the tray is a rejection factor to 88% of answerers. Most of them, 66%, prefer lighter colored meat. Only 27% of them believe that chicken meat causes an environmental impact and 48% do not know the meaning of animal welfare. More than half of the interviewed do not consider animal welfare aspects before consuming any kind of meat. From these results obtained, it is possible to conclude that any effort to improve the product quality, mainly concerned to animal welfare and sustainability aspects, requires prior educational initiatives.

**Key Words:** consumer opinion, quality attributes, quality quiz, market trends

P180 Inherent weaknesses in the cultural methods used for Salmonella detection  Nelson Cox¹, R. Jeff Buhri², John Cason², Paula Fedorka-Cray ¹ USDA, ARS, Russell Research Center, Athens, GA

Expert consensus on the most appropriate sampling sites and methods for determining the Salmonella status of raw poultry and poultry products has never been reached. In addition, the lack of uniformity and inherent weaknesses in many frequently used methods complicates routine Salmonella detection. In poultry, the method of sampling a broiler carcass, the type of laboratory media used, and the number of colonies selected are only several factors that can influence the number of positive samples and/or serotypes isolated. Often two or more selective broths and plates are used to reduce the likelihood of false-negative results. In a recent study, postchill commercial broiler carcasses (neck skin, carcass rinse, or whole carcass enrichment) were sampled using multiple culture media [tetrahionate and GN Hajna broths and Brilliant Green with Sulfadiazine (BGS) and XLT-4 agar plates]. Only a single Salmonella serotype was detected using the rinse method while two and 5 different serovars using neck skin and carcass enrichment, respectively. Using the same media/agar combinations, from 49 natu-
rally contaminated broiler carcasses BGS and XLT-4 yielded the same Salmonella serotypes 22% of the time whereas different serotypes were found for 78% of the samples. In another study 34 of 35 S. Lille isolates were recovered from BGS plates and not at all on XLT-4. Conversely, S. Kiambu isolates were detected exclusively on XLT-4 plates. These studies highlight the variability of detecting individual serotypes even when using only two plating media. In addition to culture media, the number of colonies selected and tested from a sample can dramatically influence the number of positive samples and the number and different serotypes encountered. When only one colony was selected from each plate, 42/52 broiler carcasses were Salmonella positive. If 2 or 3 colonies were tested from each plate, 49/52 were positive. By picking more than one colony an additional serotype was found on 40 of the 49 positive carcasses and on 23 of these 40, two or more additional serotypes were detected. More research is needed to better understand the limitations that exist in our laboratory methods for isolating Salmonella, particularly from raw poultry and poultry-related samples.

Key Words: Salmonella, cultural methods, sampling, broilers

P181 Efficacy of chemical sprays to eliminate inoculated Salmonella from defeathered broiler breast skin

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Contamination of poultry with Salmonella is a food safety concern. Because Salmonella-free broilers cannot always be produced on the farm, antimicrobials are used in the processing plant. The objective of this study was to look at the efficacy of several chemicals to eliminate 104 cells of a marker S. Typhimurium inoculated onto the breast skin of seven week old broiler carcasses. The breast skin on each side of 35 defeathered broilers (70 skin samples) was inoculated with 0.1 mL of a 104 S. Typhimurium. After drying for 2 min, the following hand spray treatments were applied to the breast area of the hanging carcasses (21 mL/carcass): (1) no spray, (2) water spray, (3) 1.4% H2O2, (4) 2.5% Ox-B (5) 4% Ox-B, (6) 6% Ox-B, (7) 50 ppm chlorine. Ox-B is a stable complex of reactive oxygen species comprised of H2O2 and Cl2. After treatment, carcasses remained hanging/dripping for 2 min and then skin samples (5cm2) were aseptically removed, placed in an 80 mL stomacher bag with 30 mL of 1% buffered peptone and stomached for 1 min. Bags were placed at 37°C for 24h and then samples streaked onto BG/ultra agar plates containing 200 ppm nalidixic acid. Plates were incubated at 37°C for 24h. The number of positive skin samples/number sampled were 10/10, 9/10, 8/10, 0/10, 0/10, 1/10, and 7/10 for treatments 1-7 (listed above) respectively. Ox-B biocide eliminated inoculated Salmonella on all but one skin sample compared to the results for H2O2 (8/10) and 50 ppm Cl2 (7/10). Chlorine and H2O2 both have been shown to be very effective for eliminating Salmonella in previous studies using whole carcass rinse sampling. This research demonstrates that the combination chemical Ox-B can eliminate Salmonella on the skin of defeathered broiler carcasses when applied as a spray prior to immersion chilling.

Key Words: breast skin, chemical spray, Salmonella

P182 An investigation of protein extractions in broiler pectoralis muscle at varying extraction pH values

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This study was designed to evaluate the solubility of proteins extracted from broiler pectoralis muscle. Sarcoplasmic and myofibrillar protein extractions were performed at 24 hours postmortem. Both extractions were conducted with buffers at pH levels of 5.4, 6.4, 6.9, 7.2, 7.5, 8.0, and 9.0. Protein concentrations were determined using the Better Bradford assay. Foam expansion was used to evaluate protein denaturation and functionality. Gel electrophoresis was conducted for both sarcoplasmic and myofibrillar protein extracts. Sarcoplasmic protein concentrations peaked at extraction buffer pH 7.5, and myofibrillar concentrations peaked at buffer pH 7.2. An inverse relationship was noted between the protein concentrations and percentage of foam. Gel electrophoresis revealed that as extraction buffer pH increased from 6.4 to 9.0, the abundance of the protein band corresponding to glycogen phosphorylase decreased in the myofibrillar protein extract and increased in the sarcoplasmic extract. Some protein bands that were found at pH 6.4 and above were noticeably missing at pH 5.4. This could be due to the pH of the buffer solution lowering the pH of the muscle tissue close to its isoelectric point, resulting in fewer proteins being extracted. These results indicate that the content, composition, and functionality differ at the varying buffer pH values.

Key Words: sarcoplasmic, myofibrillar, extraction, pH, broilers

P183 Efficacy of ultraviolet light against Listeria monocytogenes on ready-to-eat meats

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The ubiquitous nature of Listeria monocytogenes and its ability to be viable at refrigerator temperatures as well as at 37°C is a threat to the food processing industry as a post process surface re-contamination organism. Therefore, it becomes critical to minimize the incidence and number of cells of the pathogen during processing as well as product storage. In this study, a non-thermal post process decontamination method – Ultraviolet (UV) light was evaluated against L. monocytogenes at different growth phases and temperature both in growth media and on food matrix. Listeria monocytogenes serotype 4a was cultured in Brain Heart Infusion (BHI) broth at 37 and 4°C. Cells were harvested during their log and stationary phase and subjected to UV radiation at low (3–4 mW/ sq. cm) and high (7-8 mW/ sq. cm) intensity for 0, 10, 30, 50, 70, 90 and 110 s. And for the RTE product L. monocytogenes was spray inoculated onto bologna and allowed 30 min. of attenuation time. Inoculated bologna was then subjected to UV radiation at low and high intensities for 0 to 300 s. Cells were recovered on Modified Oxford agar (MOX) and data was analyzed using ANOVA to determine significant differences between the means at p<0.05. Overall, populations of L. monocytogenes were significantly reduced (p<0.05) after 10 (4°C) and 30 s (37°C) of exposure and further significant (p<0.05) reductions were observed at 50, 70, 90, and 110 s irrespective of temperature and UV intensities. On bologna, 150 s of UV exposure resulted in significant reductions (p<0.05) irrespective of the intensities. Moreover, irrespective of temperature, intensity, and exposure times, significantly higher (p<0.05) reductions were observed in the log phase cells as compared to the stationary phase cells in the laboratory media as well as on bologna. Results from this study indicate a significant reduction in L. monocytogenes population between the log and stationary phase on different media types and at different exposure times signifying the potential use of UV light in the food industry to control L. monocytogenes.

Key Words: Listeria monocytogenes, Ultraviolet light, Ready-To-Eat meat

P184 Carcass yield of broilers submitted to different LED colors on artificial lighting

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The composition and carcass yield reflect significantly on the quality of the final product. Recognized as an indispensable element for the production of the birds, the artificial lighting can interfere in the production and behavior of birds. The objective of this study was to evaluate the carcass yield and noble cuts of broilers submitted to different colors in the artificial lighting. The work was developed in the poultry house belonging to Experimental poultry Sector, Federal University of Grande Dourados (FCA/UFGD). 1350 chicks were used male of Cobb® line, distributed in completely randomized design. Five lamps were tested: 1 Treatment (yellow LED), 2 Treatment (red LED), 3 Treatment (blue LED), 4 Treatment (white LED) and 5 Treatment (Compact Fluorescent), with five repetitions. A light 23 hours of program was used (natural and artificial). To 42 days were slaughtered 30 birds per treatment, evaluating the carcass yield, chest and thigh-drumstick. The treatments means were compared by Tukey test the probability 5%. The results showed no significant difference (p>0,05) between the treatments for the variables chest, thigh-drumstick and carcass yield. The results obtained in this work can be related to the light program used. Under the conditions in which the work was realized, the artificial lighting with fluorescent lamps can be replaced by different LED colors with-out affecting negatively the carcass yield, chest and thigh-drumstick of broiler.

Key Words: colors, chest yield, nobles cuts, meat quality

P185 Effects of dietary energy and protein levels and supplementation with essential oils on growth performance of broilers Thomas Weiland\textsuperscript{1}, Konstantinos Mountzouris\textsuperscript{2}, Vassilis Paraskevas\textsuperscript{2}, Irida Palamid\textsuperscript{2}, Tobias Steiner\textsuperscript{3}, Konstantinos Fegeros\textsuperscript{3} \textsuperscript{(1) BIOMIN Deutschland GmbH, Stadtfelden, Germany \textsuperscript{(2)}Department of Nutritional Physiology and Feeding, Agricultural University of Athens, Athens, Greece \textsuperscript{(3)}BIOMIN Holding GmbH, Herzogenburg, Austria

Four hundred and fifty, one-day-old, male Cobb broilers were randomly allocated in 6 experimental treatments for 6 weeks in order to investigate the effect of a reduction in dietary energy and protein levels and supplementation with essential oils (EO) on growth performance. Each treatment had 5 replicates of 15 broilers each. All experimental treatments received corn-soybean meal basal diets. The first diet that served as a positive control (diet A) was formulated to meet broiler nutrient requirements for maximizing meat yield according to Cobb recommendations for starter (1 to 14 d), grower (15 to 28 d) and finisher (29-42 d) growth periods. Diets B and C served as negative controls and were suboptimal in energy (ME) and crude protein (CP) levels by 3% and 6%, respectively, compared to diet A. Each diet was offered with or without supplemental EO (125 mg/kg), resulting in the following 6 treatments: A=positive control (optimal basal diet), AEO=diet A+EO; B=negative control suboptimal for ME and CP, -3% vs. diet A; BEO=diet B+EO; C=negative control suboptimal for ME and CP, -6% vs. diet A; CEO=diet C+EO.

Feed and water were available ad libitum. Performance parameters (body weight, feed intake, feed/gain ratio and mortality) were monitored on a weekly basis. Performance parameters were analyzed using the general linear model (GLM) - general factorial ANOVA procedure. Statistical significant effects were further analyzed and means were compared using Duncan’s multiple range test.

Overall mortality during the experiment was low and averaged 3.56%. Overall feed/gain was affected by diet (1.67, 1.72 and 1.74 for diets A, B and C, respectively; P=0.01) and tended to be improved by EO supplementation (1.69 vs. 1.73; P=0.089). In conclusion, a reduction in dietary ME and protein levels adversely affects broiler feed efficiency, whereas supplementation with EO has potential to compensate these effects.

Key Words: Energy, Protein, Essential oils, Broilers

P186 Use of organic minerals in broiler diets: Response to reduced levels in Bioplex® proteinate form K.A. Jacques\textsuperscript{1}, R.A. Vieira\textsuperscript{2}, M.I. Hannas\textsuperscript{2}, L.F.T. Albino\textsuperscript{2}, H.S. Rostagno\textsuperscript{2} \textsuperscript{1}Alltech Inc., Nicholasville, KY \textsuperscript{2}Universidade Federal de Viçosa, Minas Gerais, Brazil

Minerals are essential for broiler growth and many physiologic processes, however increases in mineral supplementation in animal production have led to concerns regarding accumulation in the environment. Feeding mineral chelates has been suggested as they are more bioavailable compared with inorganic sources. This trial evaluated use of reduced levels of chelated minerals and Se-enriched yeast in broilers from 1-21 and 1-49 days of age. A total of 2,000 Cobb 500 broiler chicks were distributed into a completely randomized block design with 8 treatments and 10 replicates of 25 birds. Treatments consisted of a non-supplemented diet, a diet supplemented with inorganic minerals and six diets including chelated minerals (Bioplex® Zn, Mn, Fe, Cu; Alltech Inc.) and Se-enriched yeast (Sel-Plex®, added at 11, 22, 33, 45, 56 or 67% of inorganic mineral concentrations. Performance parameters evaluated included weight gain, feed consumption, feed conversion, viability, and European efficiency index (EEF). At the end of each phase, 2 birds/experimental unit were killed and breast, liver and tibia samples were collected for mineral analyses. Also, excreta (litter) samples were collected. Data were evaluated using Student-Newman-Keuls test (P<0.05). Livability at 49 days was lower (P<0.05) in unsupplemented vs. supplemented birds (91.2% vs 98-99.6%). At 49 days of age, the 33% organic mineral treatment maintained (P<0.05) weight gain (3.47 kg) and EEF (393.35) compared with the inorganic treatment (3.52 kg and 396.21, respectively). Likewise, liver mineral concentrations were also maintained in the organic treatment, as were mineral levels in tibia (tibia Zn, Mn and Cu: 71.00, 1.45, 0.20 ppm, respectively). Selenium concentrations in breast muscle were numerically (P<0.05) improved with the 33% organic mineral treatment (1.20 vs 0.99 ppm). Zinc, Mn and Cu excretion in litter at 49 days of age was lower (P<0.05) for the 11, 22, 33, 45% organic mineral treatments compared with the inorganic treatment at traditional concentrations. For example, concentrations of Zn, Mn, and Cu in litter were 172.95, 185.10, and 37.45 ppm, respectively, for the 33% organic mineral treatment compared with 312.66, 368.12, and 57.53 ppm, respectively, for the inorganic treatment. In summary, feeding organic minerals at 33% the average concentration of inorganic sources traditionally used by the poultry industry maintained performance, tissue mineral concentrations, and EEF while reducing mineral excretion.

Key Words: organic minerals, chelated minerals, selenium yeast, performance, environmental pollution

P187 Effects of diet type and nutrient density in grower feed on growth performance of broiler chicks X. Wang\textsuperscript{3}, E. D. Peebles, W. Zhai \textsuperscript{1}Department of Poultry Science, Mississippi State University, Mississippi State, MS

The effects of diet type and amino acid (AA) and apparent metabolizable energy (AME) levels in the grower phase (d 8 to 21) on growth performance and d 42 carcass traits of broiler chicks were investigated. A total of 1,120 Ross × Ross male 708 chicks were randomly allocated to 80 pens (14 chicks per pen, 10 replicates per treatment). Eight experimental diets (2×2×2 factorial design) with 2 diet types [high distiller’s dried grains with solubles diet (hDDGS) or high meat and bone meal diet], 2 AA densities (moderate or high), and 2 AME densities (moderate or high), were fed to the broiler chicks from d 8 to 21. Body weight and feed intake were measured at each phase (starter: d 0 to 7; grower: d 8 to 21; finisher: d 22 to 42), and 4 chicks per pen were processed and deboned on d 42. From d 8 to 21, high AA density in the feed decreased...
feed intake without affecting BW gain, which resulted in a lower feed conversion ratio (FCR). A high AME level lowered feed intake, but increased BW gain, which also resulted in a lower FCR. Among all groups, chicks fed the hDGS diet with lower AA and AME exhibited the lowest BW gain and highest FCR. From d 22 to 41, feed intake, BW gain, and FCR were not affected by dietary treatment from d 8 to 21. The weights of carcasses, wings, leg quarters, breasts, and tendons on d 42 were not affected by dietary treatment from d 8 to 21. However, abdominal fat deposition was increased in the groups fed moderate levels of AA and AME when compared to the groups fed diets containing high AA and moderate AME or moderate AA and high AME. Also, groups fed diets with high AA and AME had a higher fat pad weight than did groups fed diets containing high AA and moderate AME. It can be concluded that grower feeds containing high AA or high AME levels may exhibit improved growth performance during the grower phase without associated effects on d 42 meat yields. However, these same dietary regimens may alter abdominal fat deposition.

**Key Words:** amino acid, metabolizable energy, growth performance, carcass yield, fat

**P188 Evaluation of three commercial probiotics on broiler performance, plasmatic xanthophylls, and skin yellowness** Xóchitl Hernández-Velasco1, Gustavo Martínez-Martínez2, Arturo González-Lara1, Benjamin Fuente-Martínez2, Manuel Quiroz-Pesina3, Ernesto Avila-González2 1Departamento de Medicina y Zootecnia de Aves, FMVZ-UNAM, Mexico City, Mexico 2Centro de Enseñanza, Investigación y Extensión en Producción Avicola FMVZ-UNAM, Mexico City, Mexico 3Industrias VEPINSA S.A. de C.V., Los Mochis, Sinaloa, Mexico

A study was conducted to test the effect of three commercial probiotics on body weight gain, feed intake, feed conversion ratio (FCR), plasmatic levels of xanthophylls, and skin yellowness (b+) in male and female broilers. Four hundred 1-d-old Ross 308 straight-run broiler chickens were raised on a starter diet through 10 d, a grower diet from 11 to 21 d, and a finisher diet from 22 to 49 d of age using ALLIX program. The broilers were randomly allotted to 4 treatments, with 4 replications (pens) of 25 birds each (2 males and 2 females). A 4 by 2 factorial was used (4 feed treatments & 2 sexes, male / female): 1) control, 2) Floramax® in drinking water at days 1, 12, 25, and 35, 3) Calsporin® and 4) Alquerfeed® (0.6 kg/ton). Diets were based on sorghum + soybean meal + meat meal, and were added with 85 ppm of xanthophylls of Aztec marigold flower (Tagetes erecta). All nutrients were formulated according to recommendations of the primary breeder. Feed and water were provided ad libitum. Body weight gain, feed intake, and feed conversion ratio were calculated weekly throughout the study. At day 21 of age and weekly, skin pigment deposition (b+) was measured of 10 randomly selected birds from each of four pens per treatment. The same way samples of blood from two birds per pen were collected for plasma xanthophylls analysis. Data were analyzed using analysis of variance (ANOVA) and means were compared by Turkey test. Performance at 49 days of age was not significantly different between treatments (P>0.05). The lowest plasmatic levels of yellow xanthophylls corresponded to the control group (17.2 µg/ml) compared to the treatments 2, 3 and 4 (19.4, 18.7, 20.1 µg/ml respectively) (P<0.05). Skin pigmentation at 49 d of age was significantly better in females (20 b+) than males (18 b+) (P<0.01).

This experiment was sponsored by Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (PAPIIT) Project IN203910-3, Dirección General de Apoyo al Personal Académico (DGAPA), Universidad Nacional Autónoma de México (UNAM).

**Key Words:** probiotics, skin yellowness, plasmatic xanthophylls, broilers

**P189 Bacillus licheniformis (GalliPro® Tect) and antibiotics in synergy improves performance and feed conversion ratio in Clostridium perfringens challenged broilers** Kristina Ulrich Sørensen1, Christine Fossing1, Greg F Mathis2 1Chr Hansen A/S, Animal Health and Nutrition, Denmark, 2Southern Poultry Research, Inc., Athens, GA

Growth retardation in broilers can be associated with impaired intestinal health which poses a major problem in broiler flocks. *Clostridium perfringens* is prevalent in broiler production worldwide causing necrotic enteritis. *C. Perfringens* infections may show up as an acute clinical infection that leads to increase mortality and can account for great losses. The infection can be treated with medication, however antibiotics affects both the pathogens as well as beneficial microorganisms. *Bacillus licheniformis* are known to improve intestinal health and integrity of broilers through support of the colonization of at beneficial microflora. *Bacillus licheniformis* (GalliPro® Tect) in combination with Bacitracin Methylen Disalicylate (BMD) is hypothesized to be an effective combination in promoting intestinal health and growth in *C. Perfringens* infected broilers.

A *Clostridium perfringens* challenge to initiate necrotic enteritis study was conducted to examine the effect of dietary supplementation of *Bacillus licheniformis* (GalliPro® Tect) combined with Bacitracin Methylen Disalicylate (BMD) on weight gain and feed conversion ratio (FCR). The trial was performed with 1440 Cobb broilers all dosed with a fresh broth culture of *C. perfringens* (1.0 x 10⁶ CFU/ml). The broilers were fed a commercial US corn-soybean diet, all containing Salinomycin at an inclusion rate of 60 g/ton. The broilers were randomly divided into three groups at hatch and fed the three diets until 42 days of age: 1) Negative control, 2) BMD (50g/t feed), 3) BMD (50g/t feed) + *Bacillus licheniformis* (GalliPro® Tect) 8x10⁶ CFU/g feed.

Broilers fed the *B. licheniformis* (GalliPro® Tect) + BMD diet showed a significant higher weight at slaughter of 3.7% compared with the BMD fed group (P<0.05). The FCR was significantly improved at day 42 by 7.8 FCR points when *B. licheniformis* (GalliPro® Tect) was combined with BMD compared with BMD fed alone (P<0.05).

In conclusion, the results indicate that the combination of *B. licheniformis* (GalliPro® Tect) and BMD supplied to *C. perfringens* challenged broilers is more effective in improving weight gain and FCR than by use of BMD alone.

**Key Words:** Bacillus licheniformis, Clostridium perfringens, Antibiotics, Broilers, Growth

**P190 Bacillus subtilis (GalliPro® Max) and antibiotics in synergy improves broiler performance and feed conversion ratio** Kristina Ulrich Sørensen1, Christine Fossing1, Greg F Mathis2 1Chr Hansen A/S, Animal Health and Nutrition, Denmark, 2Southern Poultry Research, Inc., Athens, GA

Broilers are hatched under strictly hygienic conditions without access to microorganisms from other animals or the environment. These conditions make the broiler gut vulnerable against pathogens. Antibiotic growth promoters (AGP) are commonly used in broiler production and are powerful to eliminate pathogens and thus promote growth of the broiler. *B. subtilis* is known to improve intestinal health and integrity of broilers through support of the colonization of at beneficial microflora. However, while AGPs eliminate both pathogens as well as beneficial bacteria, *B. subtilis* (GalliPro® Max) is hypothesized to be affected by the presence of AGP to a minor degree.
A feeding trial with broilers was conducted to study the effect of dietary supplementation of *B. subtilis* (GalliPro® Max) combined with Bacitracin Methylen Di salicylate (BMD) on weight gain and feed conversion ratio (FCR). The trial was performed with 2160 Cobb broilers at hatch randomly divided into three groups: 1) Negative control, 2) BMD (50g/t feed), 3) BMD (50g/t feed) + *B. subtilis* (GalliPro® Max) 8x10^8 CFU/g feed. The trial lasted until slaughter at day 42. The diets were commercial US corn-soybean, all containing Salinomycin (60 g/ton).

The *B. subtilis* (GalliPro® Max) + BMD fed group showed a significant higher weight of the birds at day 42 of 4.5 - 5% compared with the BMD group and the control group (P<0.05). Furthermore, in the *B. subtilis* (GalliPro® Max) + BMD group, FCR was significantly improved with 7-9 FCR points (P<0.05) compared to the other groups. No significant differences were observed between the control and the BMD fed groups.

In conclusion, these results show that *B. subtilis* (GalliPro® Max) supplemented to broilers together with BMD improved performance parameters above the performance level obtained by use of BMD alone. Furthermore, the results indicate that *B. subtilis* (GalliPro® Max) is not eliminated by BMD, but works in synergy with BMD to promote a higher general health status than is obtained by use of BMD alone.

**Key Words:** Bacillus subtilis, antibiotics, broiler, growth, feed conversion ratio

**P191** Comparison of the effects of a Bacillus amyloliquefaciens probiotic (Ecobiol) and an AGP when added to broiler diets on digestibility of feed

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The experiment was conducted to evaluate the effects of *B. amyloliquefaciens* probiotic (Ecobiol) (10^7 CFU/g of product) on digestibility from 45 to 47 d of age. A total of 96 Cobb broilers were randomly assigned to 16 cages from day 1 to 47 of age under controlled conditions. Two diets were formulated: Starter (0-21d) and Grower (21-47d). All feeds were isonutritive and met NRC (1994) requirements for broilers. Three treatments were established: (T1) the control diet, (T2) the control diet supplemented with Ecobiol (1 kg/Tn) and (T3) the control diet supplemented with AGP (Bacitracin 55 ppm). At the end of the feeding period, a 72 h excruca and feed collection period was run out for digestibility determination from 45 to 47 d of age. Samples of feed and feces were analyzed for crude protein, crude fat, energy, crude fiber, carbohydrate and phosphorus and digestibility was calculated. Results were analyzed with a PROC GLM test. The crude fat digestibility in T1 (93.6) tended to be (P=0.08) lower than in T2 (94.3) and T3 (94.9). Digestibility of phosphorus was significantly (P<0.03) higher in T2 (82.7) and T3 (84.5) than in T1 (81.2). There were no significant differences between the groups in crude protein, energy, crude fiber and carbohydrate digestibility. According to our results, we concluded that there were no statistical differences in the digestibility coefficients analyzed between the group fed with bacitracin and the group fed with Ecobiol. If compared both groups with the control group, it is concluded that Ecobiol and bacitracin separately tend to improve digestibility of crude fat and improve phosphorus digestibility.

**Key Words:** AGP, nutrient digestibility, Bacillus, broiler

**P192** Effects of a Bacillus amyloliquefaciens probiotic (Ecobiol) added to broiler diets with AGP on performance and dressing parameters

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The trial investigated the effects on growth performance and dressing parameters when a *B. amyloliquefaciens* probiotic (Ecobiol) (10^7 CFU/g of product) is added to a broiler standard feeding program. Three diets were formulated: Starter (0-18d), Grower (19-32d) and Finisher (33-42d). All feeds contained salinomycin (60g/Tn) and were based on over 50% wheat, and did not contain xylanase. Three treatment groups were established: (C) a control diet, (AGP) the control diet supplemented with AGP (Flavomycin 10g/Tn of feed) and (E+AGP) the control diet supplemented with AGP and Ecobiol (Ecobiol 1000g/Tn + Flavomycin 10g/Tn). A total of 576 Ross 308 broilers were randomly housed in 18 pens and monitored from day 1 to 42 of age for differences in performance parameters. All birds were vaccinated against Newcastle disease, Infectious bronchitis and Infectious bursal disease. Results were analyzed with a PROC GLM test. The body weight in E+AGP group (3002g) was significantly (P=0.06) higher than in groups C (2837g) and AGP (2883g). There were no significant differences between the groups in feed intake. The E+AGP group (1.68) has significantly better FCR compared to FCR of groups C (1.78) and AGP (1.76). Animals of the E+AGP group (380) tended (P<0.12) to have a better Production index (Body Weight, Feed Intake, FCR and Mortality) than animals of the groups C (351) and AGP (359). Additionally, at the end of the trial, 10 birds with the same weight from each treatment were euthanized to evaluate dressing performance: The dressing percentage was significantly (P=0.013) higher in broilers from the E+AGP group (73%) than in those from groups C (70.5%) and AGP (71.4%). There was a tendency (P<0.06) for increased breast weight percentage of E+AGP group (21.3%) compared to groups C (19.6%) and AGP (20.3%). There were no significant differences in drumsticks and abdominal fat percentage. According to our results, it is concluded that the addition of Ecobiol together with AGP not only did not show contra indications between the combination of both products but also produced a synergistic effect, leading to better body weights, FCR, production index, dressing performance and breast weight in animals fed with Ecobiol + AGP than those fed only with AGP.

**Key Words:** Bacillus, AGP, performance parameters, dressing parameters

**P193** Effects of replacing MHA-Ca salt with 65% DL-Methionine on growth performance and carcass traits of broilers

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To meet the sulphur amino acid (TSAA) requirements of broilers, diets are commonly supplemented with either DL-methionine (DLM), liquid DL-methionine-hydroxy analogue-free acid (MHA-FA) or DL-methionine hydroxy analogue-calcium salt (MHA-Ca). Literature reviews have shown that the relative bio-effectiveness (BE) of MHA-Ca supplemented with 65% DL-Methionine (T2) is on average 65% (wt./wt. basis) for poultry. The objective of this study was to determine the effects of replacing MHA-Ca with 65% DLM on growth performance and carcass characteristics of broilers. Day old male broilers were randomly allotted to 7 dietary treatments in a randomized complete block design to 56 experimental pens. All diets (corn-soybean meal-based) were formulated to meet or exceed the nutrient requirements of the breeder’s recommendations, except for TSAA. Dietary treatments included: T1, Basal (BS) negative control diet deficient in TSAA without supplementation of any methionine (MET) source; T2, BS + MHA-Ca (84% BE) to reach 100% of the commercial TSAA recommendation; T3, BS + DLM replacing MHA-Ca of T2 with 65% on product basis; T4, BS + 50% of the MHA-Ca supplementation level used in T2; T5, BS + DLM replacing MHA-Ca of T4 with 65% on product basis; T6, BS + 150% of the MHA-Ca supplementation level used in T2; and T7, BS + DLM...
replacing MHA-Ca of T6 with 65% on product basis. Thus, a ratio of 65:100 was maintained in all treatment pairings. Body weight (BW), cumulative feed consumption (FC) and feed conversion (FCON) (feed: BW) were determined on a weekly basis through 42 days of age. Mortality (MOR) was recorded daily. Carcass weight (CW), percentages of carcass yield (CY) without giblets and breast meat yield (BMY) were determined prechill at 42 d of age. Overall, birds fed the BS diet (T1) had reduced (P < 0.0001) BW compared with birds fed the 100 (T2 and T3) and 150% (T6 and T7) diets. Birds fed the BS diet (T1) had lower (P < 0.0001) FC and higher (P < 0.0001) FCON. No differences were observed for MOR among treatments. Reduced (P < 0.0001) CW were observed for birds on the T1 diet, whereas, percent CY and BMY were higher (P < 0.0001) for birds fed the 100 (T2 and T3) and 150% (T6 and T7) diets. In conclusion, reduced growth performance was observed for broilers in TSAA deficient diets. Replacing 100 parts of MHA-Ca with 65 parts of DLM did not affect growth performance and carcass traits of broilers.

Key Words: broiler, methionine, bio-efficiency, hydroxy analogue, carcass

P194 Feed manufacture technique affects heat transfer to feed that may influence nutritional value Angela Lampsc, Ashley Evans, Joseph Moritz Department of Animal Science, West Virginia University, Morgantown, WV

Past research has shown that frictional force generated in the pellet die effects both pellet quality and nutrient digestibility. Furthermore, frictional force may be affected by conditioning temperature, production rate, and diet formulation. However, the best indicator of heat transfer to feed, hot pellet temperature (HPT), is a difficult metric to accurately obtain and is seldom reported in research. Two studies were conducted to determine the effect of conditioning on HPT as influenced by die frictional force. Experiment (Exp) 1 utilized a corn-soybean meal based diet that was pelleted at six conditioning temperatures: 75, 80, 85, 88, 90, and 93°C. Exp 2 utilized a wheat-soybean meal based diet that was pelleted at two conditioning temperatures: 82 and 93°C. Treatment manufacture was replicated eight and nine times in Exp 1 and 2 respectively. In each Exp, pelleting was conducted over a two-day period and feed production rate was constant across conditioning temperatures. HPT was obtained by a Fluke 51 II thermocouple thermometer, 80PK-24 temperature probe, and insulated container. Pellet durability was obtained using the New Holman Pellet Tester. In both Exp, HPT and pellet durability were sequentially increased with increased conditioning (P<0.05); however, the difference between HPT relative to conditioning temperature varied. In Exp1, HPT was decreased compared to conditioning temperature, with the magnitude of temperature decrease being greater for conditioning temperatures of 85°C and above (P<0.05). In Exp 2, the low conditioning temperature resulted in an increase in HPT, whereas the high conditioning temperature caused a decrease in HPT (P<0.05). Both Exp demonstrate that low conditioning temperature increases frictional heat within the die. The location and extent of heat transfer in the pelleting process may be important to mechanisms that alter nutrient conformation and determine pellet quality and digestibility.

Key Words: pelleting, conditioning, hot pellet temperature, pellet quality, heat transfer

P195 Dietary electrolytes and thermal conditioning: minimizing heat stress in broilers Manoel Garcia-Neto*, Maria Clara Silva Minoello, Elisa Helena Giglio Ponsano, Marcel Alexandre Almeida, Max José Fabia-Junior, Marcos Franke Pinto UNESP - Univ Estadual Paulista, Aracatuba, Brazil

In tropical climates the heat is one of the major constraints to production of broilers and is responsible for inducing a high mortality, especially in the finishing phase. Thus, the objective of this study was to compare the thermal conditioning early (TC) and feed formulation using dietary electrolytes (DE). Therefore, the electrolyte balance of K+-Na-CI was set at 350 mEq/kg and electrolyte ratio (K+-Cl)/Na in the 3:1 program PPF (http://www.fnrva.unesp.br/ppfr). A total of 300 Cobb 500 1-d-old male broiler chicks was randomly allocated to 24 floor pens with six replicates per treatment in a 2x2 factorial arrangement (with and without TC and with and without DE). Dietary treatments consisted: (T1) a traditional diet without TC, (T2) traditional diet with TC; (T3) with the application of dietary electrolyte and without TC and (T4) application of dietary electrolyte with TC. The thermal conditioning was conducted at 5 d of age (36°C for 24 h), only half of the batch (150 birds). After this period, all birds were transferred to boxes of 1.5 x3m (12 birds / box), with wood shavings reused as litter. Chicks were exposed to acute stress (36°C) for 8 h at the age 36, in all treatments, being electronically monitored the temperature and humidity of the microclimate of the birds. Feed and water were provided ad libitum, even during periods of stress. Were measured performance data (weight gain, feed intake and feed conversion) and mortality rate. The early thermal conditioning (T2) and effect of dietary electrolytes (T3) were effective to minimize the mortality of broilers subjected to acute heat stress with a significant difference (P<0.05), without prejudice on broiler performance. The results also showed that there was a more favorable effect when applied dietary electrolytes and thermal conditioning simultaneously (treatment T4). However, for the treatment none of these strategies has been applied (T1), the mortality rate was 83% over that in which they were applied (T4). It was concluded from this study that both techniques: the thermal conditioning early as the dietary electrolytes are efficacious in minimize the damaging effects caused by heat broiler.

Key Words: acute stress, cation-anion balance, dietary cation-anion, electrolyte diet, heat stress

P196 Effect of environmental temperature and age of broilers on energy value of soybean acid oil José Roberto Sartori*, Francine Vercese, Vítor Barbosa Fascina, Ivan Mailinich Gonçalves Souza, Mariana Kiyomi Maruno, Priscila Cavaclal de Araujo, Vanessa Cristina Pelicia, Carolina Carvalho de Miranda Juliana Cristina Ramos Rezende, Natan Cruz Alexandre, Antonio Celso Pezzato Universidade Estadual Paulista - UNESP, Faculdade de Medicina Veterinária e Zootecnia - FMVZ, Botucatu, Brazil

The aim of this research was to evaluate the effect of the environmental temperature and broiler age on the energy value of soybean acid oil. Male Cobb broiler chicks were housed in 54 galvanized wire cages allocated in three climate chambers (hot, cold and thermoneutral) during the initial (10-14 days; n=324), growing (25-28 days; n=216) and final phases (39-42 days; n=162) and it was conducted in a completely randomized design with 3 x 3 factorial arrangements of treatments (three temperatures and three ages) with six, four and three repetitions at the initial, growing and final phase, respectively. The temperatures of the chambers were adjusted according to each stage of breeding: 20, 18 and 15°C (cold); 28, 24 and 22°C (thermoneutral); and 34, 32 and 30°C (hot) for initial, growing and final phases, respectively. Diets consisted of the reference diet and the test feed (90% of reference diet + 10% of soybean acid oil). Metabolic trials were performed using the total collection of feces and the values of apparent and true metabolizable energies (AME and TME, kcal/kg) of soybean acid oil were calculated and corrected by the nitrogen balance of the test ingredient (AMEn and TMEn, kcal/kg), as fed-basis. It was found 8,603 kcal for gross energy / kg. The mean values of AMEn observed for broiler chicks in cold, thermoneutral and hot temperature were 6,195; 6,716; and 6,443 kcal /
kg, respectively. For initial, growing and final phases were 6,345; 6,610 and 6,399 kcal/kg, respectively. There was no significant interaction between temperature and breeding phase (P>0.05) for metabolizable energy. The temperature also did not affect the energy of soybean acid oil and the AMEn and TMEn were higher for birds in growing and in the final phase. The metabolizable energy values of test ingredient increased with the age of broiler; but they were not affected by environmental temperature.

**Key Words:** broiler, by-product, metabolizable energy, stage, stress

**P197 Effect of environmental temperature and age of broilers on energy value of pearl millet** Francine Vercese,12 José Roberto Sartori, Vitor Barbosa Fascina, Fabiana Golin Luigi Luiggi, Ana Cristina Stradiotti, Fernanda Uhlmann Godoy, Nathália Monteiro, Mônica Megumi Aoyagi, Gustavo do Valle Polycarpo, Fabyla Barros Carvalho, Thaila Cristina Putarov, Edgard Onoda Caldas, Antonio Celso Pezzato

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A study was carried out to evaluate the effects of environmental temperature and age on energy value of pearl millet (Pennisetum glaucum) and it was conducted in climate chamber. Male Cobb chicks were housed in metabolic cages during the initial (10-14 days; n=324), growing (25-28 days; n=216) and final phases (39-42 days; n=162). Birds were distributed in 54 cages and were divided into three climate chambers (hot, thermoneutral and cool). The cages were arranged in two batteries of three floors each. The experimental design was a completely randomized 3 x 3 factorial arrangement (three temperatures and three ages) with six, four and three replications at initial, growing and final stages, respectively. The temperatures of the chambers were adjusted according to each stage of breeding: 20, 18 and 15°C (cold); 28, 24 and 22°C (thermoneutral); and 34, 32 and 30°C (hot) for initial, growing and final phases, respectively. The traditional method of total collection of feces was used and diets were composed of reference diet and test diet (40% pearl millet + 60% reference diet). The apparent and true metabolizable energies (AME and TME) of pearl millet were calculated and corrected by nitrogen balance (AMEn and TMEn) of pearl millet, in kcal/kg, as fed-basis. It was found 4,010 kcal for gross energy / kg. The mean values of AMEn observed for broiler chicks in cold, thermoneutral and hot temperature were 3,083.28; 3,128.85; and 3,099.19 kcal / kg, respectively, and the initial, growing and final phases were 3,037.; 3,111.; and 3,163. kcal / kg, respectively. There was no significant interaction between temperature and breeding phase (P>0.05). Birds, at the final stage, had the higher values for AME, AMEn and TME. The metabolizable energy values of pearl millet increased with the age of broiler; but the environmental temperature did not affect this parameter.

**Key Words:** broiler, metabolizable energy, Pennisetum glaucum, stage, stress

**P198 Effects of essential oil supplementation on growth performance of turkey hens fed to 98 days of age** Thomas Weiland, Tobias Steinert, Michael Hulet1 BIOMIN Deutschland GmbH, Stadttoldendorf, Germany 1BIOMIN Holding GmbH, Herzogenburg, Austria 1Department of Animal Science, Penn State University, University Park, PA

Consumer fear of a possible increase in antibiotic-resistant bacteria has encouraged a search for alternatives for use in the diets of commercial poultry and other livestock. An increase in research and development of “natural fed” (use of no animal protein products), organic and antibiotic-free (ABF) diets is a result of increased consumer demand for these products. Essential oils (EO) were reported to improve nutrient digestibility, growth performance and feed efficiency in poultry, hence can contribute to productivity in ABF feeding programs for turkeys.

The objectives of this experiment was to evaluate the effect of supplementing a basal ABF diet with matrix-encapsulated essential oils on the growth efficiency and performance of turkey hens fed to 98 days of age.

Birds (Hybrid, Ontario, Canada) were brooded in 6 pens until 14 days of age and then split into 12 pens. Birds were supplied feed and water ad libitum. Diets were based on corn and soy bean meal and were pelleted at 80°C. The feeding program included a pre-starter (0 to 14 days), starter (14 to 42 days), grower (42 to 70 days) and finisher (70 to 84 days) diet.

Birds were assigned to two treatments with 45 birds per pen and 6 pens per treatment: (1) Control, where birds were fed the basal diet, and (2) EO, where birds were fed the basal diet supplemented with matrix-encapsulated EOs (Digestarom® P.E.P. MGE 150). The EO supplement was included in the basal diet at a dosage of 150 g/t in the pre-start, starter and grower diet, and 100 g/t in the finisher diet.

EO supplementation increased (P<0.001) final live weight by 5.9% (Control: 8604 g vs. EO: 9113 g); increased (P<0.001) feed consumption by 7.2% (Control: 19059 g vs. EO: 20425 g). Feed conversion ratio was improved (P<0.001) in the starter diet, but did not differ from the Control (Control: 2.337 vs. EO: 2.317; P=0.05) at the conclusion of the experiment. Total mortality and culls amounted to 1.7 and 1.8% in the Control and EO treatments, respectively.

In conclusion, supplementation of ABF diets with matrix-encapsulated EO has potential to improve growth performance in turkey females fed to 14 weeks of age.

**Key Words:** Essential oils, Turkeys, Performance

**P199 Effects of yeast cell wall preparation on the performance, immune responses and ileal microflora of broiler chickens** Guo Shuangshuang State Key Laboratory of Animal Nutrition, College of Animal Science and Technology, China Agricultural University, Beijing, China

The present study was carried out to investigate the effects of yeast cell wall preparation (YCWP, Actigen, Alltech Inc., USA) on the performance, immune responses and ileal microflora of broilers which were compared to the effects of chloroteracycline, a commonly used antibiotic growth promoter (AGP). A total of 528 day-old male broiler chicks (Ross 308) were randomly assigned to four groups: negative control (NC, no additives), positive control (PC, 0.1% chloroteracycline), YCWP I (400 g/t YCWP used throughout the trial), YCWP II (800 g/t, 400 g/t, 200 g/t YCWP used on days 0 to 7, 8 to 21 and 22 to 42, respectively). From 0 to 3 wk of age, the feed intake and feed conversion ratio (FCR) of the YCWP I were lower than those of NC and PC birds (P<0.05). The 0-to-3 wk FCR of the YCWP II was also lower than that of the NC. The 0- to 6 wk FCR in the YCWP I and PC tended to be lower than those of the YCWP II and NC (P=0.091). The YCWP decreased d 28 and d 42 serum lysozyme activities compared with the NC (P<0.05), without significant differences found between the two YCWP groups and the PC group. On d 21, the YCWP and AGP decreased the content of jejunal secretory immunoglobulin A (sIgA) versus the NC (P<0.01) and the d 42 jejunal sIgA content of the YCWP I and PC were lower than that of the NC. The ileal microflora was monitored by using PCR-denaturing gradient gel electrophoresis (PCR-DGGE). On d 21, the results of cluster analysis based on the PCR-DGGE profiles showed that the ileal community of the YCWP I was distinguished from other three groups and that of the YCWP II was similar to the PC. Furthermore, the identification of DGGE bands suggested that the number of Lactobacillus johnsonii increased and that of Clostridium perfringens.
decreased in the YCWP I compared with the other treatments. On d 42, the number of DGGE bands in the PC was the lowest and cluster analysis implied that the ileal microflora of two YCWP groups were close to each other with the highest similarity (63%). Meanwhile, in contrast to the NC and PC, the YCWP decreased the population of Clostridium perfringens. In conclusion, both YCWP and AGP diminished the humoral and enteric immune responses, but they exerted beneficial effects on the ileal microflora through different modes of action. The YCWP were comparable to the AGP and the YCWP I treatment resulted in more efficient feed utilization of broilers.

**Key Words:** Yeast cell wall preparation, Growth performance, Immunity, Ileal microflora, Broilers

**P200 Breeder age and vitamin supplementation in the first week of life on the performance of broilers** Ireniza de Alencar Nääs1*, Rodrigo Garófallo Garcia2, Fabiana Ribeiro Caldara1, Ibiara Correia Lima Almeida Paz2, Nilsa Duarte Silva Lima2, Mayara Rodrigues de Santana2, Rodrigo Borille2, Ana Flavia Basso Royer2, Marília Carvalho Figueiredo Alves2, Silvana Simm2 1Universidade Estadual de Campinas, Campinas, Brazil 2Universidade Federal da Grande Dourados, Dourados, Brazil

Vitamin supplementation can directly influence the development of birds in the initial phase, reflecting the performance of the animal at the end of creation. The breeders’ age influence the egg weight, and consequently the weight of hatched chicks and chickens. This research study aimed to evaluate the effect of vitamin supplementation in the first week of life on the performance of broilers originated from trees of different ages. A total of 2,592 one day old pullets from Cobb genetic strain were housed in an entirely randomized design, distributed in a 2x3 factorial, two broiler breeder ages (29 and 44 wks) and three levels of vitamin (without vitamins, the level recommended by the manufacturer) with 8 replicates per treatment. Statistical analysis was performed using PROC GLM of SAS and compared by Tukey 95% probability. Vitamin supplementation did not affect the performance of pullets in the first week and at 42 days old. The age of the breeders influenced the pullets weight gain, the final mean weight and average feed intake during the first week of the birds. The use of vitamin complex is recommended in case of nutritional deficiency of the female breeders, health problems, among other factors that may affect the performance of pullets.

**Key Words:** feed intake, feed efficiency, vitamins

**P201 The mycotoxin deoxynivalenol predisposes for necrotic enteritis in broilers** Gunther Antonissen1, Filip Van Immerseel1, Frank Pasmans2, Richard Ducatelle2, Freddy Haesebrouck2, Leen Timmermont2, Marc Verlinden1, Mia Eeckhout1, Sarah De Saeger2, Evelyne Delezee1, Sabine Hessenberger1, An Martel2, Siska Croubels1 1Department of Pathology, Bacteriology and Poultry Diseases & Department of Pharmacology, Toxicology and Biochemistry, Faculty of Veterinary Medicine, Gent University, Merelbeke, Belgium 2Department of Pathology, Bacteriology and Poultry Diseases, Faculty of Veterinary Medicine, Gent University, Merelbeke, Belgium 3Department of Food Science and Technology, Faculty of Biosciences and Landscape Architecture, Gent University, Merelbeke, Belgium 4Department of Bio-analysis, Faculty of Pharmaceutical Sciences, Gent University, Merelbeke, Belgium 5Institute for Agricultural and Fisheries Research (ILVO) Animal Sciences Unit, Gent, Belgium 6Biomin Research Center, Tulln, Austria 7Department of Pharmacology, Toxicology and Biochemistry, Faculty of Veterinary Medicine, University of Ghent, Gent, Belgium

Zinc sulfate at both supplemental levels. The results from this trial indicated the development of corn-soybean meal diets with 10 mg Zn/kg as Zn proteinate (Bioplex Zn®) is more effective than Zn sulfate on growth performance and bone Zn concentration of broiler chicks. A total of 240 1-day old male broiler chicks was raised in cages in an environmentally controlled room for 3 wk. Dietary treatments consisted of feeding a corn-soybean meal basal diet without zinc supplementation or with two supplemental levels of Zn (10 and 20 mg/kg) from either Bioplex Zn® or from zinc sulfate. Eight replicate cages of six chicks were randomly assigned to each of five treatments. Body weight and feed consumption were recorded weekly. At the end of the trial, two birds from each cage were randomly selected and euthanized to collect tibia samples for zinc analysis. Chicks fed the diet supplemented with 10 mg Zn/kg as Bioplex Zn had higher (P<0.05) weight gain than those fed the diets with either no supplemental Zn or Zn sulfate at both supplemental levels. The Zn concentration of tibia ash from chicks fed the diet containing 20 mg Zn/kg as Bioplex Zn was higher (P<0.01) than that from chicks fed no supplemental Zn or Zn sulfate at both supplemental levels. The results from this trial indicate that supplementing corn-soybean meal diets with 10 mg Zn/kg as Clostridium perfringens induced subclinical necrotic enteritis (NE) causes worldwide important economic losses in the broiler industry. The trichothecline mycotoxin deoxynivalenol (DON) may affect the intestinal epithelial barrier function, subsequently inducing protein leakage into the intestinal lumen. The objective of this study was to examine whether DON at contamination levels below the maximum European guidance level of 5000 µg/kg in poultry feed is a predisposing factor for NE in broilers.

In this study we used a highly reproducible in vivo infection model mimicking subclinical NE (Gholamiandehkhordi et al., 2007). A total of 360 one-day-old Ross 308 broilers were randomly divided into four groups of three replicates with 30 birds per replica. All birds were fed a starter diet during the first eight days of the experiment, subsequently a grower diet for eight days, followed by a finisher diet until euthanasia. Throughout the entire experiment, groups 1 and 4 received a blank diet while groups 2 and 3 received a diet experimentally contaminated with DON. All birds in group 1 and 2 were challenged orally with a net B positive C. perfringens strain containing approximately 4 x 10^8 cfu/ml for four consecutive days starting at day 17. The remaining groups received sterile medium.

The blank feed contained DON at 75 ± 22 µg/kg (starter), 83 ± 24 µg/kg (grower) and 100 ± 29 µg/kg (finisher). The contaminated feed contained DON at 3761 ± 1100 µg/kg (starter), 4281 ± 1300 µg/kg (grower) and 4384 ± 1300 µg/kg (finisher). At 1, 2 or 3 days after the final challenge with C. perfringens, chickens were euthanized and scored macroscopically for intestinal NE lesions. Chickens that received DON and C. perfringens had significantly (alpha=0.05, P<0.001) more lesions than chickens that received only C. perfringens, with 46.6% and 19.5% of chickens positive for NE lesions, respectively. In non-inoculated groups no NE lesions were present. In conclusion, the presence of DON in the feed in concentrations lower than the maximum European guidance level is a predisposing factor for the development of NE in broilers.

**Key Words:** broiler, deoxynivalenol, necrotic enteritis

**P202 Dietary Zn proteinate (Bioplex Zn®) is more effective than Zn sulfate for improving broiler growth performance and tissue Zn concentration** Marquisha Paul1, Tuoying Ao, Lizza Macalintal, Anthony Pescatore, Austin Cantor, Mike Ford, Karl Dawson 1Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY

The objective of this study was to test the effects of supplementing a corn-soybean meal diet with either Zn proteinate (Bioplex Zn®) or Zn sulfate on growth performance and bone Zn concentration of broiler chicks. A total of 240 1-day old male broiler chicks was raised in cages in an environmentally controlled room for 3 wk. Dietary treatments consisted of feeding a corn-soybean meal basal diet without zinc supplementation or with two supplemental levels of Zn (10 and 20 mg/kg) from either Bioplex Zn® or from zinc sulfate. Eight replicate cages of six chicks were randomly assigned to each of five treatments. Body weight and feed consumption were recorded weekly. At the end of the trial, two birds from each cage were randomly selected and euthanized to collect tibia samples for zinc analysis. Chicks fed the diet supplemented with 10 mg Zn/kg as Bioplex Zn had higher (P<0.05) feed intake and weight gain than those fed the diets with either no supplemental Zn or Zn sulfate at both supplemental levels. The Zn concentration of tibia ash from chicks fed the diet containing 20 mg Zn/kg as Bioplex Zn was higher (P<0.01) than that from chicks fed no supplemental Zn or Zn sulfate at both supplemental levels. The results from this trial indicated that supplementing corn-soybean meal diets with 10 mg Zn/kg as Zn proteinate (Bioplex Zn®) is more effective than Zn sulfate for improving broiler growth performance and tissue Zn concentration.
Bioplex Zn is adequate to support weight gain, feed intake and tissue Zn accumulation of broiler chicks during the first 3 weeks of growth.

**Key Words:** broiler chick, zinc proteinate, zinc sulfate, growth performance

**P203 Effects of supplemental zinc sulphate and zinc methioninate on broiler performance** Jaime Alcañiz1, Marta Gutierrez, Juan Jose Mallo, Marta Gracia

A feeding trial was carried out to evaluate the effect of different inclusion level and different sources of zinc on performance of broilers until 35 days of age. A total of 300 Cobb chicks (50% males and 50% females), from 1 to 35 days of age were used and allocated at random to the experimental treatments. The experimental design included 5 dietary treatments: T1, Basal diet (BD)(Control); T2: BD + Zn-sulphate (SZn) at 150 ppm; T3: BD + Zinc methionine (MZn) at 150 ppm; T4: BD + SZn at 450 ppm and T5: BD + MZn at 450 ppm). Treatments were replicated 6 times and 10 broilers per pen were housed.

Starters feeds were fed from 0 to 21 days and grower feeds from 22 to 35 days of age.

Observations included performance parameters (growth, body weight, feed intake, feed efficiency, European Production Efficiency Factor, general health, and percent of mortality and culling), Zn deposition in tissues and blood parameters.

The data were analysed as a completely randomised block design by General Linear Methods (GLM) of SPSS. Significance was declared when probability \( P \leq 0.05 \).

At 35 days, differences were still non-significant, however, chickens supplemented with Zn were 6.4% heavier than controls (1,649 vs 1,754 g, \( P < 0.10 \); for T1 and T2-T5, respectively). From 21 to 35 d of age, birds receiving MZn at 150 ppm (T3), grew 13.2% faster than Controls (79.5 vs 70.2 g/d, \( P < 0.05 \). No differences were observed in feed intake or feed conversion.

No differences were detected in Zn deposition for skin, breast, fat, liver or kidney. However, birds with MZn (150 or 450) and SZn at 450 ppm had a higher pancreas Zn deposition than Controls (29.70, 37.41, 42.17, 39.71 and 44.49 ppm; for T1 to T5, respectively). The same pattern was shown in Zn bone deposition (171.76, 200.99, 225.36, 222.28 and 238.59 ppm; for T1 to T5, respectively).

The mean corpuscular haemoglobin (MCH) and the mean corpuscular haemoglobin concentration (MCHC) were lower in broilers receiving SZn at 150 ppm (54.5 vs 51.1 pg and 39.9 vs 37.5 g/dl, \( P < 0.05 \) for MCH and MCHC, respectively).

**Key Words:** zinc sulphate, zinc methioninate, performance parameters, broiler

**P204 Influence of an acidifier administration in diets supplemented- or not with an antimicrobial growth promoter on broiler performance** Konstantinos Mountzouris1, Irida Palamidi1, Vassilis Paraskevas1, Renata Urbaityte2, Sigrid Pastine2, Konstantinos Fegoros1 1Department of Nutrition Physiology and Feeding, Agricultural University of Athens, Athens, Greece 2Competence Centre BIOMIN GmbH, Herzogenburg, Austria

The aim of this work was to evaluate the effect of an acidifier feed additive on broiler performance. Due to ongoing use of antimicrobial growth promoters (AGP) worldwide, except Europe, acidifier (Biotropic Top3, Biomin GmbH, Austria) efficacy was additionally evaluated with concomitant AGP administration.

Five hundred and forty four, 1-d-old, male Cobb broilers were randomly allocated in 4 experimental treatments for 42 d. Each treatment had 136 broilers arranged in 8 replicates of 17 broilers each. All treatments received maize-soybean meal basal diets (BD), formulated for starter (1 to 14 d), grower (15 to 28 d) and finisher (29-42 d) growth periods. Experimental treatments were: C: control (BD diet no other additions); B: BD+acidifier (1g/kg diet); A: BD+avilamycin (2.5 mg/kg diet) and BA: combination of B+A. Performance experimental data regarding body weight (BW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), livability and European Production Efficiency Factor (EPEF) were analyzed per growth phase and overall basis by one-way ANOVA, taking the treatment as the only fixed effect. Significant effects (\( P \leq 0.05 \)) were further analyzed and means were compared using Duncan’s multiple range test.

Treatments A and BA had significantly improved BW, BWG and FCR during the starter phase compared to treatments C and B. In the grower phase, treatment BA showed the best BW and BWG compared to treatments C and B, while it was not different from A. FCR and FI did not differ among treatments. Finally, in the finisher phase treatments BA, A and B were significantly better in terms of BW, BWG and FCR compared to C. Overall BWG, FCR and EPEF were significantly improved in treatments BA, A and B compared to C. There were no differences among treatments in the birds overall livability.

In conclusion, concomitant acidifier and avilamycin administration significantly improved performance in the starter and grower phase compared to the acidifier alone. Overall, acidifier administration in the diet improved significantly broiler performance compared to the control treatment. Further work aims to shed further light in the model(s) of acidifier function in gut ecology and broiler nutritional physiology.

**Key Words:** Acidifier, antimicrobial growth promoter, broiler, performance, diet

**P205 Effect of an algae-based antioxidant supplement containing selenium yeast on chicken meat quality K.M. Brennan1, L. Araujo1, C. Encina1, B. Salvá1, R. Flores1, A. Bahados1 1Altech Inc., Nicholasville, KY 2Universidad Nacional Agraria La Molina, Lima, Peru 3Altech Peru, Lima, Peru

The effects of a nutrient supplement designed to strengthen antioxidant defense (Economas®, Altech Inc) on meat quality of male broilers was analyzed. Commercial Cobb 500 broilers (n=50,400) were distributed into 2 treatments with 3 replicates of 8,400 birds. The birds were processed at 38 days of age using current industry procedures. The control group was fed corn/soy diets containing 60 IU vitamin E (VE) and 300 ppm selenium (Se) as sodium selenite, while treatment diets contained Economas®E®, an algae-based antioxidant supplement containing Se yeast, at 200 g/T. The carcasses were chilled for at least 2 hours, drained, weighed and stored at 4°C. Samples were weighed at days 3, 6 and 9 to determine drip loss. Breasts were weighed and packed in sealed bags and stored at 4°C for further laboratory analysis (cooking losses, water holding capacity, hardness, pH and color). Drip loss values were 1.737, 2.697 and 4.124% for days 3, 6 and 9 post-slaughter, respectively, in the control group. In the treatment group, drip loss values were 1.723, 2.436 and 2.945%, respectively, were observed. Significant differences between treatments were found at days 6 and 9. Cooking loss values were 32.6, 31.4, 30.1 and 28.6% in the control; in the treatment group values were 31.3, 30.8, 29.4 and 27.9%. Water holding capacity values were 19.6, 20.4, 21.4 and 24.6% at days 1, 4, 7 and 10 post-slaughter in the control group; in the treatment group values were 21.4, 22.6, 23.4 and 25.8% respectively. Meat hardness values.
were 7.73, 5.95, 3.50 and 2.36 kg at days 1, 4, 7, and 10 post-slaughter in the control group. For the treatment group values were 4.59, 3.05, 2.75 and 2.03 kg respectively. Differences between groups were significant for cooking losses, water holding capacity and meat hardness in all dates. The inclusion of EconomasE® in the diet significantly influenced meat quality attributes studied including cooking losses, water holding capacity, tenderness (measured as hardness), color and pH. Tenderness was improved due to the better capacity of retaining water, indicating that the cell membranes were in better condition compared to the control group.

Key Words: broilers, meat quality, drip loss, hardness, selenium yeast

P206 Impact of a formaldehyde-based feed preservative on phytase recovery from feed. Jim Wilson1, Craig Wyatt2, Tiago Tedeschi dos Santos2, Noel Sheehan1, Charles Stark1, Peter Street1, Kurt Richardson1 1Antox Corporation, Lawrenceville, GA 2AB Vista Feed Ingredients, Marlborough, UK 2Enzyme Services and Consultancy Ltd, Ystrad Mynach, UK 2Department of Poultry Science, North Carolina State University, Raleigh, NC

Phytase aids in releasing phytate bound phosphorus from plant based feed ingredients. Including phytase in the formulation strategy helps to accomplish some important dietary goals. These include the reduction of phosphorus excretion into the environment as well as reducing dietary formulation costs associated with phosphorus supplementation. Salmonella control in animal feed has become an important part of an overall HACCP type program. Formaldehyde is a chemical intervention that can be used to aid in controlling Salmonella in feed or feed ingredients. The following experiment was undertaken to determine the impact of feed treatment with a formaldehyde-based feed preservative (FBFP) on the recovery of three commercial phytase products. A poultry breeder ration was manufactured at the North Carolina State Feed Mill Educational Unit (Raleigh, North Carolina). The ration was supplemented with one of three commercial phytase products, which were added to the ration at the manufacturers recommended usage rate. Phytase was added at the mixer prior to treatment and after treatment of the feed with a FBFP. After mixing, the feed was conditioned for 30 seconds at 80°C prior to pelleting through a 4.4 mm x 35 mm pellet die. Pellets (78°C) were cooled to 13°C with ambient air (11°C) in a countercflow cooler. Samples of feed for phytase analysis were obtained prior to and after pelleting. The FBFP was applied to the feed at 0 and 2 kg/MT via air atomization. Feed treatment with the FBFP did not significantly affect phytase recovery from non-pelleted feed. In pelleted feed, no significant difference in phytase recovery was observed for two of the three commercial phytase products. A recent broiler trial with these three commercial products indicates that phytase activity in the animal with respect to bone mineralization is not affected by feed treatment with an FBFP. Thus, the lower recovery for one of the commercial phytase products in this study may be due to an analytical issue with recovering the enzyme from the feed rather than an effect on product efficacy.

Key Words: Formaldehyde-Based Feed Preservative, Salmonella, Phytase, Feed Treatment, Pelleting

P207 Response of male broilers to a Citrobacter braakii phytase. Daniel Anciau*, sergio vieira, catarina stefanello, rafael cruz, heitor rios Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

A study was conducted to evaluate a Citrobacter braakii phytase (RONOZYME® HiPhos, DSM Nutritional Products) supplemented in corn-soybean meal diets fed to a total of 350 Cobb 500 slow feathering male broilers. Birds were fed a positive control diet (PC) with 0.42% nPP and 0.84% calcium as well as diets with non phytate phosphorus (nPP) gradually reduced from 0.32%, 0.26%, 0.20% and 0.14% nPP. Calcium was maintained at 0.8% in all diets with graded nPP reduction. Supplementation of phytase was done at both 50 ppm and 100 ppm (500 and 1,000 FYT/kg, respectively). Experimental diets were fed from 7 to 25 d of age with birds placed in battery cages with 10 replicates of 5 birds per treatment. All diets had 22.75% CP (1.22% dig. Lys, 0.91% dig. TSAA, and 0.79% dig. Thr) and 3,050 kcal ME/kg. Analyzed CP, Ca, total P and phytase in the diets were similar to formulated. Birds were sacrificed at 25 d with tibia, femur and toe collection immediately done afterwards. Equivalences in phosphorus supplied by phytase were estimated using linear regressions between responses and reduction in diet nPP, such as: body weight gain (BWG, g), feed conversion rate (FCR), tibia bone ash (TBA, in g and %), femur bone ash (FmA, in g and %) and toe bone ash (ToA, in g and %). All regressions presented R2 > 0.92. Equations for BWG (y = 2,677 X + 808); FCR (y = -0.662 X + 1.477); g TBA (12.4 X + 1.034); % TBA (y = 59.8 X + 30.98); g FmA (y = 8.97 X + 0.59); % FmA (y = 67.5 X + 27.7); g ToA (y = 23.7 X + 23.1) and % ToA (y = 19.3 X + 8.71) estimated using diets with reduced phosphorus. Equivalency of phosphorus obtained using the average of all studied parameters was of 0.110% for 50 ppm and 0.162% for 100 ppm. It is concluded that the added phytase presented increased releases of dietary phosphorus from 500 to 1,000 FYT which indicates an opportunity for cost reduction due to reduction in the need of dietary phosphate supplementation and higher profitability in broiler operations.

Key Words: Broiler, Phytase, Citrobacter braakii, Bone, Ash

P208 Effect of full-fat soybeans and the influence of an exogenous protease on broiler performance. Murtala UMAR FARUK1, Rafiaella AURELI1, Wolfgang SCHLIFFFKA2, Katrine PONTOPPIDAN3, Preben NIELSEN3, Jiri BROZ2 1AB Vista Feed Ingredients, Marlborough, UK 2DSM Nutritional Products, Germany 3DSM Nutritional Products, France

Increase in soybean prices poses a challenge to the poultry industry in providing quality feed to optimize animal performance and profit. In addition, the global industrial need to reduce energy consumption during soybean processing is to result in an increased availability of soybean meal containing more anti nutritional factors (ANF) such as trypsin inhibitors. Literature indicates an impaired performance when soybean meal containing high amount of ANF or when full fat (raw) soybeans were used in feeds for poultry. However, there is still the need to evaluate the potential influence of exogenous proteases to alleviate this impaired performance.

The objective of the present study was therefore, to evaluate the influence of a protease (RONOZYME® ProAct) to alleviate the reduced performance when broiler birds were fed diets containing full fat soybeans.

This short term study (day 0 to 21 post-hatch) was conducted according to a 3*2 factorial arrangement with 3 inclusion levels of full fat soybeans (0, 10 and 20%) and 2 levels of RONOZYME® ProAct (0, 1500 PROT/kg). Thus, the trial contained a total of 6 treatments designed to mimic different qualities of soybean meal. The levels of trypsin inhibitor activity were 0.941, 3.501 and 6.066 mg/g TIA-AOCS in the diet calculated. The trial contained a total of 6 treatments designed to mimic different qualities of soybean meal. The levels of trypsin inhibitor activity were 0.941, 3.501 and 6.066 mg/g TIA-AOCS in the diet containing 0, 10 and 20% full fat soybeans respectively. Parameters evaluated included feed intake, body weight gain and FCR.

Final body weight gain on day 21 was significantly reduced with the increasing level of full fat soybeans in the diet (1092 g/bird, 1016 g/bird, and 867 g/bird for 0, 10 and 20% full fat soybeans dietary inclusion respectively). The addition of RONOZYME® ProAct significantly improved body weight gain (4 and 3 % for the diet containing 0, and
20% full fat soybeans respectively). Feed intake was significantly reduced with the increasing level of full fat soybeans (140 g/bird, 1345 g/bird for 0, 10 and 20% full fat soybeans dietary inclusion respectively). The inclusion of RONOZYME ProAct influenced feed intake (146 g/bird, 1378 g/bird, 1263 g/bird for 0, 10 and 20% full fat soybeans dietary inclusion respectively) resulting in similar FCR with the control.

In conclusion, the inclusion of full fat soybeans in the diet of broiler birds significantly increased body weight gain, feed intake and deteriorated FCR. Supplementation with RONOZYME ProAct improved these parameters.

**Key Words:** Full fat soybeans, Anti-nutritional factors, Protease, Protein utilization, Broiler performance

**P209 Evaluation of adding Synergen to wheat-based diets on the performance, metabolizable energy, and nutrient digestibility of broiler chicks** Ryan Samuel1, Kathryn McClain, Marquisha Paul, Mike Ford, Austin Cantor, Anthony Pescatore, James Pierce, Tuoying Ao 1Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY.

Synergen is a naturally fermented product designed to allow for a more flexible approach to feed formulation. The objective of this experiment was to evaluate additions of Synergen to normal and reformulated wheat-based diets on the performance and nutrient digestibility of birds. The eight dietary treatments represented a 2 x 4 factorial arrangement of two nutrient levels and four enzyme levels. Day old male broiler chicks (384) were randomly assigned to eight treatments with eight replicate pens of six chicks per cage and were raised for 21 d. The normal ME diet was formulated to provide all nutrients equal or greater than the recommendations of NRC (1994). The low ME diet was reformulated to contain 0.1% less available P and total calcium and 75 kcal/kg less ME than the normal ME diets. Synergen was added at 0, 200, 400 or 600 g/T. Acid-insoluble ash was added to all the diets as an internal marker for the measurement of ileum nutrient digestibility. There were no significant ME*enzyme interactions for ADG, ADFI, or G:F. ADG tended to be (P<0.08) and was lower (P<0.01) for chicks fed the low ME diets compared to the normal ME diets for weeks 1 and 2, respectively. ADG tended (P<0.09) to be improved by 400 g/T Synergen inclusion regardless of ME level. ADFI tended (P=0.06) to be greater when diets contained 0 or 600 g/T enzyme, however feed efficiency was only improved by 400 g/T of Synergen during weeks 1 and 2. The digestibility of energy (~80%) was greatest (P<0.02) from diets containing 200 g/T Synergen. A significant ME*enzyme interaction indicated that there was no effect of Synergen on the energy digestibility of normal ME diets. The digestibility of the essential amino acids for poultry, except Met and Ser, were increased by Synergen inclusion up to 100% light transmission), with 4 replications (pens) of 25 birds each. Light transmission was regulated with commercial sunshade plastic net curtains). Light intensity (lux) and levels of ultraviolet light were registered daily. Diets were based on sorghum+soybean meal, and were added with 90ppm of xanthophylls from Aztec marigold flower. Body weight gain, feed intake, and FCR were calculated weekly throughout the study. Twice a week, skin pigment deposition was measured, and samples of blood from three birds per pen were collected for plasma xanthophylls analysis. Data for skin yellowness and plasma xanthophylls were fitted into a multiple linear regression model in which the sex of the bird represented the indicator variables (males=0; females=1) while the treatments and the time of pigment consumption represented the independent variables. Growth performance data were analyzed via ANOVA for a completely randomized design and means were compared by Turkey test. Weight

**P210 Evaluation of multiple DDGS sources on broiler growth performance** Mallori Williams1,2, Joseph Klein1, Robert Loar3, Jason Lee1 1Poultry Science Department, Texas A&M AgriLife Research, College Station, TX 2Poet Nutrition, Sioux Falls, SD

The ethanol by-product corn distillers dried grains with solubles (DDGS) is a nutritionally suitable ingredient for poultry diets. However, the multiple extract processes including de-oiling results in variable nutrient content. The objective of this experiment was to evaluate the effects of two different types of DDGS on broiler performance. The dietary experiments consisted of two different DDGS sources (A and B) from different locations and a control diet which was a corn-soybean meal based diet. Dietary phases included a starter (day 1-14), grower (day 14-27), and finisher diet (day 28-40), with experimental treatments containing 5%, 10%, and 15% of each DDGS source per dietary phase, respectively. Diets were formulated on an iso-nitrogenous and iso-caloric basis. Forty day-old male broiler chicks were placed per replicate pen containing 13 replicates per treatment for a total of 39 pens. Birds were reared in floor pens for the 40 day trial. Experimental parameters consisted of average body weight at the conclusion of each dietary phase, mortality corrected feed conversion ratio (FCR), and mortality. At the conclusion of the starter phase, significant (p<0.05) differences were observed in body weights and FCR. Broilers fed a diet including DDGS B had elevated (p<0.05) body weights at 14 day of age as compared to the control and DDGS A fed broilers. Following the grower phase of the experiment, broilers fed DDGS B had increased (p<0.05) body weight as compared to broilers fed DDGS A, however, both were similar to control fed broilers. No differences were observed in body weight at the conclusion of the trial. Broilers fed both DDGS sources had an increased FCR (p<0.05) following the starter phase as compared to the control fed broilers. No differences (p>0.05) were observed in FCR ratio during the grower phase, finisher phase, or cumulatively for the entire trial between either of the DDGS sources and the control fed broilers. These data confirm that DDGS is a suitable ingredient for inclusion in broilers diets and with accurate nutrient information should be considered in least cost feed formulations.

**Key Words:** Broiler, Performance, Dried Distillers Grains with Solubles

**P211 Effect of intensity natural lighting on skin yellowness in broilers fed xanthophylls from Aztec marigold flower** Xochitl Hernández-Velasco1, María Jiménez-Flores2, Benjamin Fuente-Martínez2, Manuel Quiroz-Pesina3, Ernesto Ávila-González2 1Departamento de Medicina y Zootecnia de Aves, FMVZ-UNAM, Mexico City, Mexico 2Centro de Enseñanza, Investigación y Extensión en Producción Avícola FMVZ-UNAM, Mexico City, Mexico 3Industrias VEPINSA S.A. de C.V., Los Mochis, Sinaloa, Mexico

The aims of this study were to evaluate the effect of different levels of natural lighting in both pigment absorption and skin deposition. One thousand (500 females and 500 males) 21-d-old Cobb 500 broiler chickens were randomly divided into 5 treatments (10, 25, 50, 65, and 100% light transmission), with 4 replications (pens) of 25 birds each. Light transmission was regulated with commercial sunshade plastic net curtains). Light intensity (lux) and levels of ultraviolet light were registered daily. Diets were based on sorghum+soybean meal, and were added with 90ppm of xanthophylls from Aztec marigold flower. Body weight gain, feed intake, and FCR were calculated weekly throughout the study. Twice a week, skin pigment deposition was measured, and samples of blood from three birds per pen were collected for plasma xanthophylls analysis. Data for skin yellowness and plasma xanthophylls were fitted into a multiple linear regression model in which the sex of the bird represented the indicator variables (males=0; females=1) while the treatments and the time of pigment consumption represented the independent variables. Growth performance data were analyzed via ANOVA for a completely randomized design and means were compared by Turkey test. Weight
gain, feed intake, FCR, and plasma xanthophylls were not affected by the level of lighting transmission (P>0.05). Skin pigment deposition showed a polynomial effect to the level of lighting transmission as well as to the time of pigment consumption in days. This relationship is explained by the following equation: y=2.62+0.015x* level of lighting transmission-1.46*sex+1.55* time of pigment consumption -0.035* time of pigment consumption^2.0001* level of lighting transmission^2, (P<0.05), R²=72%. A positive correlation between skin yellowness and level of ultraviolet rays was observed. These data would indicate that, where pigmentation is of concern, low light transmission can adversely affect pigmentation, more in males than in females. Moreover, it was observed that or every 10% less of natural lighting transmission, skin pigmentation decreased by 0.15b+ and that or every day of pigment consumption, skin pigmentation increased by 1.55b+.

This work was supported by the Support Program for Research and Innovation Projects in Technology (PAPIIT) of DGAPA (project IN203910-3), UNAM.

**Key Words:** intensity lighting, skin yellowness, plasmatic xanthophylls, broiler, Aztec marigold flower

**P212 Effects of in ovo injection of 25-hydroxycholecalciferol on carcass characteristics of Ross × Ross 708 broilers** Abiodan Bello**, 1** David Peebles1, Patrick Gerard2 1Department of Poultry Science Mississippi State University, Mississippi State, MS 2Clemson University, Clemson, SC

The provision of various supplements to embryos has been shown to influence subsequent broiler carcass traits. In this study, the effects of *in ovo* injection of 25-hydroxycholecalciferol [25(OH)D3] at various dosages in 100 µL of commercial diluent on the carcass characteristics of Ross × Ross 708 broilers were investigated. Eggs were randomly arranged on each of 10 replicate levels in a single-stage incubator. On d 18 of incubation, each egg was subjected to 1 of 6 treatments with the use of a multi-egg injector. Treatments included non-injected and diluent-injected (100 µL of commercial diluent) controls, and those that received 100 µL of diluent containing 0.20, 0.60, 1.80, or 5.4 µg of 25(OH)D3. On d 21.0 of incubation, male and female chicks were placed at a commercial density in 60 miniature floor pens of a light-controlled facility. The birds were fed commercial diets and grown under commercial conditions. On d 49 post-hatch, 2 male and 2 female birds were selected from each treatment replicate group for processing. Total weights of carcasses (CW) and abdominal fat pads were determined and carcasses were afterwards chilled for 4 h. The chilled carcasses were then deboned and weights of the wings, thighs, legs, tenders, and breasts were determined and calculated relative to CW. There were no treatment main effects or treatment x sex interactions for any of the parameters investigated. However, CW was significantly higher in males (2.51 ± 0.04 kg) when compared to that of females (2.06 ± 0.04 kg), whereas relative abdominal fat pad weight was higher in females (3.32 ± 0.20%) when compared to that of males (2.64 ± 0.20%). The results of this study imply that the effects of *in ovo* injection of 0.20 to 5.40 µg of 25(OH)D3 on d 18 of incubation does not influence the carcass characteristics of Ross × Ross 708 broilers at d 49 post-hatch.

**Key Words:** 25-hydroxycholecalciferol, broilers, in ovo injection, carcass characteristics, processing

**P213 INCLUSION OF WORM LEACHATE IN THE DRINKING WATER OF BROILER CHICKENS AS GROWTH PROMOTER** Maria de Lourdes Angeles’, Sergio Gomez-Rosas NATIONAL FORESTRY, AGRICULTURE AND LIVESTOCK RESEARCH INSTITUTE, Ajuchitlan, Mexico

The objective of the research was to evaluate the addition of worm leachate (WL) as a natural source of humic acids in the drinking water of broilers raised in holding and floor-pens. In Exp. 1, 140 broilers were individually allocated in holding pens and assigned to four increasing levels of WL in the drinking water (0, 10, 20 and 30%) from 21 to 49 d of age. There were 35 replicate pens for each WL level. The WL was obtained from a vermicompost of red Californian earth worms fed with a mixture of swine and sheep manure. The content of total humic acids (Tha), humic acids (Ha) and fulvic acids (Fa) on the WL were 0.61, 0.47 and 0.14 mg/L. The water and WL mixture was provided in plastic bottles fastened to the pens. The daily feed and water intake were registered. Broilers were weighed at the beginning and end of the study. Excreta were totally collected during three days to estimate the retention of nutrients. The ileal content was collected the last day of the study to estimate the ileal digestibility of nutrients. In Exp. 2, 600 broilers kept in floor pens (50 birds/pen) were randomly assigned to 3 increasing levels of WL in the drinking water (0, 10 and 20%) from 21 to 49 d of age. There were 4 replicate pens per treatment. The WL was the same used in experiment 1. The water and WL mixture was provided through bell drinkers connected to 200 L tanks. Feed was offered ad libitum. Broilers were weighed at the beginning and end of the study and the last day all birds were killed for carcass processing. In both experiments, results were subjected to ANOVA and regression analysis. In Exp. 1, the daily water intake was similar among the WL levels but the daily intake of Tha, Ha and Fa was linearly increased (P<0.01) as the level of WL increased in the drinking water. The final weight, daily weight gain, daily feed intake, the nutrient retention and the ileal digestibility of nutrients were similar among treatments. The feed conversion ratio showed a quadratic response regarding the WL levels, being the response lowest for the 20% WL (y = 2.3046 - 0.0111x + 0.0003x^2; R² = 0.56; P<0.05).

In Exp. 2, there was a trend (P<0.10) for a quadratic response in the final body weight, being the response higher in broilers that were added with 20% WL in the drinking water (y = 3.4599 - 0.0087x + 0.0008x^2; R² = 0.68). The same trend was observed in the daily weight gain. The daily feed intake, feed conversion ratio and carcass measurements were not different among the WL levels. The results suggest that the WL could be used as growth promoter in broiler chickens, but the optimum level to be added in drinking water should be further determined. It is also important to clarify the mechanisms of action by which the WL may improve the productive parameters in poultry.

**Key Words:** Broilers, worm leachate, Humic acids, growth performance, nutrient use

**P214 Effects of phytotherapeutic additives and organic acids in Eimeria spp oocysts excretion** Vicente Barbosa Fascina*, José Roberto Sartori, Francine Vercese, Everton Moreno Muro, Monica Megumi Aoyagi, Ivan Mailinh Gonçalves Pereira de Souza, Thaila Cristina Putarow Universidade Estadual Paulista, UNESP/FMVZ, Botucatu, Brazil

The present study aimed to verify the effects of isolated or associated phytophenics additive (PA) and organic acids (OA) on broiler chickens challenged with eimeria. A total of 240 one-day-old chicks were distributed in a completely randomized design with six treatments with five replications. The treatments were: control diet without addition of additives (CD); CD + avilamycin and sodium monensin (antibiotic performance enhancer – APE); CD + vaccine against coccidiosis; CD + PA (PA= turmeric extracts, citrus extract and grape seed extract + Chinese cinnamon essential oil, Chile Boldo leaves, fennel seeds); CD + OA (OA = lactic, benzoic, formic, citric and acetic acid); CD + PA + OA (FAOA). At the sixthteenth day, birds were inoculated orally with 1x10^6 of *E. acervulina*, 1x10^5 of *E. maxima* and 1x10^5 of *E. tenella*. At days 4, 5, 6 and 7 after inoculation, an excrete sample per experimental unit was collected for determination of oocysts excretion.
Five days after inoculation, broilers receiving free-supplemented diets showed higher (P<0.05) oocysts excretion (4.89x10⁴) compared to FA-fed broilers (2.24x10⁴) or OA-fed broilers (2.12x10⁴). On sixth day after inoculation FАОA-fed broilers had lower (2.34x10⁴) oocysts excretion (-50.86%) (P<0.01) compared with others treatments. Seven days after the oocysts inoculation APE-fed broilers showed lower values than broilers receiving free-supplemented diets (P<0.05) and the phytotherapeutic additives promoted an intermediate reduction of oocysts excretion (-39.28% compared with free-supplemented diets and +47.2% with APE). Phytotherapeutic additives, isolated or associated with organic acids, reduce the eimeria oocysts excretion in broiler chickens and it can be used as an alternative to conventional anticoccidial drugs when its use is not allowed.

Key Words: acidifiers, cinnamaldehyde, coccidiosis, herbal extract, ionophorophors

P215 Effects of dietary Ca and P levels on pullet growth performance and keel bone deformities raised in floor pens or conventional cages P.E. Eusebio-Balcazar1, A. Ampaire1, M.M. Beck2, S. Purdum1 1Department of Animal Science, University of Nebraska-Lincoln, Lincoln, NE 2Department of Poultry Science, Mississippi State University, Mississippi State, MS

The aim of this study was to evaluate the effects of dietary Ca and P levels in pullet diets of Lohmann Brown (B) and Bovan White (W) pullets raised in floor pens (F) or cages (C). For this purpose, a total of 256 1-d old pullets in pullet diets of Lohmann Brown (B) and Bovan White (W) pullets. Thus, genetic lines performed differently in F or C systems; (P=0.056) but lower (P=0.012) mild keel bone fractures compared to BC pullets suffered more keel bone depressions compared to BF pullets (P<0.01) and no differences were found for W pullets raised in the two housing systems and Ca & P levels were the main treatments and strains were considered subplots. Half of the pullets were individually sexed (7-10 wk) and egg quality of laying hens from 0 to 27 weeks of production. At 16 weeks of age were given an intravenous flooding-dose of 15N-Phe (125 mM, 25% APE) and throughout production. Protein turnover was determined in brown layers (Bovans Brown) at 16, 21 and 31 weeks of age. A complete randomized design with three treatments and ten replicates per treatment, where each age of the hen was a treatment, and each hen represented a replicate, was used as experimental design. Ten laying hens at each age were given an intravenous flooding-dose of 15N-Phe (125 mM, 25% APE) at 10 ml/kg. After 10 min, birds were slaughtered and the breast muscle excised and frozen in liquid nitrogen. Excreta was also collected and frozen. The acid-soluble fraction (2% perchloric acid) containing free amino acids from muscle was separated from the protein precipitate. The ratio of 15N:14N of each fraction was determined via GCMS. Quantification of 3-methylhistidine in both muscle and excreta was also determined via GCMS. No statistical differences were found for the fractional degradation rates for the three ages of layers (11.66%, 12.15%, and 8.15% for 16, 21 and 31 wk of age, respectively, P Value = 0.3597). The fractional protein synthesis rate in skeletal tissue significantly increased for 21 wk (pre-peak) layers compared to 16 wk pullets (4.46% and 7.11%, respectively, P Value = 0.0057) and then declined at 31 wk (2.61%). There was no significant difference between the fractional protein synthesis rate of the 16 wk protein (4.46%) compared to the 31 wk layer (2.61%). Further studies are needed to determine regulatory control of the fractional synthesis rate and fractional degradation rate for broiler breeders and commercial layers to better understand how they are using the tissue amino acids. Laying hens and broiler breeders may rely on skeletal muscle tissue as a source of protein for egg production. Fractional protein synthesis rate decreased for layers with increased egg mass production at 31 wk. Fractional degradation rates in commercial layers did not show the same changes with sexual maturity compared to broiler breeders.

Key Words: protein turnover, sexual maturity, fractional synthesis rate, fractional degradation rate, 15N-PHE

P217 Program Nutrition strategy on the productive performance and egg quality of laying hens fed distillers dried grains with solubles (DDGS) diets Megan van Benschoten1, Anthony Pescatore, Austen Cantor, Tuoying Ao, Ryan Samuel, Michael Ford, William David King, James Pierce 1Alltech-University of Kentucky Nutrition Research Alliance, Lexington, KY

Recent changes in ingredient prices and availability have resulted in greater use of DDGS in poultry diets. This study evaluated the effects of including 25 and 35% DDGS in corn-soybean meal diets with Programmed Nutrition (PN) premix on the productive performance and egg quality of laying hens from 0 to 27 weeks of production. At 16 weeks of age 288 Hy-Line W-36® hens were randomly allocated to five dietary treatment groups with 12 birds per replicate. Dietary treatments consisted of 1) Corn-soybean (positive control), 2) 25% DDGS, 3) 25% DDGS plus Alltech PN Broiler Grower Premix®, 4) 35% DDGS, and 5) 35% DDGS plus Alltech PN Broiler Grower Premix®. Diets were formulated to meet NRC recommendations with reduced avail-
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Table P (0.29 vs. 0.19 %) and Ca (4.2% vs. 4.1%) in DDGS diets. A random sample of 6 eggs was selected from each replicate group every 4 weeks for egg quality analysis. During 17 weeks of lay percent shell and shell breaking strength were decreased with the inclusion of DDGS (P<0.05), however, the PN premix improved percent shell at 25% DDGS and partially alleviated the deleterious effects due to 35% inclusion of DDGS. The PN premix also lessened the effects of 35% DDGS inclusion on shell breaking strength. Inclusion of DDGS decreased lightness (L*) values, while increasing red (a*), and yellow (b*) yolk color values (P<0.001). No effects on egg weight, Haugh Units, or yolk weight were noted. At 27 weeks of lay inclusion of DDGS decreased body weight (P=0.01), however, the PN premix partially alleviated the negative effect at the 35% inclusion rate. Overall there was no effect of DDGS inclusion up to 35% on feed intake, feed conversion rate, or hen-day production. This experiment indicates that inclusion of up to 35% DDGS reduces shell quality and body weight in early lay and that the PN premix can partially alleviate some of the negative effects.

Key Words: DDGS, Layers, Egg Quality, Program Nutrition Strategy

P218 Transcriptome analysis of the guinea fowl pancreas Samuel Nahashon, Carl Darris  

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The steady increase in commercialization of Guinea fowl (Numida meleagris) has been driven by the demand for alternative and leaner animal protein sources. However, programs to improve Guinea fowl production performance and commercialization lag behind those of other poultry species such as chickens and turkeys. This is in part due to lack of genetic information specific to the Guinea fowl. The purpose of this study was to generate genetic resource information that would lead to discovery of genes that may be associated with unique and economic traits of the guinea fowl. Total RNA was extracted from the pancreas of adult Guinea fowl using Qiagen's RNeasy MiniPrep Kit followed by cDNA library prep and RNA sequencing using the Illumina Hi-Seq 2000 whole transcriptome single end read sequencing platform (Illumina, Inc.; San Diego, CA). The transcriptome of the pancreas was assembled using Trinity software (r2012-05-18), and Bowtie software was used to create alignments for the assembled reads. Sequences generated through the Hi-Seq Analysis were mapped to the chicken genome (gga _ref Gallus Gallus-4.0) using the Bowtie Alignment Software which yielded 89 million lines of reference mapping coordinates. The reads mapped to the chicken genome were well distributed across all chromosomes. The Cufflink Software gene expression analysis identified 6,668 of these genes which resulted in 29,791 assembled transcripts. A total of 3,000 sequences were annotated and submitted to GeneBank. These sequences provide an invaluable tool for comparative mapping of the avian genome and understanding of genes that may be associated with unique and economic traits in Guinea fowl and other poultry species.

Key Words: Guinea fowl pancreas, transcriptome, sequence tags, poultry

P219 Use of alkanes in determination of grass intake for free range chickens Mini Singh, Tugrul Durali, Tim Walker, Aaron J Cowie

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A total of 1440 Cobb 500 as hatched broilers were used in a 42d growth trial in order to establish the quantity of grass consumed by birds given access to range. From d1-20 all birds were housed indoors in pens and were given access to range from d21-42 for several hours per day. Natural n-alkane profiles were determined for the grass, the pelleted diet, the woodshavings and, on d42, the used litter. The contribution of grass, feed and woodshavings to the overall litter composition was estimated using a least square optimization algorithm. Allowing for incomplete recovery (based on published values) and subtracting the contribution of woodchip the intake of feed and grass was established. Grass consumption was estimated to be 3.72-4.24 % of total “as fed” intake. Considering the number of hours the birds spent on the range and the average feed intake from d21-42, this equates to 1.55-1.78 grams of grass per bird per hour of range access in this study. This is the first study to use alkane signatures to quantify the amount of grass consumed by free-range broilers. This information may be used to formulate a free-range diet that considers the qualitative effects of grass consumption on total nutrient intake. In particular, adjustments to dietary energy and dietary electrolyte balance (DEB) may be required in order to accommodate the interfering influence of grass intake.

Key Words: alkane analysis, grass consumption, free range, broilers, grass

P220 Bio-energy conversion cost: a new index to evaluate the bio-economic efficiency Manoel Garcia-Neto*, Marcel Alessandro Almeida, Carla Rodriguez Paes, Danilo Guallberto Sandre, Max José Almeida Faria-Junior, Marcos Franke Pinto  

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This study evaluated a nonlinear programming excel workbook PPFR (http://www.fmv.unesp.br/ppfr) for determining the optimum nutrient density and maximize margins. Two experiments were conducted with 240 one-day-old female chicks and 240 one-day-old male chicks distributed in 48 pens (10 chicks per pen, 4 replicates) in a completely randomized design. The treatments include the average price history (2009s and 2010s) for broiler increased and decreased by 25% or 50% (5 treatments to nonlinear feed formulation) and 1 linear feed formulation. Body gain, feed intake, feed conversion were measured at 21, 42 and 56 d of age. Chicks had ad libitum access to feed and water in floor pens with wood shavings as litter. The bio-economic Energy Conversion [BEC= (Total energy intake*Feed weighted cost per kg)/ (Weight gain*kg live chicken cost)] was more sensitive for measuring the bio-economic performance for broilers, and especially with better magnitude. This allowed a better assessment of profitability, the rate of growth and not just energy consumption, the production of broilers, by incorporating energy consumption, allowing for more sensitivity to the new index (BEC). The BEC was demonstrated that the principle of nonlinear formulation minimizes losses significantly (P<0.05), especially under unfavorable conditions the price of chicken in the market. Thus, when considering that a diet of energy supply shows up as the most expensive item of a formulation, it should compose necessarily the formula proposed for a bio-economic index. Thus, there is need to evaluate more accurately, not only the ingredients of a ration, but the impact of nutrients on the stability of a solution, mainly due to the energy requirement. This strategy promotes better accuracy for decision making under conditions of uncertainty, to find alternative post-formulation. From the above, both weight gain and feed conversion, as traditional performance indicators, cannot finalize or predict a performance evaluation of an economic system creating increasingly intense and competitive. Thus, the energy concentration of the diet becomes more important definition to feed formula, by directly impact profit activity by interactions with the density of nutrients. This allowed a better evaluation of profitability, the rate of energy performance for broilers, by incorporating the energy consumption formula, allowing more sensitivity to the new index (BEC). These data show that nonlinear feed formulation is a toll to offer new opportunities for poultry production to improved profitability.

Key Words: energy density, feed formulation, gross margin, maximum
P221 The use of dual-energy x-ray absorptiometry to determine body composition of feed restricted broilers Justina Caldas\textsuperscript{sc}, Karen Vignale, Judith England, Sandro Cerrate, Craig Coon \textit{Department of Poultry Science, University of Arkansas, Fayetteville, AR}

Dual Energy X-Ray absorptiometry (DEXA) has been validated and regression equations developed at the University of Arkansas for determining the body composition of broilers fed standard feed programs from hatch to 60d of age (Salas et al., 2012). Salas and group developed the equations by scanning freshly killed broilers and determining the proximate analysis of the total broiler carcass with wet chemistry. Recently, while conducting broiler feed restriction studies for net energy estimation, negative DEXA fat values were obtained when the body composition was determined. The low levels of body fat in feed restricted broilers at 28 days of age justified the need to re-evaluate optimum scanning conditions (fresh or frozen) and also develop and validate with wet chemistry potential new body composition equations. Eighty one Cobb 500 male chickens, 28 days of age with body weight ranging between 600 - 1300 g, were selected for DEXA body composition studies. The broilers were previously feed restricted (85, 55 and 38%) from 12-28 d. The birds were weighed and scanned in fresh and frozen state using DEXA scanner (Lunar Prodigy, GE) equipped with small animal software. Following the scan, broilers were autoclaved at 121 °C with 22 psi for 1.5 to 2.5 h depending on the weight of the bird and then acclimated to room temperature for 2 hr. The carcasses were blended individually in a heavy duty blender for 30 sec. 130 g sample of homogenate from each broiler was freeze dried, weighed, ground and assayed for total crude protein, ether extract or fat and body mineral content (BMC). Linear regression equations between the respective DEXA and chemical parameters were established and data to compare fresh and frozen state were subjected to least-squares ANOVA using statistical analysis system (JMPpro – SAS) for p value ≤ 0.05. The results related to scanning condition (fresh and frozen) displayed no statistical differences for fat, protein and BMC. The equations for predicting the body composition developed from scanning frozen broilers gave a 0.09 point better coefficient of determination (R$^2$) for estimating carcass fat. The basis of this improvement remains to be answered. It may be related to a better configuration of fat tissue in the frozen state that allows an improved fat estimation with the DEXA. The R$^2$ for the equations to adjust the original DEXA results to predict more accurate protein, fat, BMC and water were 0.96, 0.54, 0.77, 0.97 for fresh and 0.97, 0.63, 0.82, 0.98 for frozen broilers, respectively. All equations show statistical significance (p<0.0001*). Obtaining an accurate fat estimation in young broilers with a low amount of body fat is the most challenging analysis using the DEXA.

Key Words: DEXA, body composition, broiler, feed restriction

P222 Trace Elements as feed additives in Poultry nutrition in the EU: The role of the European Food Safety Authority Gloria López-Gálvez\textsuperscript{2}, Matteo L. Innocenti, Claudia Roncancio-Peña \textit{EFSA, Parma, Italy}

The European Food Safety Authority (EFSA) plays a central role in the assessment of food and feed in the European Union. Its main tasks are: Provision of scientific advise to the European Commission (EC), data collection and cooperation with Member States (MS) in the food and feed safety areas.

Regarding the feed safety aspect, one of the main areas is the evaluation of feed additives. The procedure for authorising the placing on the market and use of additives in poultry feed is established in the EU by Regulation 1831/2003, where it is foreseen that authorisations of feed additives are preceded by an EFSA evaluation. In particular Trace elements, mainly used as nutritional feed additives, are generally assessed by EFSA for their use in all animal species. Since the establishment of EFSA, the Panel on Additives and Products or Substances used in Animal Feed (FEEDAP) has delivered 24 opinions related to corresponding Trace Elements risk assessments, thus providing scientific advise to the EC. The elements included in the opinions are: (i) the evaluation of the safety of the additive (target animals, consumer, user, environment), (ii) the evaluation of its efficacy and (iii) the Report of the European Union Reference Laboratory (EURL), which includes the relevant control methods. The FEEDAP Panel has developed technical guidance documents for the preparation of applications and assessment of feed additives, which include, where appropriate, the specific requirements as for poultry.

Concerning Data collection related to the assessment of Trace elements, including Cooperation with MS, some relevant items are cited and further described: (a) two projects directly linked with trace elements in animal nutrition, “Selected trace and ultratrace elements: Biological role, content in feed and requirements in animal nutrition – Elements for risk assessment” and “Extensive literature search on the bioavailability of selected trace elements in animal nutrition: incompatibilities and interactions”; (b) two projects on “Request for data on selenium and chromium levels in food and beverages” and “Long term dietary exposure to selenium in young children living in different European countries”, which outcome has served for the assessment of consumer safety.

The above-mentioned areas are considered in detail; any relevant factor related to poultry is highlighted and further discussed.

Key Words: DEXA, composition, broiler, feed restriction

P223 Effects of nutrient variability in corn associated with geographical location and xylanase inclusion on energy utilization Ashley Campasino\textsuperscript{1sc}, Tryon Wickersham\textsuperscript{2}, Helen Masey O’Neill\textsuperscript{1}, Jason Lee\textsuperscript{1} \textit{1Poultry Science Department Texas A&M AgriLife Research, College Station, TX 2Animal Science Department, Texas A&M AgriLife Research, College Station, TX 3AB Vista, Marlborough, UK}

As both the largest included ingredient in commercial poultry diets and the most widely grown cereal grain in the United States, variable nutrient content of corn related to growing conditions and geographical location has been reported. Dietary exogenous enzyme supplementation has been suggested as a means for compensating for lower quality nutrient profiles and improves flock performance. The purpose of this study was to examine the effects of corn with various nutrient profiles associated with geographical location and xylanase inclusion (16,000 BXU/kg) on ileal digestible energy (IDE), ileal energy and nitrogen digestibility coefficients (IEDC and INDC), and nitrogen corrected apparent metabolizable energy (AMEn). The experimental design consisted of a 3 x 2 factorial yielding a total of 12 treatment groups with each treatment consisting of 10 replicates. Each replicate pen included 17 1-day-old male broilers, reared in floor pens. Corn and soy-based diets were fed in three dietary phases: starter (day 0–17), grower (day 18–34) and finisher (day 35–41). Corn was included in equal amounts in the diet regardless of nutrient content and was included at 61.6% in the starter, 65.0% in the grower and 71.0% in the finisher. On days 17 and 41, ileal and fecal contents were collected from 5 and 3 birds respectively, and pooled on a per pen basis; titanium dioxide was utilized as an indigestible marker. On day 17, differences (P<0.05) were observed regarding corn source in all evaluated parameters with a range of 230 kcal/kg for IDE, 195 kcal/kg for AMEn, 4.0% for INDC, and a 5.9% difference in IEDC. Similar differences were observed on
day 41 with a range of 144 kcal/kg for IDE, 187 kcal/kg for AMEn, 6.3% for INDC, and a 2.1% difference in IEDC. Xylanase inclusion increased (P<0.05) AMEn on day 17 and 41, and increased IDE, IEDC, and INDC on day 41. An interaction was present on day 17 between corn source and xylanase inclusion revealing that xylanase inclusion increased IDE and IEDC in only 2 corn sources. These data confirm that nutrient variability in corn does in fact impact energy digestibility and xylanase inclusion can uniformly increase nutrient digestibility.

Key Words: xylanase, broiler, digestibility, corn

P224 Lipid Encapsulated Phenolics Ronald Holser USDA-ARS-RRC, Athens, GA

Encapsulation of bioactive compounds by a solid lipid matrix provides stability and a mechanism for controlled release in formulated products. Phenolic compounds exhibit antioxidant and antimicrobial activities and have applications as feed additives. Ferulic acid, a common phenolic compound, was encapsulated with saturated triglycerides using a laboratory fluidizer. The stability of encapsulated ferulic acid particles was evaluated by light scattering measurements and fluorescence spectroscopy over a 3 month period. Spectral analysis was performed with excitation at 377 nm and emission at 425 nm. The results showed no significant change in particle diameter, 717.6 nm ± 28.4 nm, or loss of ferulic acid from particles.

Key Words: Additive, Antioxidant, Encapsulation, Nanoparticles

P225 Performance of broilers hatched of two incubation systems Araceli Pacheco1SC, Andréa Ribeiro2SC, Patrícia Ebling1, Anderson Kummer2, Gabriel Pontalti1, Daniele Pozzebon1 1Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil 2Faculdade de Itapiranga, Porto Alegre, Brazil

An experiment was carried out to evaluate the effect of incubation system - multiple stage and single stage - on the performance of broilers from 1 to 40 days of age. A total of 336 1-d-old Cobb 500 broilers chickens were distributed in four treatments (T) with 7 repetitions of 12 birds each, in a completely randomized design with a 2 x 2 factorial arrangement, with sex and incubation system as the factors. The birds received the same diets in all periods and feed and water were offered ad libitum. Weekly were evaluated body weight (BW), weight gain (WG), feed intake (FI) and feed efficiency (FE). In the period of 1 to 7 days, the females of multiple stage were the lightest (p<0.01) and had the lowest WG (p<0.01) and worst FE (p<0.06) than other T. From 8 to 21 days, this same T continued to be the lightest (p<0.02) and gained less WG (p<0.02), however there were no differences for FI and FE with the others. From 22 to 40 days the multiple stage system, independently of sex, produced chickens with less WG (p<0.01) and worst FE (p<0.07), without differences for FI. In the total period, the birds from multiple stage system exhibited the worst WG (p<0.02), with no differences for the other responses. In all periods, only was observed a difference in FI due to sex and not to the incubation system. These results are due mainly to females from multiple stage that always showed, although only numerically in some periods, worse responses than other T, placing the performance of multiple system in an inferior level. The worst results obtained with females from multiple stage system can be explained by the fact that females hatch before than males and because the larger hatch window in this incubation system, spend more time inside the hatchet without feed and water.

Key Words: multiple stage, single stage, body weight, weight gain, feed intake

P226 Effects of reduced protein diets using the Missouri Ideal Tur- key Protein on male turkeys from 0 to 21 weeks of age Whitney MahoneySC, Jeffre Firman Department of Animal Science, University of Missouri, Columbia, Missouri

Protein is one of the major cost components in turkey diets. When diets are formulated on an ideal protein basis, the levels of crude protein decrease with the use of pure amino acids; performance is maintained and feed costs are decreased. Thus, with the use of the Missouri Ideal Tur- key Protein, there is potential for a significant protein reduction with the addition of pure amino acid sources. This experiment was conducted to determine if protein can be further reduced and replaced with pure amino acids (methionine, lysine, threonine, tryptophan, valine). The experimental objectives were to determine if reduced protein turkey rations can successfully provide matching performance to an industry standard through additions of these available amino acids. The experi- ment was designed as a randomized complete block with 450 toms assigned to one of five treatment groups. Each treatment group consisted of 8 replicates with 10 toms per replicate. The five treatments consisted of an industry standard control(C), an ideal protein based diet, and a 3%, 6% and 9% crude protein (CP) reduction from the ideal protein based diet. Amino acids were balanced based on our determined ideal protein in turkeys and additional pure amino acid sources made up for the reduced protein level. Weight gain and feed intake were recorded at 3 week intervals. Body composition was taken at the conclusion of the trial (21 weeks). Birds fed the ideal protein diets showed similar growth to that of the control. A 3% reduction in CP also showed similar growth to that of the industry control. Birds fed diets with a 6% reduc- tion in CP showed a 6% reduction in growth from the control. A 9% reduction in CP showed a 9% reduction in growth from the industry control. Further, there was no effect of dietary treatments on feed gain or carcass composition. These results suggest that with the addi- tion of pure amino acids, crude protein can be reduced by 3% in turkey rations without affecting performance.

Key Words: turkey, reduced protein, amino acids, ideal protein
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