P125 A simple PCR assay for differentiation of Mycoplasma gallisepticum vaccine strains ts-11, 6/85, and F strain from commonly used Mycoplasma gallisepticum challenge strains. J. D. Evans* and S. A. Leigh, Poultry Research Unit, USDA-ARS, Mississippi State.

Mycoplasma gallisepticum (MG) is an important avian pathogen causing significant economic losses within the poultry layer industry. To limit these losses, commercially available vaccine or attenuated strains of MG are commonly used within the layer industry to control MG-induced mycoplasmosis. The route by which these attenuated strains impart protection from field strain challenge remains a subject of much debate. Further, the application of these attenuated strains can complicate MG diagnostics. In an effort to develop tools to aid in MG research and diagnostics, we have compared available MG sequences of the attenuated vaccine strains to those of the sequenced pathogenic MG strain R609 in search of a means to easily differentiate attenuated from pathogenic strains of MG. Via gapA sequence alignments and comparisons, we have identified and designed primers toward strain differentiation. Application of primers toward a conventional PCR assay demonstrated differentiation by production of a sole 220 bp product by the attenuated MG strains ts-11, 6/85, and F strain and no product from R609 and other commonly-used laboratory challenge/pathogenic strains (S6 and R strain). Further trials demonstrated that lowering the annealing temperature from 60°C to 55°C increased product formation from the attenuated MG strains and yet did not result in product formation from the pathogenic laboratory strains tested. Research also demonstrated the suitability of these primers for real-time PCR analyses towards differentiation of attenuated and laboratory challenge strains of MG.

Key Words: Mycoplasma gallisepticum, Mycoplasmosis, Diagnostics, Attenuated Vaccine

P126 Primer sequence-independent full genome amplification and sequencing of the vg/ga strain of Newcastle disease virus. F. Peralta*, 1P. Villela1, and C. Afonso2, 1Poultry Diagnostic and Research Center, Athens, GA, 2South East poultry Research Laboratory, Athens, GA.

The Villegas-Glisson Newcastle disease virus strain from the University of Georgia (VG/GA) was isolated from the intestine of healthy turkeys and has been demonstrated to replicate in the respiratory and intestinal tract of chickens. Field experiences have shown that the VG/GA is useful in the control of velogenic-visceroptic strains which preferentially target the intestinal tract of the birds. The differential replication pattern that diminishes the damage to the respiratory tract and an improved local immunity represented by increased IgA production in the intestinal tract are the unique features of the vaccine. In order to assess the genomic base of its tissue tropism, a modified primer sequence-independent amplification method was used to obtain the complete nucleotide sequence of the VG/GA strain. The VG/GA genome was compared to full genome Newcastle disease virus (NDV) sequences available in the Gene bank. The VG/GA strain groups within the class II, genotype II viruses that correspond to most of the respirotropic vaccine strains used in the poultry industry and differed from lentogenic enterotropic strains that belong to the class II in the genotype I. The composition of the VG/GA strain genes and proteins were compared with those of the LaSota strain, differences were observed at both the nucleotide and amino acid levels. The changes observed in proteins associated with tissue tropism may explain the differential phenotype of the VG/GA. Further studies including the generation of a reverse genetic system for the VG/GA are required to verify the significance of those changes.

Key Words: VG/GA strain, Genome, Tropism

P127 Susceptibility of five migratory aquatic birds to H5N1 highly pathogenic avian influenza virus (A/Chicken/Korea/IS/06). Y. K. Kwon* and D. E. Swayne, Southeast Poultry Research Laboratory, Athens, GA.

It is not known that which migratory aquatic species are important in spreading H5N1 highly pathogenic avian influenza (HPAI-H5N1 viruses, and the pathobiology of infections by such viruses. The objective of this investigation was to assess the susceptibility of Mute swans (Cygnus olor), Greylag geese (Anser anser), Ruddy Shelducks (Tadorna ferruginea), Mandarin Ducks (Aix galericulata) and Mallard ducks (Anas platyrhynchos) to intranasal or contact inoculation with A/Chicken/Korea/IS/06 (H5N1) virus, which was genetically very close to H5N1 HPAl viruses isolated from wild birds in Siberia and Mongolia. Mute swans and Ruddy Shelducks were the most severely affected of the five species, exhibiting depression, diarrhea, and 100% mortality within 10 days of inoculation. Grossly, moderate to multifocal to confluent pancreatic necrosis and splenomegaly were identified in these two species. Histologically, brain, pancreas, spleen, heart, oral cavity and adrenal gland were the most consistently affected, and HPAl virus was most frequently detected in the parenchyma of these organs. One dead of three inoculated Mandarin ducks developed severe necrotized pancreatitis and meningoencephalitis, and segmental necrosis of myofibers in heart. Influenza viral antigen was detected in sites with histologic lesions. Unlike these species, Greylag geese suffered moderate depression, but lacked mortality. However, the geese had severe cerebral malacia and meningoencephalitis. Viral antigen was observed in necrotized neurons and neuropil in the brain, especially hemisphere of cerebrum. Mallard ducks were resistant to the H5N1 HPAI virus, lacking gross and histologic lesions, and viral antigen. These results imply that Mute swans and Ruddy Shelducks are highly susceptible to A/Chicken/Korea/IS/06 virus, and Mandarin ducks and Greylag are intermediately susceptible, whereas Mallard ducks are more resistant.

Key Words: Aquatic birds, Avian Influenza, H5N1 virus, Susceptibility, Spreading

P128 Comparison of phosphate-buffered saline and Spray-Vac™ vaccine stabilizer for aerosol application of FVAX-MG™. S. A. Leigh*, S. L. Branton, and S. D. Collier, USDA, ARS, Mid-South Area Poultry Research Unit, Mississippi State, MS.

Infection of layer chickens with Mycoplasma gallisepticum (MG) can result in decreased egg production compared to uninfected hens. Live MG vaccines are available; however, the methods used to administer these vaccines by the end user vary, resulting in the potential for marked differences in vaccine efficacy. In order to help poultry producers obtain uniform results using the live vaccines, various conditions for vaccine delivery are being investigated. One area of investigation is the ability to use tap water and well water for rehydration of lyophilized vaccines. PBS and Spray-Vac™ vaccine stabilizer were compared for their ability to protect FVAX-MG™ during vaccination. PBS powdered concentrate was added to commercial distilled water at a rate of 1 g/l. Spray-Vac™ concentrate was added to local well water at the manufacturer recommended ratio (4 oz/gal). Equal amounts of vaccine were rehydrated and diluted with either of the two solutions and used to vaccinate one half of a 75,000 bird pullet house. Approximately 6 weeks following vaccination, blood samples were drawn from equal numbers of pullets vaccinated using either PBS or Spray-Vac™ as a stabilizer. Blind random samples were tested for vaccine efficacy by serum-plate agglutination (SPA). The results showed that in both cases, 100% of tested birds were SPA positive, with an average score of 1+. These results from the field trials suggest that rehydrating FVAX-MG™ with Spray-Vac™ in well water gives equivalent results compared to using distilled water stabilized with PBS.

Key Words: Mycoplasma gallisepticum, Vaccine stabilizer, Pullet, Mycoplasmosis, SPA
P129 Molecular characterization and phylogenetic analysis of Mexican Newcastle disease virus isolates.

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Newcastle disease virus (NDV) was isolated in Mexico for the first time in 1946 and the last report of a field outbreak caused by a highly virulent strain dates from year 2000, when 13.6 million birds were slaughtered and 93 farms quarantined. Mean Death Time test resulted in velogenic classification of 12 Mexican NDV strains, isolated around Mexico City between 1946 and 2006. Analysis of the deduced amino acid sequences of the F protein cleavage site from these isolates predicted that 11 were velogenic viruses, while one isolate was classified as Lentogen (like Ulster). A phylogenetic tree based on the nucleotide sequences of the F gene revealed that these Mexican NDV isolates corresponded to genotypes I, V and VIII (one, 10 and one isolates, respectively). Isolates belonging to genotype V are related to isolate Largo71 (isolates from 1946, 2004, 2005 and 2006) and Gamefowl/S/02 (isolates from 1998, 2000 and 2001). The virus classified into genotype VIII was isolated around 1947-48, and this is the first time that is analyzed by molecular biology, however, it has been used in Mexico as challenge strain. The distinctive genomic differences between the two groups of genotype V viruses (isolates from 1998 to 2001 and from 2004 to 2006) suggest that two different lineages of NDV are challenging the poultry industry in the central region of Mexico.

Key Words: Newcastle disease virus, Virulence, Genotype, Lineage, Mexico

P130 Expression of recombinant H5 protein for the development of a competitive ELISA for detecting of H5 antibodies.

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In recent years a highly pathogenic H5N1 influenza strain is circulating in Asian, European, and African countries. This strain has raised public concerns as it is seemingly able to readily cross species borders. It has been found capable to infect domestic poultry, water fowl, and birds of prey as well as several mammalian species, including humans. The aim of this study is to develop a competitive enzyme linked immunosorbent assay (c-ELISA) to detect antibodies against influenza hemagglutinin (HA) 5 in serum samples, regardless of the species investigated. The HA gene of an influenza strain (H5N2) was cloned and sequenced. Based on the sequence, a plasmid was subsequently generated for the expression of the HA in a Baculovirus system using the Bac-to-Bac approach. The generated recombinant H5-encoding Baculovirus was used to produce a His-tagged HA protein. The recombinant protein was purified by affinity chromatography and used for the establishment of an ELISA system. In an indirect approach using chicken sera with antibodies raised against H1, H2, H3, H5, H6, H7, H9, H10, H12, H13, and H15 reactivity with the recombinant protein was observed with H1, H2, H5, H6, and H10. This indicated that for a specific reactivity a c-ELISA would be valuable. For this purpose an H5 monoclonal antibody (mAb) was used. In first experiments using H5 antisera an inhibition of the binding of the H5 mAb was observed. This showed that the use of a c-ELISA for the specific detection of H5 antibodies might be possible.

Key Words: Influenza, Recombinant hemagglutinin, ELISA, Diagnosis

P131 Detection of infectious laryngotracheitis virus from the darkling beetle and its larval stage (lesser mealworm) by real-time PCR.

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Infectious laryngotracheitis virus (ILTv) causes an acute respiratory disease of chickens. Severe forms of ILT cause high mortality, whereas milder forms can cause a decrease in body weights, condemnations, and poor egg shell quality and production. ILT tends to recur on the same farm, because this virus can persist for a long time and become latent. Mechanical transmission can occur by contaminated equipment, dust, water, feces, and litter. Since vaccine viruses can cause reactions as nearly as severe as the wild type viruses, prevention of LTV exposure in chicken farms is important. The darkling beetle, Alphitobius diaperinus, and its larvae, the lesser meal worm, commonly infest poultry litter in commercial farms. The parasites can destroy poultry building insulation, consume feed and water, and transmit infectious disease causing organisms. In addition, they may harbor such pathogens as infectious bursal disease V/IBDv/, fowl pox, avian reovirus, and Newcastle disease viruses, as well as Salmonella and E. coli bacteria. Primers were designed and procedures were developed to detect ILT by real-time PCR. Adult beetles and their larvae were collected from commercial broiler farms, which were diagnosed as having vaccinal ILT. The parasites were first treated with hydrogen peroxide to remove microorganisms from the external surfaces of the parasites. ILTV DNA was extracted from the beetles and larvae using a commercial kit. Results showed that most of the beetle and larvae samples were positive for ILTV DNA. Therefore, it is important to kill these common parasites on ILTV positive farms to obtain a thorough reduction in virus load in the litter.

Key Words: ILTV, Darkling beetles, Lesser meal worm, Real Time PCR

P132 Variable regulation of chicken embryo fibroblasts gene expression by H5N1 avian influenza viruses.

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Highly pathogenic avian influenza viruses (HPAIVs) cause severe clinical disease associated with high mortality in chickens and other gallinaceous species. However, the mechanism by which different strains of AIV overcome host response is still not clear. In the present study, differences in early transcriptional host responses were evaluated by infecting chicken embryo fibroblasts (CEF) with two highly pathogenic H5N1 avian influenza viruses, CK/HH/220/97 and Egret/HK/757.2/02. A complete chicken genome microarray was used to assess differences in gene expression between cells infected with either virus. A total of 191 genes showed differential expression by two-fold or more at 4 hpi when comparing the two viruses. Gene ontology revealed that the differentially expressed genes are involved in many vital functional classes including immunity/cytokinesis, apoptosis, transcription, cell cycle and proliferation and development. Semi-quantitative RT-PCR was used to validate the differential expression of selected genes from different categories and to investigate whether these genes and/or other genes were induced or suppressed later in the infection. It was found that CK/HH/220/97 is a stronger inducer of the innate immune response in CEF than Egret/HK/757.2/02, particularly IFN-α and the Mx gene. Our data suggest that avian influenza viruses may use different mechanisms and multiple strategies to evade host response.

Key Words: Avian influenza virus, Microarray, RT-PCR, IFN-α, Mx1

P133 Assessment of Clostridium perfringens and Clostridium septicum from commercial broilers with gangrenous dermatitis and asymptomatic broilers within the same houses.

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Poultry gangrenous dermatitis (GD) is an acute bacterial disease causing rapidly progressing necrosis of the skin, abdominal subcutaneous tissue, and underlying musculature. GD mortality in the U.S. can reach as high as 1% per day for up to two weeks. Clostridium species, specifically C. perfringens and C. septicum, are common causative agents isolated from skin lesions associated with GD. Within this study assessed and compared the clostridial agents present in broilers with GD lesions and asymptomatic broilers raised in the same houses. Gastrointestinal tract (GIT), liver, and spleen samples were collected from live symptomatic (n=28) and live asymptomatic (n=27) broilers. Skin lesion tissues were collected from the diseased broilers only. Samples were plated on Clostridial agar to obtain presumptive C. perfringens and C. septicum isolates. Multiplex toxin gene PCR was performed on each isolate. RAPD PCR was performed on toxin gene positive isolates to determine genetic diversity. From the GD symptomatic broilers 295 toxigenic Clostridium were isolated versus only 32 in asymptomatic broilers. Of the GD symptomatic bird-derived isolates 110 were identified as C. perfringens.
perfringens and 185 as C. septicum. Of the asymptomatic bird-derived isolates 26 were identified as C. perfringens and 6 as C. septicum. While no pathogenic endemic lineages could be identified from the dendrograms, there was clear evidence of genetic relatedness between the Clostridium isolates cultured from the GIT, liver, spleen and/or skin lesions from within the same GD symptomatic broiler. These results are consistent with the hypothesis that the GIT Clostridial imbalance observed between GD and asymptomatic broilers may lead to damage in the mucosal barrier allowing Clostridium to translocate through the epithelium into the bloodstream, progress to the organs and infect the subcutaneous tissue causing necrosis.

Key Words: Broilers, Clostridium, Gangrenous dermatitis


The necessity to maintain the breeder houses free of Salmonella is very important because this way we have broiler chickens free of Salmonella too, reason why we must carry out continuous samplings to have the guarantee to maintain Salmonella free birds. The present study was carried out in a breeder open house. Material and Methods. Fifteen drag swabs, fifteen manure samples, fifteen floor eggs and fifteen broiler chickens of these same breeders were taken. The drag swabs and the manure samples were settled in a pre-enrichment broth and incubated 37°C over night and later processed according to the Mexican Official Regulation (NOM-005-ZOO-1993). The floor eggs were washed with a phosphate buffered solution for external sampling and then plated in Mac Conkey and Trypticine soy Agar. Chicken liver, spleen, gall bladder, duodenum and egg yolk sac were collected and processed according to the Mexican Official Regulation (NOM-005-ZOO-1993). Results. There was not isolation of Salmonella enterica in this work, nevertheless, we identified other bacterial groups like Escherichia coli, Enterobacter sp, Proteus vulgaris and Proteus mirabilis. This study reinforces the importance of carrying out continuous samplings and practical of biosecurity in farms to have free Salmonella birds.

Key Words: Salmonella enteritidis, Salmonella spp, Salmonella sampling

P135 Evolution of the VP5 gene of very virulent infectious Bursal Disease virus. M. Hernández*, P. Villegas2, D. Hernández2, L. Maya1, V. Romero1, G. Tomás1, and R. Pérez2, 1University of Uruguay, Montevideo, Uruguay, 2University of Georgia, Athens.

Infectious Bursal Disease Virus (IBDV) causes a highly contagious immunosuppressive disease in young chickens. As other Birnaviridae viruses, the IBDV genome consists of two segments of double-stranded RNA. While the segment B encodes the viral protein VP1, the segment A encodes a precursor polyprotein for VP2, VP3, and VP4 and, in a second overlapped open reading frame, the protein VP5. There are classic, variant, and very virulent strains (vvIBDV) of IBDV that differ in pathogenic and antigenic traits. Among them, the vvIBDV is the most worrisome strain because of the huge productive and economic losses that is causing in its rapidly spreading throughout the world. Although the molecular basis for the increased virulence remains unclear, it seems to be associated with a co-evolution of the VP2 and VP1 genes, supporting the fact that the virulence trait requires the action of more than one single gene. Since VP5 seems to be responsible for the viral release and is discussed as a potential cellular apoptotic inducer, it has been associated with IBDV virulence. Remarkably, it has been observed that the VP5 protein of the vvIBDV have four additional amimonomerinal residues as a consequence of an alternative start codon. In the present work we have amplified, cloned, and sequenced the entire VP5 gene of Uruguayan vvIBDV. The phylogenetic analysis clusters our isolates with other vvIBDV strains from around the world. The comparative nucleotide and amino acid sequence analyses showed two conserved amino acid (133R and 221W) in all very virulent viruses. It also revealed the existence of nucleotide and amino acid changes among the Uruguayan isolates. Unexpectedly, the Uruguayan vvIBDV showed a point mutation in the alternative start codon of the VP5 and, as a consequence, lack the four amino acid typical of others vvIBDV. Our result indicates that the VP5 gene of vvIBDV has evolved both by the acquisition of specific amino acids as well as changing the start site of translation. This fact, together with the variability detected among our isolates, support a relevant role of this gene in IBDV evolution.

Key Words: Gumboro, IBDV, Virulence, VP5, Evolution

P136 Kinetic growth essay of an ExIEC (extraintestinal invasive Escherichia coli) strains isolated from chickens with yolk sac infection. C. C. Rosario*, and C. C. Esclava¹, ¹Facultad de Medicina Veterinaria y Zootecnia, UNAM, Circuito Exterior, ²Facultad de Medicina, UNAM, Circuito Exterior.

Escherichia coli is one of the most frequently isolated pathogenic bacteria, responsible of at least 5% of the mortality in commercial flocks. At present, pathogenic strains of E. coli are placed within APEC group. Despite several methods have been described to determine the virulence of a given strain, control of colibacillosis is difficult since a reliable method is not currently available. In order to determine the virulence of an ipaH+ strain, a kinetic essay was used. One hundred fertile eggs from a Leghorn commercial breeder flock were randomly placed into four groups of 25 embryos each, and inoculated as follow: Group I: 100 μl of sterile PBS, Group II: 105 CFU/100 μl of HB101 (Negative control), Group III: 105 CFU/100 μl of CR-000515 (Positive control) and Group IV: 105 CFU/100 μl of FM-095785 (ExIEC strain). Twenty μl of allantoid fluid were collected aseptically from 5 chicks at 0, 3, 6, 9 and 12 hours post-inoculation. Ten-fold dilutions were performed to dermine CFU/ml of allantoid fluid and results were analyzed with ANOVA, differences among groups were determined by Tukey’s test. There was no growth in embryos inoculated with sterile PBS during the whole trial period. A constant growth from 3 to 12 hours among the three strains were seen, however, K-12 had the lowest growth follow by CR-000515 and FM-095785. A significant statistical difference (P=0.0001) between the PBS and K-12 group, and between the last one with CR-000515 and FM-095785, nevertheless, there was no statistical difference (P>0.05) between the last two groups. These results suggest that strain FM-095785 is a pathogenic strain since it had the highest level of growth. A pathogenic strain should posses different virulence traits that allow them to growth and proliferate in adverse environments. In this case, virulent bacteria should be able to grow in allantoid fluid, colonize and kill embryos; that is a common feature seen in yolk sac infection cases, where ExIEC strains were found.

Key Words: Escherichia coli, APEC, Poultry, Yolk sac infection, Virulence


Intravenous cellulosic microparticle (MP) injection is a patented method used to select broilers that are resistant to pulmonary hypertension syndrome (PHS, ascites). In addition to occluding pulmonary arterioles, MPs cause a localized inflammatory response with mononuclear cell infiltration in the perivascular region. PHS-resistant broilers (R-line) are able to resolve the vascular occlusion and inflammation, whereas PHS susceptible broilers (S-line) may progress to PHS. Previous studies showed that the inflammatory cell infiltrate was more extensive in lungs from R- versus S-line broilers. Information on pro-inflammatory cytokines involved in leukocyte recruitment (e.g., IL-8) and activation (e.g., IL-1β, IL-6, IFN-γ) was not available. The objective of this study was to examine the time course of expression of these cytokines in lungs from R- and S-line broilers before (0h, no MP) and 2, 6, 12, 24 and 48h post-MP injection. Four wk-old R- and S-line broilers (6 per line and time point) were injected i.v. with MP. At each time point, the right lung of each broiler was collected and preserved in RNA-stabilization buffer. Cytokine expression was examined by quantitative RT-PCR and the fold change in cytokine expression relative to 0h levels was computed by the ΔΔCt method. In both lines, the expression of IL-1β, IL-6, and IL-8 increased consistently from 0 to 6h, reached peak levels at 6 and 12h, and decreased thereafter, whereas IFN-γ expression increased consistently
from 0 to 48h. Lungs from R-line broilers had higher (P<0.05) IL-1β and IL-6 at 2, 6 and 12h, higher IL-8 at 6 and 12h, and higher IFN-γ expression at 6 and 48h p.i. than lungs from S-line broilers. Higher expression of pro-inflammatory cytokines in R-line compared to S-line lungs following i.v. MP injection may explain the ability of R-line broilers to effectively counteract the MP-induced pulmonary hypertension and resolve the vascular occlusion.

Key Words: Ascites, Broilers, Cytokines, Microparticle, RT-PCR


A survey of egg quality and Salmonella contamination of eggs sold on supermarkets was carried out in Entre Rios, a province of Argentina. A total of 216 samples (mostly boxes) of six eggs were purchased from 27 supermarkets situated in different cities from Entre Rios (2 from Villa San José, 4 from Colón, 4 from Villa Elisa, and 17 from Concordia). Egg quality was assessed by measuring egg weight, % eggshell, eggshell thickness, yolk colour and pH of the pool yolk-albumen. Eggshells, boxes, and content (yolk-albumen) were tested for the presence of Salmonella, using cultural method. Twenty-five grams of eggshells or egg box or twenty-five ml of yolk-albumen of each sample was mixed with trypticase soy broth supplemented with ferrous sulfate. The mixture was preenriched for 24 h at 37ºC. Samples were selectively enrich in tetrathionate broth, plated on Hektoen and Xylose lysine desoxycholate agar plates. Suspect colonies were picked and subjected to biochemical and serological tests. In terms of colour of the eggshell, 68% has white colour and 32% brown. The % egg per weight class was: 47.3 % extra large, 45.8% large, 6.2 % medium and 0.7% small. The average of % eggshell (eggshell weight x 100/egg weight) was between 11% and 13%. Egg thickness ranged from 0.40 mm to 0.55 mm. About 21% samples were positive for Salmonella, using cultural method. Twenty-five grams of eggshells from pre-chill and post-chill broiler carcass were taken form both groups. For each breeders sample, five 9 days old SPF embryos were inoculated to attempt challenge virus reisolation. One carcass half of each carcass pair was rinsed in 200 mL of 2% buffered peptone, while the companion half was rinsed in 2% buffered peptone with 50 g of sterile sand added. All carcasses were rinsed for 1 min with a mechanical shaker. Salmonella, Campylobacter, and Escherichia coli were enumerated from rinsates and the prevalence of Salmonella and Campylobacter was determined. Salmonella and Campylobacter were isolated from 17% and 50% of the carcass halves, respectively. There was no significant (P>0.05) difference in Salmonella or Campylobacter incidence between the two treatments. Addition of sand had no effect on the number of Salmonella recovered from half carcasses, but did improve the recovery of Campylobacter from pre-chill carcasses by 2.1 log10

Key Words: Avian Influenza, Challenge, Vaccination, Excretion

P140 Interactive effects of ammonia and light intensity on hematocrit variables in broiler chickens. H. A. Olanrewaju*, J. P. Thaxton*, A. A. Dozier III†, J. Purswell†, S. D. Collier†, and S. L. Branton†, USDA-ARS-PSU, Mississippi State, MS; Mississippi State University, Mississippi State.

This study examined the influence of atmospheric ammonia exposure, light intensity, and their interaction on blood gases, electrolytes, and acid-base balance in broiler chickens under environmentally controlled conditions. The experiment consisted of a 3 × 3 factorial treatment structure arranged in a completely randomized design. The 9 treatments consisted of 3 levels of ammonia concentrations × 3 levels of light. Venous blood samples were collected on d 6, 11, 14, and 35. Partial pressure of CO2 (pCO2), hematocrit (Hct), hemoglobin (Hb), and Na+ significantly (P<0.05) increased while partial pressure of O2 (pO2) and K+ decreased with increasing ammonia concentration. As light-intensity increased, Hct, Hb and BW also significantly (P<0.05) increased with concurrently reduced pO2 and K+. Significant (P<0.05) ammonia × light-intensity interaction were observed for Hb, Hct, K+ and BW. The interaction of ammonia × light-intensity for 7 d further exacerbated physiological variables. The main effect of ammonia was more pronounced than that of light-intensity. These conditions were more pronounced as duration of ammonia concentration exposure and light-intensity increased from d 7 to 14 of exposure. However, all affected physiological variables returned to normal at later time points in the exposed chickens as affected by the treatments. Plasma corticosterone and glucose levels were not significantly affected by the treatments. Plasma corticosterone and glucose levels were not significantly (P>0.05) altered by exposure to differing levels of ammonia or light intensity, suggesting an absence of stress related to ammonia, light intensity or their interaction. It was concluded that exposure of broiler chickens to aerial ammonia concentrations from 0 to 50 ppm from 1 to 14 d of post-chatch in the presence of light-intensities ranging from 0.2 to 20 lx had no direct effect on some physiological blood variables and did not induce stress in broilers.

Key Words: Ammonia, Light-intensity, Acid-base balance, Broiler, Well-being

P141 Impact of added sand on the recovery of Salmonella, Campylobacter, Escherichia coli, and coliforms from pre-chill and post-chill broiler carcass halves. J. F. Hannah*, D. L. Fletcher†, N. A. Cox‡, D. P. Smith†, J. A. Cason‡, J. K. Northcutt§, R. J. Buhl*, and L. J. Richardson*, 1University of Georgia, Athens, GA; USDA-AFS, Russell Research Center, Athens, GA.

A study was conducted to evaluate the use of sand to a rinse for bacterial enumeration and determining the incidence of pathogens from broiler carcasses. During each of 4 replications, 6 pre-chill and 6 post-chill broiler carcasses were collected from a commercial processing plant. All carcasses were split along the midline. One carcass half of each carcass pair was rinsed in 200 mL of 2% buffered peptone, while the companion half was rinsed in 2% buffered peptone with 50 g of sterile sand added. All carcasses were rinsed for 1 min with a mechanical shaker. Salmonella, Campylobacter, and Escherichia coli were enumerated from rinsates and the prevalence of Salmonella and Campylobacter was determined. Salmonella and Campylobacter were isolated from 17% and 50% of the carcass halves, respectively. There was no significant (P>0.05) difference in Salmonella or Campylobacter incidence between the two treatments. Addition of sand had no effect on the number of Salmonella recovered from half carcasses, but did improve the recovery of Campylobacter from pre-chill carcasses by 2.1 log10.
P142 Effect of deboning time and cold storage on water-holding capacity of chicken breast meat. H Zhuang* and E. M. Savage, ARS-USDA, Athens, GA.

Water-holding capacity (WHC) is a very important qualitative characteristic of meat and directly affects the yield of further processed meat and consumer acceptance of pre-packaged fresh meat. Boneless skinless chicken breast meat for further processing and consumer usage is commonly deboned at various postmortem times and preserved by cold storage before use. The objective of our study was to investigate the effect of 2 different deboning times and cold storage on water-holding capacity of chicken breast meat. Broiler breast meat (pectoralis major) was removed from carcasses early post-mortem (2h) and later post-mortem (24h). Storage treatments of samples included: 0d; 1d at 3°C, 7d at 3°C (2h deboned meat only) and 6d at -20°C plus 1d at 3°C (frozen and thawed storage, 2h deboned meat only). Water-holding capacity was estimated by cooking loss, drip loss, filter paper press and a swelling/centrifugation method. Based on the measurements of the cooking loss and filter paper press, cold storage and deboning time did not affect WHC of the 2h samples; however, based on the measurements of the swelling/centrifugation method, cold storage and deboning time significantly enhanced WHC of the 2h samples. Only the frozen and thawed storage treatment resulted in significantly increased drip loss of the 2h samples. These results suggest that the effect of cold storage on WHC of chicken breast meat depended on the methods used for WHC estimation. There is a need to develop a standard method for WHC estimation for chicken breast meat.

Key Words: Chicken Breast, Storage, Water-holding capacity, Drip loss, Cook loss

P144 Bacterial levels associated with lime as a litter amendment. K.S. Macklin*, J.P. Blake, J.B. Hess, and T.A. McCaskey, Auburn University, Auburn, AL.

Litter treatments are commonly applied to poultry litter to reduce ammonia and bacterial levels. A trial was performed in which the effects of hydrated lime (HL) on total aerobic and anaerobic counts, percent moisture and pH were measured from litter. This was performed by using clean pine shaving litter that had been placed into 16 environmental chambers (2.44 m x 2.44 m x 2.44 m). Chicks from a commercial hatchery were used and were placed at a density of 70/pen. In this experiment, there were four treatments, with each getting four pens. Treatments included a non-litter amended control (CON) and (HL) applied at 50, 100 and 150 lbs/1000ft2. Litter samples were collected weekly from three areas of each pen and started the day before chicks were placed and continued until birds were removed 7 weeks later. For each sample bacterial counts were determined; additionally litter pH and moisture content were elucidated. Bacterial counts (cfu/g) and percent moisture results were transformed using log10 and arcsine transformations, respectively. The data was analyzed using GLM with P<0.05 and significant means were separated using Tukey’s HSD.

Results indicated no statistical difference (P>0.05) in average bacterial counts or percent moisture for any of the treatments. The only statistical difference demonstrated that the 100 and 150 lb application rates raised the average litter pH by 1 unit, as compared to the control.

Key Words: Lime, Litter, Bacteria

P145 Evaluation of an empirical nonlinear model to estimate feed intake in broiler breeders. L. F. Romero*, M. J. Zuidhof, F. E. Robinson, A. R. Renema, and A. Naeima, 1University of Alberta, Edmonton, AB, Canada, 2Alberta Agriculture and Food, Edmonton, AB, Canada.

The robustness of an empirical non linear model to predict metabolizable energy (ME) intake in broiler breeder hens was evaluated with respect to a linear model using metabolic BW, average daily gain (ADG) and egg mass (EM) data. Prediction equations were developed from Experiment 1 (20 to 60 wk), which used 288 Ross 708 pullets that were individually caged at 16 wk and assigned to one of four feed allocation treatments: Standard (STD), High (HIGH) (Standard+10%), Low (Standard-10%), and Individual based feed allocation (IND). Equations were evaluated on data from Experiment 2 (18 to 58 wk), which used 288 females of three strains (Hubbard Hi-Y, Ross 708 and Ross 508); four BW curves; and two photo-stimulation ages (18 and 22 wk). The non linear model included: 1) a non fixed exponential parameter of metabolic BW, 2) exponential terms to model the interaction between ADG and BW (aBW^ADG), and between EM and BW (dBW^EM), and 3) a normally distributed term associated with metabolic BW, which was linearly related to the plane of nutrition of HIGH, STD and LOW in a second regression.

In the nonlinear model, cross elasticities showed that the ADG requirement increased by 0.60% and the EM requirement decreased by 2.07% for a 1% increment in BW. Likewise, marginal ADG ME requirements increased at greater values of ADG and marginal EM ME requirements increased for greater EM production. The normally distributed term associated with maintenance had a linear relationship with ME intake (r²=0.83). In Experiment 1, the fit of the observed vs. predicted values for the linear model was R²=0.63 and R²=0.76, and for the nonlinear model was R²=0.88 and R²=0.95 on an individual and a feed allocation treatment weekly basis respectively. Applying the equations to individual hens and strain x BW curve groups from Experiment 2, the linear model had R²=0.58 and R²=0.80 while the nonlinear model showed R²=0.84 and
R²=0.95 respectively. The nonlinear function accurately estimated feed intake of three genotypes of female broiler breeders during a production cycle while the traditional linear model had a poor fit.

Key Words: Broiler breeders, ME intake, Nonlinear model, Prediction equation

P146 Egg shell color, specific gravity and hatchability, in eggs from broiler breeders. J. R. Moyle1*, D. E. Yoho1, R. S. Harper1, A. D. Swaffar2, R. K. Bramwell1, and D. J. Elfick2, 1University of Arkansas, Fayetteville; 2Aviagen, Huntsville, AL.

It has been suggested by hatchery managers that lighter colored eggs from broiler breeder hens don’t hatch as well as darker eggs. It has also been reported that lighter colored eggs have a lower specific gravity than dark colored eggs. Two studies were conducted to evaluate the relationship between eggs’ shell color, specific gravity and hatchability. In both studies shell color was determined using a colorimeter to provide a numeric color value. Specific gravity of the eggs was determined by placing the eggs in salt solutions that had specific gravity ranging from 1.065 to 1.090 in increments of 0.005. In the first study, a total of 2,354 eggs were measured for color and then placed into one of five categories based on color and then checked for specific gravity. In the second study, 1,297 eggs were measured for color and specific gravity, with each egg labeled so that every egg could be followed through to hatch. Data were analyzed using JMP statistical software comparing the means from the observations. Results from the first study showed that eggs from the lightest color group had the lowest average specific gravity (1.07213) while the darkest eggs had the highest specific gravity (1.07596). This study did not show any difference in fertility, hatch, or hatch of fertile between the five different categories. In the second study, the mean color value for eggs within each specific gravity group was analyzed with the following results: 80.02±1.065, 77.12±1.070, 76.31±1.075, 75.95±1.080, 75.9±1.085, and 73.01±1.090. In the second study the lighter eggs did have poorer hatchability as compared to the dark eggs. From these two studies it was observed that there is a linear relationship between color and specific gravity in broiler breeder hens, with light colored eggs having a lower specific gravity than dark eggs. It was further observed that the extremely lightest colored eggs had a lower rate of hatch than the darker colored eggs.

Key Words: Specific gravity, Eggs, Color, Broiler breeder

P147 Ammonia release and nutrient content of laying hen manure as affected by distillers dried grains with solubles and enzyme supplementation. A. J. Pescatore4*, A. Singh1, R. S. Gates2, A. H. Cantor1, J. L. Pierce1, K. A. Dawson1, T. A01, and M. J. Ford1, 1Alltech/University of Kentucky Nutrition Research Alliance, Lexington, KY; 2Dept of Biosystem and Agricultural Engineering, Lexington, KY.

The effects of using distillers dried grains with solubles (DDGS) with and without enzyme supplementation in laying hen diets on the nutrient content and ammonia release of manure was evaluated. Hens were fed one of five diets: 1) corn-soybean meal diet (16% CP, 2850 Kcal/kg ME); 2) corn-soybean meal diet with 25% DDGS (16% CP, 2850 Kcal/kg); 3) Diet 2 plus 0.1% enzyme preparation (Allzyme DDGS®, Alltech Inc.); 4) low energy corn-soybean meal diet with 25% DDGS (16% CP, 2550 Kcal/kg ME); and 5) Diet 4 plus 0.1% enzyme preparation. Manure samples were collected from eight groups of six hens for each of the dietary treatments. An equilibrium flux chamber technique was used to determine ammonia gas release from the manure. Manure samples were analyzed for pH, moisture content and percent N, P, and K. There was no effect of treatments on moisture content or pH. Ammonia release was highest for hens fed the corn-soybean meal diet (Diet 1) and lowest for those fed the low energy DDGS diet (Diet 4). Total ammoniacal nitrogen content for all of the DDGS diets was higher than for the corn-soybean meal diet. Manure from hens fed the DDGS diets had lower P and K content than that from hens fed the corn-soybean diet. Total nitrogen content was lowest for manure from hens fed diets supplemented with the Allzyme DDGS® enzyme preparation (Diet 3 and 5). The results indicate that inclusion of DDGS and enzymes in laying hen diets can affect ammonia release and nutrient content of the manure.

Key Words: Ammonia, DDGS, Manure content


There are many variables that affect hatchability, with hatching egg selection and quality considered among the important factors. However, to what extent egg pack quality affects hatch of fertiles is not completely known. Therefore, the purpose of this study was to determine the effect of setting poor quality hatching eggs on overall hatch and hatch of fertile. All hatching eggs were obtained from the University of Arkansas broiler breeder research farm and consisted of both quality hatching eggs and cull eggs (both misshapen and dirty). In order to simulate an attempt to salvage hatching eggs, groups of eggs were subjected to different treatments prior to placing them in the incubator. These treatments included, dirty eggs wiped with a wet cloth, or sanded with an abrasive pad, and dirty unaltered eggs. Additionally, eggs were set as cracked (slightly checked); cull (misshapen), upside down, or correctly (control). Each treatment group consisted of 120 eggs with the trial replicated three times. All eggs in each group were incubated to hatch and a residue breakout of all unhatched eggs was performed following the incubation period. Results showed that there was significantly reduced percent hatch and hatch of fertile as compared to the control in all categories except cracked eggs. Cull eggs showed the greatest deviation from control. Cleaning dirty eggs resulted in no significant improvement in percent hatch compared to dirty, untouched eggs (dirty 65.3, sanded 66.2, or wiped 67.3 %, respectively). Additionally, eggs that were dirty, sanded or wiped had a higher incidence of contamination compared to controls (8.5, 4.4, and 5.1 %, respectively). In conclusion, poor egg pack will reduce overall hatchability; and attempts to improve egg pack quality by cleaning dirty eggs, did not improve hatch or hatch of fertiles as compared to dirty, untouched eggs, and did not reduce the number of contaminated eggs.

Key Words: Broiler breeders, Cull eggs, Egg pack, Egg quality, Hatchery

P149 Hatchability of eggs from young and old broiler breeders as influenced by egg position and turning during storage. J. Dowden*, D. E. Yoho, G. Wiggins, and G. Johnson, Louisiana Agriculture Experiment Station Louisiana State University Agricultural Center, Baton Rouge.

To determine if there are any effects of egg position and turning during storage on hatchability for today’s modern broiler breeder, two trials were conducted. In each trial, 1440 freshly laid broiler breeder eggs from two flocks (young and old) were collected from a commercial farm. In the first trial, the broiler breeders were 31 or 60 weeks of age. In the second trial the broiler breeders were 29 or 64 weeks of age. Eggs were randomized before being assigned to treatment. Treatments were arranged in a 2 x 2 x 3 factorial arrangement with two broiler breeder ages (young and old), two turning treatments (turned once daily or unturned), and three positions (large end up, on the side, or small end up). The eggs were stored for three days and placed in a Natureform incubator. On day seven of incubation, eggs were candled and the infertile and early dead embryos were removed. These eggs were broken to confirm infertility. At hatch, chicks were removed and counted. All unhatched eggs were removed and pips recorded. The unhatched eggs were then broken and the embryos classified as early, mid, or late dead. All percentages underwent arcsine conversion before analysis. The two trials were statistically tested and data were combined. Percent total hatchability, percent fertile hatchability, percent pips, percent early dead, percent mid dead, percent late dead, and percent dead were not significantly (P>0.05) affected by any of the position or turning treatments tested.

Key Words: Hatchability, Egg Storage, Broiler Breeder, Egg Position, Egg Turning.
P150  Hatchability of post-peak egg production broiler breeder eggs as influence by pre-storage warming.  K. Homan*, D. Ingram, and C. Wiggins. Louisiana Agriculture Experiment Station Louisiana State University-Agricultural Center, Baton Rouge.

To determine if there are any improvements in hatchability brought about by warming end of lay broiler breeder eggs prior to storage, four trials were conducted. In each trial, freshly laid broiler breeder eggs from two flocks were used. The breeder birds were 60-64 weeks of age in all trials. The eggs were transported from a commercial farm to LSU where they were immediately randomized and prepared for treatment. In trials 1 and 2, egg were warmed for 0, 2, 4, or 6 hours pre-storage. Eggs receiving 0 hours warming were immediately placed in an egg cooler at 15.5 C and a relative humidity of 60%. Eggs receiving the pre-storage warming treatments were placed in a Naturefert setter at the same time and the appropriate eggs were removed after 2, 4, or 6 hours. These eggs were transferred to the egg cooler, stored for three days, and then set. A randomized block design was used for this statistical analysis. On day seven of incubation, the eggs were candled, and infertile and early dead embryos were removed. These eggs were broken to confirm infertility. At hatch, chicks were removed and counted. All unhatched eggs were removed and pips recorded. The unhatched eggs were broken and the embryos classified as early, mid, or late dead. All percentages underwent arcsinse conversion before analysis. Trials 1 and 2 were statistically tested and data were combined. In trials 3 and 4, eggs were warmed for 0, 3, 6, or 9 hours pre-storage. These two trials were tested and data were combined.

In all trials, percent total hatchability, percent fertile hatchability, percent pips, percent early dead, percent mid dead, and percent late dead were measured. Warming eggs prior to storage did not significantly (P > 0.05) affect any of the variables measured in these trials.

Key Words: Hatchability, Broiler Breeder, Egg Warming, Incubation, Egg Storage


The objective of the present study was to evaluate the efficacy of curcumin, an antioxidant supplied by turmeric (*Curcuma longa*) powder, to ameliorate changes in gene expression in liver of broiler chicks fed aflatoxin (AF). Four pen replicates of five chicks each were assigned to each of four dietary treatments, which included: A) basal diet containing no aflatoxin B1 (AFB1) or curcumin (control); B) basal diet supplemented with 1.48% curcumin; C) basal diet supplemented with 1.0 mg of AFB1/kg diet; D) basal diet supplemented with 1.48% curcumin and 1.0 mg of AFB1/kg diet. Aflatoxin reduced (P < 0.05) feed intake and body weight gain, and increased (P < 0.05) relative liver weight. Addition of curcumin to the AFB1 diet ameliorated (P > 0.05) the negative effects of AF on growth performance and liver weight. At the end of the three week treatment period, livers were collected and immediately frozen to evaluate changes in the expression of genes involved in antioxidant function [(catalase (CAT), super oxide dismutase (SOD), glutathione peroxidase (GPx), glutathione S-transferase (GST)], biotransformation [epoxide hydrolase (EH) cytochrome P450’s (CYP 1A1, CYP 2H1)], and the immune system [interleukins (IL-6 and IL-2)] by using the quantitative real time PCR technique. There was no statistical difference in gene expression between the four treatment groups for CAT and IL-2 genes. Decreased expression of SOD, GPx, GST, EH genes due to AF was alleviated by the inclusion of curcumin in the diet. Increased expression of IL-6, CYP1A1 and CYP2H1 genes due to AF diet was alleviated by curcumin. The current study demonstrates a protective effect of curcumin on gene expression in livers of chicks fed AF.

Key Words: Aflatoxin B1, Curcumin, Turmeric, Gene expression, Broilers

P152  Persistence and level of inoculated Salmonella Typhimurium in larval and adult darkling beetles.  A. J. Roche*, N. A. Cox1, L. J. Richardson2, R. J. Buhr3, B. D. Fairchild4, G. R. Siragusa5, and N. C. Hinkle6, 1University of Georgia, Athens, 2Poultry Microbiological Safety Research Unit, Russell Research Center, Athens, GA, 3University of Georgia, Athens.

*Alphitobius diaperinus* is a common litter pest in broiler houses. Both adults and larvae are regularly ingested by broilers and could serve as vectors of *Salmonella* to the current and subsequent broiler flocks. The objectives of this study were to evaluate the persistence of a marker S. Typhimurium strain in adult and larval darkling beetles and determine the level of colonization of S. Typhimurium in the beetles. In study 1, adult and larval beetles were deprived of feed for 24 h and then provided non-medicated broiler feed for 24 h that had been sprayed with a naladixic acid resistant marker strain of *Salmonella Typhimurium* at 3 inoculation levels. The beetles were then moved to a sterile container with non-inoculated feed. Individual (n=10) and pooled samples (n=1) of the adult and larval beetles, along with the feed, were sampled up to 63 d for adults and up to 36 d for larvae. In study 2, pooled adult (n=4) and larval (n=4) beetles were sampled to determine the level of *Salmonella* over 6 wk. After each sampling time, beetles were moved into a new container and fresh feed was added. In study 3, larvae were inoculated and allowed to pupate, then sampled. In study 1, persistence lasted 63 d (20% positive) at the high inoculation, 27 d at the medium inoculation (pooled positive), and 9 d at the low inoculation (10% positive). In the beetle larvae, the *Salmonella* persisted for up to 37 d (end of sampling) in the high inoculation (70%), and up to 21 d in the medium (100%) and low inoculation (80%). In study 2, the level of *Salmonella* for the adult beetles ranged from 10 to 10^3 CFU over 6 wk and averaged 10^3 at 40 d of sampling. For the larval beetles, the level ranged from 10^3 to 10^6 CFU over 6 wk and averaged 10^5 CFU at 30 d of sampling. From study 3, 45% of the larvae were positive for the marker *Salmonella* following pupation. These data suggest that *Salmonella* can persist in adult and larval darkling beetles for sufficient time to colonize subsequent broiler flocks and can be maintained though pupation.

Key Words: *Alphitobius diaperinus*, *Salmonella Typhimurium*, Darkling beetles, Lesser mealworm, Broilers

P153  Effect of corn particle size and antibiotics on intestinal strength and gizzard size.  K. Dobbeleare*, R. S. Beyer, C. Hancock, C. M. Rude, and J. Burden, Kansas State University, Manhattan.

Healthy intestinal systems are important for fast growing poultry. Poor intestinal strength results in complications during processing, such as a decrease in line speed, due to breakage and spillage and increased carcass microbial contamination. In addition, compromised intestinal vitality leads to decreased nutrient absorption and poor feed conversion. Research has suggested that corn particle size may affect intestine and gizzard weight, while antibiotics help maintain a healthier digestive function. This study was designed to determine the effects of corn particle size and antibiotic supplements on intestinal strength and gizzard size. In this study, Cobb 500 broilers were randomly assigned to 24 battery cages, which created 4 replicates of 6 experimental treatments, utilizing a 2x3 factorial. Food and water were provided ad libitum. Treatments consisted of corn soy diets formulated to meet or exceed nutrient requirements as suggested by the NRC. One factor explored was the particle size of the corn, ground to a geometric mean of 467 and 1077 microns. Each particle size consisted of three treatments, two containing different antibiotics and the third was antibiotic free. Birds were weighed at 0, 3, 6, and 7 weeks of age. At 7 weeks, birds were euthanized according to IACUC procedures. Intestine and gizzard samples were taken for analysis. Intestinal samples were harvested fresh, packed on ice and analyzed for fragility by measuring breaking force. The data showed that diets containing antibiotic supplement had higher gizzard weights. Diets containing BMD gave higher peak force of the front section of the intestine as compared to the others. Body weights were significantly higher for diets containing antibiotic supplements when compared to the treatment containing no antibiotic. Particle size and antibiotic treatment had an effect on intestinal breaking force. Further studies should be conducted to further define the effects of both particle size and antibiotics on digestive tract integrity.

Key Words: Intestine, Particle Size, Antibiotics, Feed manufacturing, Gizzard size
**P154** The effects of low lever laser application on hatching eggs for improvement of hatchability and survival rate. A. Tesiki*, University of Cukurova, Adana, Turkey.

The main purpose of this study is to investigate the effects of low laser application on hatchability and survival rate of broilers. The experiments were conducted in the Experimental Poultry Farm of Cukurova University and a commercial farm in Cukurova Region of Turkey. These experiments were conducted as control and test groups. The eggs in the control groups were not irradiated, but they were kept at equal conditions together with the eggs in the test groups until being placed in an incubator. The effect of laser treatment on the hatchability of irradiated test groups was significantly higher than the control groups in both of the experiments. Similar results were obtained for the survival rate and the body weight of broilers at the end of the fifth week of age.

As a result, a certain regimen of low laser irradiation on hatching eggs provided significant increase on the hatching of chicks, improved the survival rate, and decreased the mortality in this experiment.

**Key Words:** Poultry, Laser, Hatchability, Mortality, Bodyweight

**P155** Dietary evaluation of Primalac and amino acid levels in commercial broilers. D. L. Everett**, A. Corzo1, W. A. Dozier, III1, R. D. Buschong3, and M. T. Kidd1,

One experiment with Ross x 708 broilers was conducted to evaluate various amino acid regimes in diets with and without Primalac using a factorial arrangement of treatments. Embryos and one day old chicks received standard vaccinations at a commercial hatchery (Pilgrims Pride, Russellville, AL), were transported to Mississippi State University hatchery, sexed, and placed equally sexed in experimental floor pens (48 pens; 12 birds per pen). Pens contained a pan feeder, nipple drinkers, and built-up pine shavings. The starter diet (Day 1 to 15) and subsequent diets (Day 16 to 29, Day 30 to 43, Day 44 to 48) contained two and one pounds of Primalac per ton, respectively. The control diet without Primalac contained bacitracin methylene disalicylate in the 1 to 15 diet and virginiamycin in the 44 to 48 diet. Three diets varying in amino acid levels were fed in all diets except the starter diet. These diets were characterized by high amino acid density (1), reduced amino acid density (2), and further reduced amino acid density (3). No Primalac x amino acid interactions occurred. Diet 1 improved (P < 0.05) BW gain over diet 2, but diet 3 resulted in an intermediate response. Diet 1 optimized (P < 0.05) feed conversion. However, diet 3 had poorer mortality (P < 0.05) than diets 1 and 2. Contrast analyses in birds fed lower amino acids (diets 2 and 3) showed higher (P = 0.12) fillet yields when Primalac was fed. Although significant interactions did not occur, further research should be conducted on potential nutrient sparing effects of Primalac.

**Key Words:** Primalac, Broiler, Nutrient density, Amino acid, Breast yield

**P156** Utilization of biodegraded groundnut pod with purified enzyme extracts from fungi by broilers. E. A. Lyayi*, T. E. Lawal, B. A. Adeniyi, and O. A. Aderamooye, University of Ibadan, Ibadan, Oyo State, Nigeria.

Purified enzyme extracts (PEEs) were obtained from Aspergillus niger (An), Trichodermar viride (Tv), Rhizopus stolonifer (Rs) and Mucor mucedo (Mm) and used to biodegrade groundnut pod (GNP), an agro industrial by-products containing high amounts of non starch polysaccharides (NSPs) and low crude protein. The biodegraded GNP was then fed to 252 broilers from day old to finisher (56 days) in comparison with Roxayzime G2G (a commercial feed enzyme) and the undegraded GNP as positive and negative controls, respectively. The birds were allocated to the 6 experimental diets with 3 replicates each in a completely randomized design. The crude fiber, neutral detergent fiber, acid detergent fiber, cellulose, hemi cellulose, acid detergent lignin and pectin in the GNP were significantly (p<0.05) reduced when biodegraded with PEEs from the fungi. Crude protein (CP), phosphorus and metabolizable energy in the GNP were significantly (p<0.05) increased. The amounts of glucose, fructose, galactose and sucrose in the GNP were significantly (p<0.05) increased on biodegradation with the fungal PEEs. Weight gain, feed intake and feed conversion ratio were significantly (p<0.05) higher in birds fed diets containing the biodegraded GNP and were not significantly different from those fed diets containing Roxayzime G2G. Apparent digestibility of nutrients followed similar pattern. Biodegradation of GNP with PEEs and with Roxayzime G2G significantly (p=0.05) reduced the viscosity of digesta especially in the crop and gizzard of the birds. Results of the study suggest that biodegrading GNP with An, Tv, Rs and Mm was effective in enhancing its nutritional value for broilers by reducing the NSPs and viscosity and by increasing the CP and phosphorus contents as well as the digestibility of nutrients. Biodegrading GNP with the fungi before feeding to broilers produced similar results as incorporating Roxayzime G2G into the feed containing GNP thus helping to eliminate the problem of handling and storage of the commercial enzyme often experienced by poultry farmers in Nigeria.

**Key Words:** Groundnut pod, Fungal enzymes, Biodegradation, Performance, Broilers

**P157** Effect of a synbiotic feed additive in comparison to an antibiotic growth promoter on broiler performance under field conditions. M. Mohnl*, and R. Nichol2, BIOMIN GmbH, Herzogenburg, Austria, 2BIOMIN Laboratory Singapore, Jalan Bukit Merah, Singapore.

Due to the growing concerns related to the use of antibiotic growth promoters in animal production there is a need for effective alternative products that will sustain high performance in animal husbandry. The aim of the present trial was the evaluation of the efficacy of a synbiotic product in comparison to a commonly used AGP on broiler performance under field conditions in Thailand. The trial was conducted with day-old broiler chicks (AA+) with 32,600 birds per group, 4 replicates per group and 8160 birds per replicate. Birds were reared in closed houses with evaporative cooling and placed on litter consisting of rice hulls. The ration fed to broilers in both trials was a standard corn-soy ration fed in a four diet feeding program. Salinomycin was used as anti-coccidial agent in all groups. Feed and water was provided to all broilers ad libitum. Drinking water application of the product was by a medicator system in place within each pen. Experimental groups included a negative control group (NC), a group which received a synbiotic product (Biomin® Poultry5Star, Biomin GmbH) via the drinking water on day 1, 2, 3 and on three consecutive days around feed change and a positive control group (PC) which received Avilamycin (5 ppm) via the feed. The birds were kept under observation for 35 days and performance parameters were determined. Compared to the NC group and the PC group live weight and mortality could be improved in the group which received Biomin® Poultry5Star. Synbiotic group and AGP group increased body weight by 4.4% and 2.6% respectively and reduced mortality by 25.7% and 2.8% in comparison to control. Similarly, feed conversion was improved in broilers receiving Biomin® Poultry5Star when compared to broilers in the NC group by 5.1%. In the present study the synbiotic product had a better potential to improve broiler performance as Avilamycin and might therefore be a promising alternative to the use of AGPs in broiler production.

**Key Words:** Synbiotic, Antibiotic growth promoter, Broiler, Performance


The increased availability of corn distiller’s dried grains with solubles (DDGS), and its use as a feedstuff for livestock diets, necessitates an improved knowledge of the nutritional composition. The non-starch polysaccharide (NSP) portion contributes to the nutritional value of DDGS and is generally associated with reduced nutrient digestibility, thus a more thorough understanding of levels and variability of the NSP components is important to gain further insight in the energy-yielding substrates in DDGS.

Thirty (30) samples of corn DDGS were randomly obtained from various commercial sources throughout the U.S. These were analyzed for percent dry matter,
acid detergent fiber, ether extract and crude protein. The soluble, insoluble and total NSP monosaccharide sugars were determined using the method of Englyst and Hudson (1987).

Across the 30 samples, considerable variation existed for acid detergent fiber, ether extract and crude protein (see table). Of these, the ether extract exhibited the highest coefficient of variation of 18.7%, followed by acid detergent fiber (14.5%). With the exception of ribose and fucose, the NSP components in the insoluble fiber portion exceeded those of the soluble portion. When the two fractions were summed, the total average NSP fraction was 22.7%. Glucose, an indicator of cellulose content, was highest in concentration. This was followed by xylose and arabinose, two components of the arabinoyxylan structure. The galactose and mannose levels were much lower and essentially equivalent in the total NSP. Levels of individual components were considerably lower in the soluble NSP fraction. The results suggest that considerable ranges in energy digestibility and content can be expected across batches of commercial corn DDGS, and that arabinoyxylans and cellulose are the two primary NSP components in corn DDGS.

### Table 1. Nutritional and Total NSP Fiber Components of Corn DDGS

<table>
<thead>
<tr>
<th>Component</th>
<th>Average, % Dry Matter</th>
<th>Std Dev, %</th>
<th>Range, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>90.25</td>
<td>1.45</td>
<td>87.73 to 94.25</td>
</tr>
<tr>
<td>Acid Detergent Fiber</td>
<td>13.65</td>
<td>1.98</td>
<td>9.09 to 17.33</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>11.17</td>
<td>2.09</td>
<td>3.18 to 13.50</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>32.56</td>
<td>3.34</td>
<td>27.80 to 46.76</td>
</tr>
<tr>
<td>Rhamnose</td>
<td>0.08</td>
<td>0.01</td>
<td>0.05 to 0.09</td>
</tr>
<tr>
<td>Ribose</td>
<td>0.11</td>
<td>0.04</td>
<td>0.06 to 0.20</td>
</tr>
<tr>
<td>Fucose</td>
<td>0.06</td>
<td>0.04</td>
<td>0.01 to 0.18</td>
</tr>
<tr>
<td>Arabinose</td>
<td>4.98</td>
<td>0.49</td>
<td>4.09 to 6.08</td>
</tr>
<tr>
<td>Xylose</td>
<td>6.42</td>
<td>0.72</td>
<td>4.81 to 7.78</td>
</tr>
<tr>
<td>Mannose</td>
<td>1.62</td>
<td>0.43</td>
<td>1.16 to 2.44</td>
</tr>
<tr>
<td>Glucose</td>
<td>7.86</td>
<td>0.86</td>
<td>6.72 to 9.68</td>
</tr>
<tr>
<td>Galactose</td>
<td>1.61</td>
<td>0.19</td>
<td>1.19 to 2.08</td>
</tr>
</tbody>
</table>

Values reported on a dry matter basis

**Key Words:** Corn, Non-starch polysaccharides, NSP, Distiller’s dried grains with solubles, DDGS

### P159 Standardized ileal amino acid digestibilities in various Western Canadian wheat and pea cultivars for broilers.

A. Bandegan1, G. Golian1, W. Guenter1, D. Hoehe2, and C. M. Nyachoti1, 1University of Manitoba, Winnipeg, MB, Canada, 2Degussa Corporation, Kennesaw, GA.

Digestibility coefficients enable accurate formulation of poultry diets with respect to dietary amino acid supply. Moreover, standardized ileal digestibility (SID) coefficients, derived by correcting apparent ileal digestibility (AID) values for basal endogenous amino acid losses should be used as they are likely more additive in a mixture of feed ingredients. Thus, two experiments were conducted to determine SID of amino acids in six wheat (Exp. 1) and five pea (Exp. 2) samples grown in western Canada. Five hundred and twenty-eight male Ross broiler chickens were fed a commercial starter diet from d 1 to 15 of age and the test diets from d 15 to 21. The assay diets contained wheat or peas as the sole source of protein with chromic oxide (0.3%) as digestibility marker. Each test diet was assigned to six replicate cages, each with 8 birds. On d 21, birds were killed to sample ileal digesta. SID values were calculated using ileal endogenous amino acid losses determined in a previous experiment in our laboratory. The determined AID and SID values for wheat and pea (mean ± SD) for essential amino acids are shown in the Table below. As expected, the results showed that estimates of SID were higher than AID values in wheat and pea. The AID and SID values for lysine were considerably higher in pea compared with wheat, whereas values for Met and Met+Cys were higher in wheat than in pea. The standardized ileal digestibility data determined in this study will provide a useful guide for practical and accurate feed formulation in broilers.

**Table 1. The determined AID and SID values for wheat and pea (mean ± SD) for some essential amino acids**

<table>
<thead>
<tr>
<th>Item</th>
<th>Wheat AID</th>
<th>Wheat SID</th>
<th>Pea AID</th>
<th>Pea SID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arg</td>
<td>82.4 ± 0.28</td>
<td>85.5 ± 0.28</td>
<td>92.4 ± 0.25</td>
<td>93.8 ± 0.25</td>
</tr>
<tr>
<td>Ile</td>
<td>86.4 ± 0.19</td>
<td>90.7 ± 0.21</td>
<td>85.5 ± 0.36</td>
<td>88.0 ± 0.37</td>
</tr>
<tr>
<td>Leu</td>
<td>87.5 ± 0.19</td>
<td>90.8 ± 0.19</td>
<td>86.5 ± 0.36</td>
<td>88.9 ± 0.38</td>
</tr>
<tr>
<td>Lys</td>
<td>79.5 ± 0.31</td>
<td>84.1 ± 0.31</td>
<td>91.1 ± 0.28</td>
<td>92.3 ± 0.26</td>
</tr>
<tr>
<td>Met</td>
<td>88.5 ± 0.20</td>
<td>91.7 ± 0.19</td>
<td>84.8 ± 0.45</td>
<td>89.2 ± 0.44</td>
</tr>
<tr>
<td>Met+Cys</td>
<td>87.2 ± 0.19</td>
<td>91.3 ± 0.19</td>
<td>80.0 ± 0.38</td>
<td>85.1 ± 0.38</td>
</tr>
<tr>
<td>Thr</td>
<td>74.5 ± 0.39</td>
<td>86.0 ± 0.39</td>
<td>81.9 ± 0.32</td>
<td>88.5 ± 0.37</td>
</tr>
</tbody>
</table>

**Key Words:** Apparent ileal digestibility, Standardized ileal digestibility, Wheat, Peas, Broilers

### P160 The implications of a threonine deficiency on mucin dynamics in growing broiler chicks and White Pekin ducklings.

N. L. Horn*, S. S. Donkin, and O. Adeola, Purdue University, West Lafayette, IN.

Mucins play a crucial role in gut health and is the major constituent of the mucus layer. Threonine is particularly relevant to the mucin structure because of the importance it serves to link carbohydrate groups to the amino acid backbone. The effects of a threonine deficiency on crude mucin excretion and mucin mRNA (MUC2) abundance were investigated in growing male broiler chickens and White Pekin ducks. Twenty-four birds of each species were fed a standard poultry starter diet from d 0 to 14 of age and then assigned to either low (3.3 g/kg) or adequate (8.2 g/kg) dietary threonine for a 14-d feeding trial. Diets were semipurified, isonitrogenous corn-soybean meal based with the addition of crystalline amino acids formulated to meet or exceed NRC recommendations for broiler chicks and ducklings. Excreta was collected from d 26 to 28 of age and analyzed for crude mucin. Mucosal contents were collected from the distal jejunum on d 28 of age, placed in Trizol® reagent, and analyzed for MUC2 mRNA abundance by RT-PCR. Data were analyzed as a completely randomized design. For broiler chicks, there was no effect (P > 0.05) of dietary threonine on crude mucin excretion or MUC2 mRNA abundance. For ducklings, there was a tendency (P = 0.06) for a decrease in crude mucin excretion, whereas there was a decrease (P = 0.03) in MUC2 mRNA abundance in response to decreasing dietary threonine. In conclusion, a threonine deficiency in broilers did not affect crude mucin excretion or MUC2 transcript abundance; although in White Pekin ducklings a threonine deficiency reduced crude mucin excretion from 37.1 to 27.9 g/100 g of excreta and MUC2 transcript abundance from 2.97 to 1.88 arbitrary units for the 14-d feeding trial. The data establish a link between dietary threonine, crude mucin excretion, and MUC2 mRNA abundance in growing White Pekin ducklings. These effects of threonine on mucin dynamics have implications for improved gut health and nutrient absorption.

**Key Words:** Chick, Duckling, Mucin, MUC2, Threonine

### P161 Evaluation of organic Mn (Bioplex Mn®) as a Mn source for broiler chicks.


A study was conducted to evaluate Bioplex Mn® (a chelated Mn proteinate) as an organic manganese source for broiler chicks. Corn-soybean meal diet without Mn supplementation, containing 26 mg/kg Mn, was used as a basal diet. One-day-old male broiler chicks were housed in starter cages with plastic covered feeders in an environmentally controlled room for 3 wk. Feed and water were supplied on an ad libitum basis. Treatments consisted of feeding the basal diet alone or with three supplemental levels of Mn (1000, 2000 and 3000 mg/kg) either from Bioplex Mn® or from analytical MnSO4 alone or with three supplemental levels of Mn (1000, 2000 and 3000 mg/kg) either...
supplementation from both sources linearly decreased (P<0.01) weight gain and feed intake of chicks and linearly increased (P<0.01) manganese concentration in tibia, liver and kidney. Slope-ratio analysis regressing weight gain and tissue Mn concentration on Mn intake indicated the relative bioavailability value of Bioplex Mn® compared with manganese sulfate were 200% and 139% respectively. 

Key Words: Bioavailability, Chick, Manganese proteinate, Manganese sulfate, Organic manganese

P162 Effects on productive parameters and digestive mucosa of broilers caused by feed supplementation with cell walls (Saccharomyces cerevisiae), beta-glucans and mannoproteins. R. Morales1*, E. Auclair2, F. García3, and J. Brufau1, 1IRTA-Animal Nutrition, Constanti-Tarragona, Spain, 2Lesaffre Feed Additives, Marquette-Lez-Lille, France, 3Saffins S.A. de C.V., Toluca, México.

An experiment was carried out in broiler chicks (Ross 308), in order to evaluate the effect of yeast cell walls (YCW) (S. cerevisiae) or Saf-Mannan®, and their main purified polysaccharides, beta-glucans (BG), and mannoproteins (MP) incorporated into the diet, on growth parameters and digestive mucosa. Four experimental treatments were proposed: T-1) Negative control (NC), no additives; T-2) NC + YCW (500 mg/kg feed); T-3) NC + MP (190 mg/kg) similar to MP content of YCW (500 mg) of T-2; and T-4) NC + BG (227 mg/kg) similar to the content of BG of YCW (500 mg) of T-2. Treatments were replicated 5 times and included 40 chickens each. Diets were prepared with wheat-barley-rye meal and were free of antibiotic growth promoters, anti-coccidial drugs and enzymes for cereals. The results after 42 experimentation days did not show clear effects on chicken live weight by the YCW use (P>0.05) (T-1=2404; T-2=2431; T-3=2419; and T-4=2430 g), only feed conversion index was numerically better in chickens fed with YCW, MP and BG when compared to control diet fed chickens (P<0.05) (T-1=1.660; T-2=1.615; T-3=1.600; and T-1=1.584 g/g); this situation coincided with a significant increase (P<0.01) in jejunum mucosa villi height (21 days) in chickens that consumed YCW, MP and BG in the diet as compared to the use of NC diet (T-1=957 μm; T-2=1159 μm; T-3=1156 μm; and T-4=1090a μm).

Key Words: Yeats cell walls, Beta-glucans, Mannoproteins, Villi height, Broiler

P163 Effect on productive parameters, by the addition of yeast cell walls (Saccharomyces cerevisiae) to broilers’ feed in two different exploitation conditions. J. Arce1*, E. Avila2, C. López-Coello3, A. García3, and R. Morales3, 1UMSNH, Morelia-Michoacán, México, 2UNAM-FMYZ, México D.F., México, 3Saffins S.A. de C.V., Toluca, México.

An experiment was carried out in broiler chickens with the purpose of evaluating productive parameters with the addition of yeast cell walls (YCW) (S. cerevisiae) or Saf-Mannan® to feed, in two different farms; with or without technical development, working for 2 and 25 years respectively (A and B), located at 1940 masl (Mexico). A total of 5,600 one-day-old chicks were used, rearing them until they were 45 days old. They were completely randomized with a factorial arrangement of 2 x 4 with 14 replicates of 50 birds each, with the following factors: farms and treatments, which consisted of a negative control (NC) without antibiotic; positive (PC) with antibiotic (Virginiamycin); NC + YCW at 500 mg/kg of feed, and PC + YCW at 500 mg/kg of feed. Results showed significant effects (P<0.01) between treatments in body weight (1,945, 1,957, 1,964 and 1,968 g), feed efficiency (4827, 4862, 4832 and 4913 g), and feed conversion (1.99, 1.91, 1.93 and 1.88 g/g) favoring treatment PC + YCW (500 mg/kg feed). Significant effects were found (P<0.01) between farms in body weight (2616 vs. 2561 g), feed consumption (4640 vs. 5098 g) and feed conversion (1.80 vs. 2.02 g/g) favoring farm A, with interaction (P<0.04) on feed conversion between the evaluated factors. Both farms showed better response to the inclusion together with antibiotic + YCW. The conclusion is that YCW at 500 mg/kg feed dose by itself is sufficient to achieve results similar to Virginiamycin, existing synergism in parameters when added jointly with YCW.

Key Words: Yeast cell walls, Saccharomyces cerevisiae, Broiler chickens, Productive parameters

P164 Production performance of single comb White Leghorne chickens fed growing diets containing blood meal and supplemental isoleucine. S. N. Nahashon*, J. Tyus III, N. A. Adeofe, and D. Wright, Institute of Agricultural and Environmental Research, Tennessee State University, Nashville, TN.

The effect of feeding blood meal supplemented with isoleucine to Single Comb White Leghorn (SCWL) chicks on their successive production performance was evaluated. In four replicates, 480 SCWL chicks were fed experimental diets containing blood meal with supplemental isoleucine from day-old to 10 weeks of age (WOA). The diets were corn-based with the protein sources being 100% soybean meal (control), 100% blood meal (BM), 50% soybean meal + 50% blood meal (SBMM), and 50% alfalfa meal + 50% blood meal (AMB). These diets contained 2,900 Kcal ME/kg and 20% crude protein (CP). Blood meal comprised 16.8, 11.0 and 14.3% of the dietary composition in BM, SBMM, and AMBM diets, respectively. At 10-15, 15-18 and 18-46 WOA birds in all treatment groups were fed corn-soy based diets containing 3,000, 3,080, and 2,900 Kcal ME/kg and 17.5, 16.5, and 16% CP, respectively. Experimental birds were provided a 23, 8, and 16 hr light regimen at day-old to 10 WOA, 10-16 WOA, and 16-46 WOA, respectively. Feed and water were provided at free choice and mortality was recorded as it occurred. At first egg, experimental birds were observed for age, body weight and egg weight (EW). Thereafter hen-day egg production (HEP), EW, egg mass (EM), egg grade (EG), internal egg quality (IEQ) and egg shell thickness (ST) were measured over five 28-day laying periods. Birds fed BM diets had 6.08, 5.24 and 2.63% higher HEP than those fed the control, AMBM, and SBMM diets, respectively. Mean EM of BM fed birds was 5.65, 5.49 and 2.34% higher than that of the control, AMBM, and SBMM birds, respectively. However, IEQ and ST were higher (P<0.05) in birds fed the control diet than the other treatment groups such that control > BM > SBMM > AMBM. Therefore, feeding diets containing blood meal and supplemented with isoleucine to SCWL chicks from day-old to 10 WOA significantly improved their egg production performance, but depressed their IEQ and ST.

Key Words: Single Comb White Leghorn, Blood meal, Production performance, Isoleucine

P165 Live and processing performance of broiler chickens fed diets supplemented with complexed zinc. B. Saenmahayak*, S. F. Bilgili, and J. B. Hess, Auburn University, Auburn, AL.

Influence of complexed Zinc (C-Zn) supplementation on live performance (BW, feed conversion and mortality), skin (incidence of sores, scabs and scratches) and foot pad quality, processing yields, and meat quality of broiler chickens were assessed at 49 d of age. A total of 1,440 male Ross x Ross 708 broilers were assigned to three dietary treatments (60 birds per pen; 8 pens per treatment): inorganic control (IC; 80 ppm ZnSO4 and 80 ppm MnSO4), C-Zn (Availa-Zinc, Zinpro Corp., Eden Prairie, MN) replaced 40 ppm ZnSO4 in control diet (IC+C-Zn) and additional 40 ppm Zn from C-Zn on top of control (IC+C-Zn). Each treatment was provided in a three-stage feeding program, which consisted of a starter (1-15 d), grower (16-41 d), and withdrawal diets (42-48 d). At 49 d of age, the incidence and severity of pododermatitis was assessed in all birds. In addition, 10 birds were randomly selected from each pen and processed to evaluate whole carcass yield, grade, skin lesions, and meat quality attributes (drip loss, cook loss, pH, water holding capacity (WHC), and color (L*, a* and b*) BW (3,241 and 3,140 g) and feed conversion (1.701 and 1.736) were significantly (P<0.05) improved with IC+C-Zn compared to the IC treatment, respectively. Feed conversion was also improved (P<0.05) with IC+C-Zn as compared to IC treatment. Total mortality averaged 1.6% and did not vary among the treatments. The incidence and severity of pododermatitis was significantly reduced with both C-Zn treatments. Proportion of birds with skin lesions decreased from 42.7% in IC treatment. Total mortality averaged 1.6% and did not vary among the treatments. No differences in carcass and component yields were detected. However, deboned fillet and total breast yields were significantly higher in IC+C-Zn than the IC treatment. Breast fillet quality attributes measured did not show any differences due to dietary treatments. Inclusion level and source of dietary Zn has a significant influence on broiler live and processing performance in this study.

Key Words: Broilers, Complexed zinc, Skin quality, Pododermatitis
P166 Performance comparison and nutrition requirement of eight commercial brown egg layer strains. P. K. Gunawardana*, M. M. Bryant, and D. A Roland, Sr., Auburn University, Auburn, AL.

Eight commercial brown egg layer strains were used to compare performance and nutrient requirements when fed diets containing three lysine levels (0.917, 0.828, and 0.747). There were eight replicates of 10 hens (21 weeks of age) for each treatment and the trial lasted 16 weeks. The results showed that there were no interactions between lysine and strain on any parameter. Lysine had significant effects on egg weight, egg mass, feed conversion, percent albumen solids, yolk color, shell color, albumen weight, egg shell and albumen components. There were significant strain effects on egg production, feed consumption, egg weight, egg mass, feed conversion, specific gravity, yolk weight, shell color, shell, albumen and yolk components, yolk albumen and whole egg solids. Strain 1 had the best overall performance. All strains peaked in production over 94% and were laying 94 to 96% at 36 weeks of age. Average egg weight (21 wk to 36 wk) was 60.3g, varying from 59.0 to 62.8g between strains. Average feed intake was 112.3g/ hen/day varying from 109.6 to 116.7g/hen/day between strains. Average Egg weight of hens fed diets containing the highest lysine level was 2.04g heavier than the hens fed the diets containing the lowest lysine level. Increasing dietary lysine from 0.747 to 0.917% significantly improved feed conversion from 2.20 to 2.06 g feed/g egg and increased egg mass from 51.8 to 54.32 g/hen/day. Average lysine intake of hens fed 0.917% level was 1023mg/hen/day varying from 1005 to 1070mg/hen/day between strains. Because feed ingredient and egg price vary there can be no fixed ideal dietary lysine requirement for optimal profits.

Key Words: Brown layer Strain, Nutrient requirement, Lysine

P167 Microsoft Excel sensitivity analysis for stochastic and linear program feed formulation. W. B. Roush*, USDA-ARS Poultry Research Unit, Mississippi State, MS.

Sensitivity analysis is a basic part of a mathematical programming solution and is helpful in making nutritional and economic decisions for a given feed formulation problem. The terms shadow price and reduced cost are familiar linear program (LP) terms to feed formulators. Because of the nonlinear nature of stochastic programming (SP), a different approach is used to define shadow prices and reduced costs. The Lagrange multiplier is used instead of shadow price to describe marginal value of nutrients. Reduced Gradient is used instead of reduced cost to describe the price at which ingredients, not used in the formulation, would enter the solution. A spreadsheet feed problem was setup with 11 ingredients and 11 constraints. LP and SP solutions were determined using the Excel Solver algorithm. Two problems compared LP and SP solutions at 50% and 69% probabilities for the protein constraint. All other constraints were held at a 50% probability. Results for the 50% probability comparison showed that the feed formulations, as expected, were exactly the same for both LP and SP. Wheat was not included in the solution. The LP reduced cost and the SP reduced gradient for unused wheat were equivalent. The LP Shadow prices and the SP Lagrange multipliers were the equivalent. Results for the 69% probability problem showed a difference in the formulated rations. The LP reduced cost was $34.25 and the SP reduced cost was $34.52 showing the respective amounts that the cost of wheat would have to be reduced to enter the solution. The shadow price and the Lagrange multiplier were $2.73 and $2.71 respectively for the amount of increase in ration cost that could be expected by a unit of change in the protein requirement. Some rounding error was noted with the results.

Key Words: Sensitivity analysis, Feed formulation, Linear programming, Stochastic programming


The effect of varying levels and sources (organic vs. inorganic) of trace mineral supplements on trace mineral concentrations in manure was studied using a commercial strain of brown shell laying hen (Hy-Line Brown). Eight replicate groups of 16 replacement pullets, 2 wk of age, were assigned to each of six dietary treatments, using a randomized block experimental design. Pullets were housed in cages and given ad libitum access to feed and tap water. Trace mineral mixes that contained Cu, Mn, Fe and Zn at 25, 50 or 100 per cent of the NRC (1994) requirements in the form of inorganic salts or proteinates (Bioplex®, Alltech, Inc.) were added to corn-soybean meal-based grower and layer diets in a 3 X 2 factorial arrangement of treatments. At 16 wk of age, the number of pullets was reduced to 12 per replicate, the pullets were transferred to layer cages (2 per cage) and switched to layer diets, and the photostimulation program was initiated. At 29 wk of age, six hens per treatment were placed in metabolism cages and manure was collected for 48 hours. Manure samples were dried, ground and analyzed for Cu, Fe, Mn and Zn by inductively coupled plasma spectrophotometry. Manure concentrations of Cu, Mn and Zn were significantly increased by the 100% level of supplementation (vs. 25 and 50%) and were unaffected by the source of minerals. Manure Fe levels were unaffected by dietary treatments. Respective concentrations of Cu, Fe, Mn and Zn in manure (DM basis) were 39, 813, 145 and 230 mg/kg for hens supplemented with the 100% level and 28, 747, 94 and 165 mg/kg for hens supplemented with the 25% level of trace minerals. The results indicate the dietary level, but not the source, of the trace minerals used with practical diets influences the concentrations of trace minerals in the manure.

Key Words: Laying hens, Trace minerals, Proteinates, Organic minerals, Manure

P169 Effect of peptides on performance, egg components, egg solids and egg shell quality of Hy-line W-36 Hens fed different protein levels in second cycle. P. K. Gunawardana*, M. M. Bryant, D. A Roland, Sr., and G. Wu, Auburn University, Auburn, AL.

A 5 — 2 factorial arrangement of five protein levels with and without Peptiva (a mixture of peptide) was used in two trials to evaluate itâ€™s effect on performance, egg composition, egg solids, and egg quality of commercial Leghorns. Molted Hy-line W-36 hens (n=1200) were randomly divided into 10 dietary treatments (8 replicates of 15 hens per treatment). Trial one lasted 8 weeks and trial two lasted 4 weeks.

In trial one, Protein had a significant effect on feed consumption, egg weight, egg production, egg mass, egg specific gravity, egg albumen solids, and percent albumen. As dietary protein increased from 13.5 to 15.6%, egg production, feed consumption and egg weight increased by 6.1%, 8.2% and 5.2% respectively. Food consumption of hens fed the diets supplemented with Peptiva was significantly lower than that of hens fed the diets without Peptiva. Peptiva supplementation significantly increased egg production of hens during the first week with production being numerically higher in week 2, 6, 8 and overall egg production. Peptiva significantly increased egg mass and improved feed conversion during the first week but all significant effects other than the feed consumption were lost after the second week. In trial two the protein effects were similar to that observed in trial one; but peptiva had no significant effects. These results suggest Peptiva may influence protein utilization but more research is needed to fully evaluate its effects on performance and profits.

Key Words: Peptiva, Peptides, Dietary proteins, Commercial leghorns

P170 Effect of increasing dietary energy while maintaining a constant energy/lysine ratio on performance, egg components, egg solids, egg quality and profits in seven commercial leghorn strains during second cycle. P. K. Gunawardana*, M. M. Bryant, D. A Roland, Sr., and G. Wu, Auburn University, Auburn, AL.

A 3 X 7 factorial experiment of three energy levels (low, medium and high) and seven commercial Leghorn strains was conducted to determine the effect of increasing dietary energy while maintaining a constant energy/lysine ratio on performance, egg composition, egg solids, egg quality, and profits in seven commercial Leghorn strains during second cycle phase 2 (from 88 to 97 week
of age). This experiment lasted 10 weeks. Seven strain of hens of hens (n = 245 of each strain) at 88 week of age were randomly divided into 21 treatments (6 replicates of 15 birds per treatment). Strain had a significant effect on feed intake, egg production, egg specific gravity, egg weight, percent whole egg solids, and haugh unit. There were no interactions between strain and dietary energy with a constant energy/lysine ratio on any parameter during second cycle. Dietary energy while maintaining a constant energy/lysine ratio had also no significant effect on any parameter. However, as dietary energy increased from 2,776 to 2,864 kcal ME/kg, egg production, final body weight of hens, egg mass, egg yolk color and egg yolk weight numerically increased; moreover, feed conversion numerically improved from 2.06 to 2.02, resulting in a 1.94% improvement of feed conversion. It is difficult to determine an ideal dietary energy level for the hens in second cycle since increasing dietary energy by addition of poultry oil had no significant effect on feed intake, egg mass or feed conversion. Because feed ingredient and egg price vary, there can be no fixed ideal dietary energy requirement for optimal profits.

Key Words: Strains, Energy/lysine ratio, Dietary energy, Lysine

P171 Testing pellet quality and pelleting efficiency in a pelleting facility in Kosova. R. I. Bakalli1*, M. Thaqi2, I. Zenelaj2, B. Pllana2, and G. M. Pesti1,
1University of Georgia, Athens, 2USAIDKCBS, Prishtina, Kosova.

It is estimated that 130,000 MT of poultry feed is produced in Kosova each year. Considerable amounts of feed are best fed as crumble or pellets. The pelleting process is defined as the agglomeration (process of molding into a mass) of small particles into larger particles by means of a mechanical process in combination with moisture, heat, and pressure. Advantages of pelleting: improved feed efficiency, improved digestibility, decreased feed wastage, reduced selective feeding, decreased ingredient segregation, destruction of pathogenic organisms. Disadvantages of pelleting: investment in equipment, maintenance costs, risk from destruction of some vitamins, amino acids, enzymes (unless stabilized forms are used). A new pelleting facility in Kosova has two pelleting presses: a flat, 6 mm diameter die press (1500 kg/h), and a ring, 3 mm diameter die press (750 kg/h). Trial 1 included testing pellet quality of common poultry feed ingredients. The durability index for: corn = 65.7, soybean meal = 41.5, sunflower meal = 97.2, wheat bran = 95.5. Trial 2 included the influence of horizontal barrel conditioner speed on pelleting efficiency and quality. If mash material speed in the conditioner was 8.19 kg/min: steam pressure was 3.3.4 bar at 810°C, capacity 438 kg/h, durability index 88.9, pelleting efficiency 150 kW/T, pelleting cost = 6 â‚¬/T; at 16.63 kg/min; steam pressure = 3.2-4 bar at 710°C, capacity = 997 kg/h, durability index = 72.3, pelleting efficiency = 71 kW/T, pelleting cost decreased to 3 â‚¬/T; at maximum speed (28.45 kg/min), steam pressure = 3.2-4 bar at 500°C, capacity = 1707 kg/h, durability index = 48, pelleting efficiency = 46 kW/T, pelleting cost decreased to 1.94 â‚¬/T. Pelleting poultry feed in Kosova will be beneficial for poultry production with possibilities to balance pelleting efficiency, pellet quality and reduce the additional spending for pelleting.

Key Words: Pelleting, Pelleting Efficiency, Pellet Durability Index

P172 Relative effectiveness of phytase sources in broiler diets. J. S. Radcliffe1, B. E. Aldridge1, L. L. Snyder1, B. W. Cousins1, and P. Ader2, 1Purdue University, West Lafayette, IN, 2BASF Corporation, Florham Park, NJ.

Five hundred forty-six, male broilers, were obtained on the day of hatch and used in a 21 d experiment to compare the relative efficacies of two bacterial 6-phytases (Phyzyme XP®) and a fungal 3-phytase (Natuphos®). Birds were randomly assigned to Petersime battery cages (6 birds/cage, 7 cages/diet). All diets were corn-soybean meal based, and were fed in meal form. A Ca to non-P based, Diet 1 with 0.50% tP and 0.80% Ca, 2) Diet 1 + 0.08% inorganic P (iP), 3) Diet 1 + 0.16% iP, 4) Diet 1 + 0.24% iP, 5) Diet 1 + 100 FTU/kg Natuphos, 6) Diet 1 + 300 FTU/kg Natuphos, 7) Diet 1 + 500 FTU/kg Natuphos, 8) Diet 1 + 100 FTU/kg Phyzyme XP, 9) Diet 1 + 300 FTU/kg Phyzyme XP, 10) Diet 1 + 500 FTU/kg Phyzyme XP, 11) Diet 1 + 100 FTU/kg Phyzyme XPT, 12) Diet 1 + 300 FTU/kg Phyzyme XPT, and 13) Diet 1 + 500 FTU/kg Phyzyme XPT. Pen BW and feed intake were recorded weekly and morbidity and mortality were recorded daily. At the end of wk 3, all birds were killed and toe samples were obtained by severing the middle toe through the joint between the second and third tarsal bones from the distal end. Toes were pooled by pen, dried to a constant weight and ashed in a muffle furnace. In general, birds fed low P diets, were able to maintain growth performance. There were no differences (P>0.10) in cumulative ADG or Gain:Feed for increasing levels of nP or phytase. Feeding increasing levels of nP (P<0.001), Natuphos (P<0.002), Phyzyme XP (P<0.03), or Phyzyme XPT (P=0.004) resulted in linear improvements in toe ash (%). Linear response equations for nP (R2=0.86), Natuphos (R2=0.94), Phyzyme XP (R2=0.57), and Phyzyme XPT (R2=0.96) for toe ash were developed. By setting the phytase equations equal to the nP equation, equivalency values were generated. Based on these equations, 500 FTU of phytase/kg of diet releases 0.89, 0.56, and 0.83 g of P per kilogram of diet for Natuphos, Phyzyme XP, and Phyzyme XPT, respectively. Based on parameters measured in this experiment there are no differences between bacterial 6-phytase and fungal 3-phytase.

Key Words: Broiler, Phytase, Equivalency, Ash, Growth


Low fiber and high energy and protein diets are essential for high performance animals. This is the reason why cereals are quite important for the animal nutrition. Ensiling is an alternative of the preservation of grains. According to Berndt et al. (2002), ensiling of grains with high humidity in the animal feeding results in agronomic advantages like significantly lower field losses, more intensive use of the land (3-4 weeks according to Mader et al., 1983; Kramer und Voorlui, 1991) and cost reduction because of the drying, thesis also supported by Silva (1997), Costa et al. (1998), Molin et al. (1999), Lemos (2006). Biagi et al. (1996) added another advantage, which is the reduction of the grain losses while maturity by earlier harvest. Other decreasing of losses was substantiated by Doggett (1988), in case of the sorghum, caused by bird damage; by Yilela et al. (1988), Santos (1992), Biagi et al. (1996), Silva (1997) as result of molds and insects infestation and the concomitant risk decreasing of mycotoxin loading when grains are ensiled (Costa et al., 2002). Lemos (2006) enumerates the control of rodents in the silo. Furthermore, the feed conversion rate was improved in the ruminant (Tonroy et al., 1974; Mader et al., 1991; Stock et al., 1991; Costa et al., 2001) and in the monogaster nutrition (Lopes et al., 2001a; Lopes et al., 2001b; Sartori et al., 2002). Jobim et al. (1999) agree that in the top layer of the silos the grain silage spoils relatively fast. The studies show that the use of biological silage additives can improve the aerobic stability of grain silages and that the tannin content can be reduced, as well as the chicken performance improved. It can be concluded that the ensiling of cereal grains is an alternative way to preserve them and to improve their nutritional value.

Key Words: Broiler, Phytase, Equivalency, Ash, Growth


An experiment was conducted to determine the relative bioavailability (RBV) of different sources of Cu for broilers. Each treatment had 8 replicate pens with 6 female Ross 708 broilers per pen in brooder batteries. Dietary treatments were: corn-soybean meal diet with no extra supplemental Cu or diets with 250, 350, or 450 ppm Cu from trasic copper chloride (TBCC), Mintrex Cu (Mintrex), or CuPlex 100 (CuPlex). Chicks were killed on d 14 via CO2 asphyxiation, and livers were collected from each chick for Cu analysis. Increasing levels of Cu in the diet linearly decreased (P < 0.03) ADG and ADFI, but this response was observed only in chicks fed CuPlex, which had decreased (P < 0.01) ADG and ADFI compared to chicks fed TBCC (level × source, P = 0.05), and chicks fed Mintrex were intermediate. As level of Cu increased from 250 to 350 ppm from
P175  Nucleotides in broilers diet from 1 to 21 days. R. Barbalho*1, G. A. Gomes2, and L. F. Araujo2, 1ICC Brazil, Sao Paulo, SP, Brazil, 2University of Sao Paulo, Pirassununga, SP, Brazil.

Sacccharomyces cerevisiae (SC), one of the most widely commercialized types of yeast, has long been fed to animals. One of the most important aspects of yeast is its high content of nucleic acids, which through proper hydrolysis can be transformed into free nucleotides. The objective this study was to examine the effects of free nucleotides from hydrolyzed yeast (Hylises™) supplementation in vegetable diets compared to a positive control. Therefore a total of 200 male broiler chickens, 1-d-old were assigned to one of the following diets: negative control (without additives), another diet with 0.6 % Hylises™/kg feed (120 g/t of nucleotides), diet with 0.6% Hylises™/kg (240 g/t of nucleotides) feed and other diet (positive control) with 1.0% glutamine/kg feed consisting of 5 replicates with 10 birds each. Performance parameters and gut morphology were recorded from day 1 to day 21 and at the end of the experiment 3 chickens per pen were utilized for gut morphology determination in terms of carcass percentage, breast yield, leg yield, wing yield and abdominal fat yield. Overall gut morphology did not differ between treatments with free nucleotides (Hylises™) and glutamine, but birds feeding with negative control showed worst crypt depth, villus high, villus height/crypt depth ratio and villus area. The results showed that birds feeding with 0.6% of Hylises™ (240g/t of nucleotides) had better performance than the others treatments and increased feed intake on first week. The glutamine decreased the performance the birds.

Key Words: Glutamine, Growth performance, Sacccharomyces cerevisiae, Yeast cell component

P176  Amino acid digestibility of yeast for broilers. R. Barbalho*1 and L. F. Araujo2, 1ICC Brazil, Sao Paulo, SP, Brazil, 2University of Sao Paulo, Pirassununga, SP, Brazil.

Although evidence suggests that ileal digestibility values are better indicators of amino acid availability than excreta-based values, ileal digestibility values are limited. One assay was carried out to evaluate the apparent ileal and excreta amino acid digestibility of diets formulated with yeast obtained from different sources for broilers. The birds were raised in battery and fed commercial broiler starter from d 1 to 19. On d 20, 150 male broilers were allocated in three treatments (T1 – Autolyzed yeast; T2 – Yeast which had its residual alcohol recovered through distilling column and T3 – Yeast which had its residual alcohol recovered through washing) in five replicates of 10 broilers in each experimental unit. The animals were given a diet containing yeast as the sole source of protein. All diets contained chromic oxide (0.5%) as the indigestible marker to calculate the digestibility estimates. During the 23rd to 27th days, the excreta were collected and, in the 28th day, all broilers of each replicate were slaughtered and ileal digesta were collected from the terminal ileum by gently flushing with distilled water into plastic containers. Ileal digesta from birds within a pen were pooled and immediately stored at ~20°C in airtight containers. The samples of the excreta and ileal digesta were analyzed for dry matter, nitrogen, and the digestibility coefficients and energy values, were calculated using the indigestibility factor of chromic oxide. The average the ileal and excreta digestibility were lower in yeast processed through distilling column and the best results were obtained with autolyzed yeast and yeast processed through washing. It was concluded that way that a bi product yeast is processed affects the nutrient digestibility of diets formulated with the inactive dried yeast and differences determined between ileal and excreta digestibilities demonstrate that amino acid metabolism by hindgut microflora may be substantial and that digestibilities measured in the terminal ileum are more accurate measures of amino acid availability than those measured in the excreta.

Key Words: Apparent ileal digestibility, Excreta digestibility, Protein source, Sacccharomyces cerevisiae

P177  The linear correlation between phytase activity measurements determined using two assay methods in animal rations. M. E. Persia1, H. Burrows1,2, R. Prata1,2, S. S. Basu1,2, and M. Lee1,2, 1Syngenta Animal Nutrition, Research Triangle Park, NC, 2Syngenta Biotechnology, Research Triangle Park, NC.

Currently, different phytase assay methods have been used to quantify the enzyme activity in the feeding industry. These methods prescribe different extraction as well as assay conditions, including the assay reaction temperature, which can have significant effects on the activity data collected. In this study, experiments were conducted to build the relationship between two such assay methods that differ, among other things, in phytase assay temperature. The direct assay (DA), a higher temperature assay (50°C) was compared to the AOAC method (37°C). Each assay method was carried out on the same feed sample generated from four diet-types with phytase inclusion levels of 250, 500, 1000, 1500 and 2500 FTU of Quantum™ phytase (QP) per kg diet. Phytase activity measured with DA and AOAC methods, reported in IU and FTU respectively, were plotted. The linear correlation generated between these two sets of data, show a high correlation-coefficient (r²) of 0.965. In an attempt to measure the contribution of assay temperature to phytase activity, liquid QP was diluted to different concentrations (250, 500 and 1000 FTU/kg) in AOAC assay buffer and enzyme assays were then conducted in parallel at both 37°C and 50°C. The plotted data showed a linear co-relationship (r² = 0.988) between the assays carried out at different temperatures. The slopes from these two linear plots, 1.52 for phytase activity measured in feed samples using the two methods and 1.63 for liquid enzyme sample measured at different assay temperatures, were similar in magnitude. This leads to the inference that difference in assay temperature was one of the major contributors to the observed differences in phytase activity measurements reported from feed analysis carried out using these two methods. In addition, based on results presented, it appears a simple linear equation can be used to convert phytase activity estimation between these two assay methods.

Key Words: Phytase, Assay, Temperature, FTU, IU

P178  Effects of trace mineral supplementation on egg production and feathering in laying hens. S. E. Scheidecker1,2, T. Weber1, S. Shields1, and H. Stilborn1, 1University of Nebraska, Lincoln, 2Alltech Inc., Nicholasville, KY.

Five experimental diets ranging in zinc (Zn) and selenium (Se) levels and Zn and Se sources were fed to laying hens from 24 to 110 weeks of age. A non-fasting molt was induced at 65 weeks of age. The diets included a basal diet with 0 ppm supplemental Se and Zn (Diet A); 30 mg/kg Se from Na Selenite combined with 100 ppm Zn from Zn Sulfate (Diet B); 30 mg/kg Se from Selplex (Alltech, Inc.) and 100 ppm Zn from Zn Sulfate (Diet C); 0.3 mg/kg Se from Na Selenite and 100 ppm Zn from Alltech Bioplex Zn (Diet D); or 0.3 mg/kg Se from Selplex and 100 ppm Zn from Alltech Bioplex Zn (Diet E). Each diet was fed to 6 replicate cages with 4 Bovan White hens per cage. Feather scores (FS) were conducted every 2 weeks during the trial using 2 scoring systems â€“ Tauson and Webster and Hurnik. Trace mineral treatment had no significant effect on feed intake, hen weights, egg weights or egg specific gravity during all phases both pre and...
post molt during this trial. Egg production showed a significant dietary effect during Phase 2 of production with hens fed diet D having improved EP of 87.4 compared to hens fed the other experimental diets. That is the only time period that there was a significant effect of treatment on EP parameters. As hens aged, feather scores by both scales showed a rapid deterioration during Phases 2 and 3 of the study with rejuvenation of feather cover following molt. By the Webster and Humik scale, diet significantly affected feather score during Phase 3 and 5 of the study. Hens on the basal diet (0 supplementation of Se and Zn) had the poorest feather cover; while hens on Diet D (Se from Na-Selenite and Zn from Bioplex) had the best feather scores during Phase 3 and Diet E (Se from Selplex and Zn from Bioplex) had the best scores during phase 5 (post molt).

Key Words: Feather Cover, Zine, Selenium, Laying Hens, Trace Mineral

P179  The effect of glycine in diets for broilers fed corn-soybean meal diets. A. Waguespack*, S. Powell, A. Donsbough1, D. Dean1, T. Bidner1, L. Southern1, and R. L. Payne2, 1LSU Agricultural Center, Baton Rouge, 2Degussa Corporation, Kennesaw, GA.

The purpose of this report is to summarize the effect of added Gly to corn-soybean meal (C-SBM) diets. Eleven experiments (Exp.) were conducted that included C-SBM, which were thought to be adequate in all nutrients, and then that diet with added Gly. All Exp. were conducted from 0 to 14 or 18 d of age. In some of these Exp., there was a significant response to added Gly in gain (ADG), feed intake (ADFI), or gain/feed (GF). Where the response to Gly was not significant, often the response to Gly was positive. In the 11 Exp. representing 93 or 100 pens of these Exp., there was a significant response to added Gly in gain (ADG), feed intake (ADFI), or gain/feed (GF) in all the diets with added Gly. All Exp. were conducted from 0 to 14 or 18 d of age. In some Exp. using C-SBM, which were thought to be adequate in all nutrients, and then that diet meal (C-SBM) diets. Eleven experiments (Exp.) were conducted that included C-SBM, which were thought to be adequate in all nutrients, and then that diet meal (C-SBM) diets.


Previous research conducted by this laboratory indicated that dietary crude protein can be as low as 15% and achieve similar broiler performance as a 23% CP diet. Two recent experiments were conducted with the objective of testing the effects of feeding a 15% CP diet with crystalline amino acid supplementation on the performance of broilers from 1-3 weeks of age. In both experiments, commercial broilers were fed a diet formulated to meet NRC requirements for the first seven days. The diet contained 22.5% CP and 3000 kcal/kg ME, and also served as the positive control diet (A). At day 7 birds were sorted by weight into battery pens with 5 birds per pen. Both experiments contained the same six dietary treatments with eight replicates per treatment for a total of 48 pens. The remaining treatments consisted of: a 15% CP negative control diet with crystalline amino acids added back to meet required levels (B), a NC diet + 1% cystine (C), a NC diet + 1% threonine (D), a NC diet + .1% glycine (E), and a NC diet + .1% cystine, threonine, and glycine (F). Glutamic acid was added to all diets to maintain a 20% protein equivalent. All diets were formulated on a digestible basis, and were designed to be isocaloric. At the conclusion of the experiments, body weight gain (BWG), feed intake (FI), and feed efficiency (FE) were measured. In Experiment 1, significant differences (P < 0.05) were found in BWG between treatments A and F, although no significant differences in FI or FE were observed. There were no significant differences (P > 0.05) in BWG, FI, or FE between any of the other treatments. In Experiment 2, treatments had no effect (P > 0.05) on performance. Overall, these results suggest that feeding a 15% CP diet + crystalline amino acids to broilers in the starter period may yield similar performance as a 23% CP diet.

Key Words: Low crude protein, Broilers, Crystalline amino acids, Performance, Starter period

P181  Comparison of dietary bacitracin methylene disalicylate (50 g/ton) vs bacitracin methylene disalicylate (25 g/ton) plus Bacillus subtilis C3102 spores (CALSORPIN®) for broiler chicks in litter pens over 3 cycles with Salmonella challenge at 10 days in 1st cycle. M. D. Sims, T. Lohrmann2, N. Otomo3, D. M. Hooge4, and J. D. Firman*, 1University of Missouri, Columbia, 2Corp. Farm, Harrisonburg, 3Quality Technology International, Inc., Elgin, IL, 4Calpis Co. Ltd., Tokyo, Japan, 4Hooge Consulting Service, Inc., Eagle Mountain, UT, 5University of Missouri, Columbia.

Three cycles of Ross x Cobb broilers were placed on clean litter in cycle 1 (January 11) and on re-used litter in cycles 2 (March 1) and 3 (April 19). Chicks were challenged with Salmonella typhimurium Copenhagen (1x10^9/g feed) at 10 d in cycle 1 only. There were 8 replicate pens with 30 chicks each per treatment, and each trial lasted 42 d. Diets included a negative control (nCON; not supplemented with antibiotic or microbial), bacitracin methylene salicylate (BMD®, Alpharma) at 50 g/ton, or BMD® 25 g/ton + Bacillus subtilis C3102 (Bc C3102; CALSORPIN®, 3 x 105 cfu/g feed). Data were analyzed statistically by cycle and 3 cycles combined. The BW and FCR results were consistent over 3 cycles (nCON poorest results in cycles 2 and 3; P < 0.05). Overall, BMD® 50 g/ton gave best FCR (1.843 vs 1.857 for BMD® 25 g/ton + Bb C3102 spores vs 1.953 for nCON (P = 0.06). The 42-d BW was 2.270 kg for BMD® 25 g/ton + Bb C3102 spores and 2.255 kg for BMD® 50 g/ton vs 2.163 kg for nCON (P = 0.13). Mortality did not differ significantly (2.36, 2.36, and 1.39% with BMD® 25 g/ton + Bb C3102 spores treatment lowest). Clostridium perfringens counts at 35 d were lower (0.30 and 0.30 CFU/g feces) in birds fed BMD® 50 g/ton and BMD® 25 g/ton + Bb C3102 spores vs nCON (1.56 CFU/g feces; P = 0.001; less than 2.30 CFU/g were “none detected” and considered “0”). Whole carcasses rinses found Salmonella counts unaltered by treatment but lower by cycles 1 to 3. The BMD® 25 g/ton + Bb C3102 spores treatment was favored economically and therefore recommended for commercial use.

Key Words: Bacillus subtilis C3102, Bacitracin, Broiler chicken, Calsporin, Direct-fed microbial

P182  Molting 16 white and brown egg laying strains without feed withdrawal. M. M. Bryant* and D. A. Roland, Auburn University, Auburn, AL.

Animal welfare concerns have made it evident that feed withdrawal is no longer an acceptable method for force molting hens. Producers are now faced with finding an alternative method that is as effective. To this end two trials were conducted to evaluate the effectiveness of three diets intended to induce molt. Trial one was an eight by two factorial study where eight strains of 66 week old white leghorns were fed one of two diets. One diet used corn to replace soy bean oil meal (SBOM) and omitted salt (CN). The other diet substituted wheat midds and soy hulls for corn and SBOM and also omitted salt (WM). The second trial was conducted using four strains of White Leghorns and four strains of Brown Leghorns that were also 66 weeks old. Each strain was fed one of two diets. One diet was the same as the CN diet in the first study and the other diet substituted SBOM for corn and omitted salt (SB). Hens were fed these molt diets for 28 days and were then fed an appropriate post molt layer feed. Performance was evaluated for sixteen weeks for both trials. The criteria used to evaluate perfor-
mance were egg production (EP), egg weights (EW), feed consumption (FC), egg specific gravity, hen mortality and interior egg qualities. In the first trial, EP and EW were higher for hens fed the WM diet early but by peak production and for the overall average (wk-1-16) there were no differences. Average FC after egg production resumed was higher for hens fed the WM diet by 6%. Some strains had EP higher than 90% at 86 weeks of age. In the second trial FC was higher for hens mated with the SB diet than those mated with the CN diet. There were no differences between hens fed the different molt diets in any of the other criteria measured. The average EP of brown egg layers at 65 weeks of age (prior to molt) was higher than white egg layers. After molting this reversed. At 16 weeks post molt (86 weeks of age) brown egg layer EP was 85% and white egg layers EP was 88%. Although all three diets were satisfactory, the method of choice would depend on ingredient prices of molt feeds.

Key Words: Molt, Hen, Strain

P183 Effect of exogenous enzymes supplementation on apparent metabolizable energy of corn. L. R. B. Dourado1, N. K. Sakomura*1, N. A. A. Barboza1, M. Hruby2, and E. Pierson2. 1FCAV-UNESP, Jaboticabal, São Paulo, Brazil, 2Danisco Animal Nutrition, St. Louis, MO.

The use of enzymes has been shown to improve digestibility of nutrients in corn-soybean diets. However, few studies have been conducted to determine the effect of enzymes specifically on corn. The aim of this work was to evaluate the apparent metabolizable energy (AME) of corn supplemented with exogenous enzymes (Danisco Animal Nutrition). A digestibility trial was conducted using a total collection of excreta method from 7 to 14 days of age: 280 7-day old Cobb * male chicks were distributed into seven dietary treatments, five replicates of 8 chicks each. A basal diet containing corn, dicalcium phosphate, limestone, salt, mineral and vitamin mixture was supplemented with enzymes evaluated. The treatments consisted of corn (without enzymes) and corn supplemented with one of the following enzymes: amylase (g min 400 g/kg feed), xylanase (g min 300 g/kg feed), phytase (g min 500FTU/g/kg feed), Avizyme® 1502 (amylase, xylanase and protease at 500 g/tone) and Grindazym® (xylanase, pectinase and β-glucanase, 500g/tone) and combination of Avizyme® 1502 and Phyzyme XP (all enzymes supplied by Danisco Animal Nutrition). Diets and excreta were analyzed for dry matter, nitrogen and energy. The supplementation of Avizyme 1502 + Phyzyme XP provided greatest improvement (p=0.08) in AMEn of corn (3578+31) compared to corn without enzymes (3504+55). The improvements for individual enzymes were from highest to lowest for Avizyme 1502, xylanase or Phyzyme XP and amylase. Supplementation with Grindazym did not improve corn AME.

Key Words: Corn, Enzymes, Apparent metabolizable energy, Broilers

P184 Feeding full fat oil seeds to laying hens: Effect on production parameters, egg quality and yolk fatty acids. Z. Hayat4,1, T. N. Pasha1, F.M. Khattak1, G. Cherian2, and M. A. Jabbar3, 1University of Veterinary and Animal Sciences, Lahore, Pakistan, 2Oregon State University, Corvallis. An experiment was carried out with three hundred, 53-week-old white leghorn hens to examine the effect of dietary full fat oil seeds (sunflower, canola, flax) at three different levels (5, 10, 15%) on egg production, egg weight, feed consumption and yolk fatty acids. The inclusion of oil seeds did not alter the egg production or egg weight when compared with eggs from hens fed the corn-soy-based control diet (P>0.05). Feeding flax (10,15%) and canola (5,10,15%) led to reduction in the total saturated fatty acids (P<0.05). The deposition of α-linolenic acid (18:3n-3), eicosapentaenoic (20:5n-3) and total long chain n-3 fatty acids was highest with flax 15% (P<0.05). The total n-6 fatty acids was 32, 26 and 15 mg/g yolk in eggs from hens fed flax (15,10, and 5%) when compared to 6 mg/g yolk in eggs from the control diet (P<0.05). The content of n-6 fatty acids and total polyunsaturates (n-6+n-3) was highest in eggs from hens fed 15% sunflower diet (P<0.05). The feed intake was less for hens fed 10% flax diet when compared to those consuming the control diet (P<0.05). These results suggest that full fat oil seeds could be incorporated into laying hen diets without affecting production performance and egg quality. In addition, inclusion of oils seeds could also provide different n-6 and n-3 essential fatty acids to humans upon consumption of these eggs.

Key Words: Eggs, Fatty acids, Full fat oilseeds, Egg quality
observed for the other biometrical characteristics. It was concluded that chick quality and biometrical characteristics of chicks 1 d posthatch can be affected by broiler breeder nutrition.

Key Words: Broiler breeders, Minerals, Vitamins

P187 Improved growth performance and bone health with organic trace mineral supplementation in broilers. J. Zhao1, R. B. Shirley1, C. A. Atwell1, J. D. Richards1, J. J. Dibner2, K. D. Christensen2, J. P. Allard2, C. D. Knight1, and A. F. Giesen1, 1Novus International Inc., St. Charles, MO, 2OK Foods, Inc., Fort Smith, AR.

Four grow-out houses each with 15,600 birds were used to investigate the impact of Mintrax® organic trace minerals (OTM) on growth performance, bone development and gastrointestinal health status in Ross 708 broilers. An inorganic trace mineral (ITM) program with 80 ppm Zn, 120 ppm Mn, and 8 ppm Cu from sulfates served as the control. OTM was added to the control ITM levels to provide an additional 40 ppm Zn and Mn and 20 ppm Cu in the starter feed. In grower and finisher diets OTM replaced 50% of the Zn, Mn and Cu to provide mineral levels comparable to the ITM control. Runtting and stunting syndrome (RSS) was diagnosed on day 7 in all houses, but by design was untreated. Histopathological examination of 14-d intestinal samples confirmed that RSS was present in both treatments. Birds receiving the OTM were heavier than Controls at each measurement throughout the study. Final 52 day body weight was 3.136 vs. 3.068 kg for the OTM and Controls, respectively (P=0.04). Feed efficiency and mortality were not significantly affected with 1.95% and 5.06% vs. 2.008 and 5.54% for the OTM and Control (P=0.25). The severity of foot pad lesions, and hence the percentage of damaged foot pads, was reduced in the OTM group versus the Control group (3.0% vs. 5.5%, P =0.04). Comparing healthy and unhealthy 14-day-old birds, RSS reduced femur weight, femur hydroxyproline content and tibia breaking strength (P<0.05); however, there was no difference in these criteria between the two treatments. Birds fed OTM had higher femur deoxypyridinoline crosslink concentration with 41.12 and 25.07 nmol/L for the unhealthy 14 day-old birds, RSS reduced femur weight, femur hydroxyproline and hence the percentage of damaged foot pads, was reduced in the OTM group and 5.54% for the OTM and Control (P>0.25). The severity of foot pad lesions, vs. 3.068 kg for the OTM and Controls, respectively (P=0.04). Feed efficiency at each measurement throughout the study. Final 52 day body weight was 3.136 kg for the OTM and 3.068 kg for the Control.

Key Words: Runtting-stunting syndrome

P188 Available calcium: Phosphorus ratio and phytase levels for egg-brown laying hens in first and second egg-production cycle. J. H. V. Da Silva1*, J. A. De Araújo1, C. de C. Goulart1, F. G. P. Costa1, and N. K. Sakomura2, 1Universidade Federal da Paraíba, Bananeiras, Paraíba, Brazil, 2Universidade Estadual de São Paulo, Jaboticabal, São Paulo, Brazil.

Two experiments (E1 and E2) were carried out to investigate available calcium (Ca):phosphorus (aP) ratio and phytase level (phytase units - PU) in first and second egg-production cycle of egg-brown laying hens. In E1, 128 laying hens housed in the first cycle, and in E2, 240 birds were used for the second cycle. E1 was performed in a factorial design 3x2+1 [three ratios: 14.1 (4.2% Ca:0.30% aP); 12:1 (3.5% Ca:0.30% aP); and 9.1 (3.5% Ca:0.38% aP) x 0 and 600 PU + control ratio: 11:1 (4.2% Ca:0.38% aP)]. E2 was performed in a factorial design 2x2x2 (3.5 and 4.2% Ca x 0.30 and 0.30% aP x 0 and 600 PU). In E1, for treatments without phytase, the highest egg weight (EW) was found with 9.1 ratio (3.5% Ca:0.38% aP) and the lowest with 12:1 ratio (3.5% Ca:0.30% aP). In E2, the lowest was 12:1 ratio (3.5% Ca:0.30% aP) and the worst, with 9:1 ratio (3.5% Ca:0.38% aP). In E2, increase in Ca levels (from 3.5 to 4.2%), aP (from 0.30 to 0.38%) and PU (from 0 to 600) decrease feed consumption. FEMR and feed:egg ratio (FEDR) improved, respectively, with the increase on aP and PU; shell-specific gravity improved with the increase on Ca in the diet. Based on results from first egg-production cycle (E1), recommend the 14:1 ratio (4.2% Ca:0.30% aP) without PU and 12:1 ratio (3.5% Ca:0.30% aP) with 600 PU. During the second cycle (E2), recommend 4.2% Ca and 0.38% aP. Supplementation of deficient diets in aP with 600 PU improves EW during the second egg-production cycle.

Key Words: Additive, Brown-egg hens, Egg-production, Enzyme, Phytate

P189 Available phosphorus levels and phytase in diets of brown-egg laying hens. J. H. V. Da Silva1*, J. A. De Araújo1, C. de C. Goulart1, F. G. P. Costa1, N. K. Sakomura2, and M. L. G. Ribeiro1, 1Universidade Federal da Paraíba, Bananeiras, Paraíba, Brazil, 2Universidade Estadual de São Paulo, Jaboticabal, São Paulo, Brazil.

Two experiments were carried out to evaluate available phosphorus (aP) requirement and phytase effect on brown-egg laying hens. In experiments 1 (E1) and 2 (E2) 240 and 288 birds, 40 and 44 week-old, were used, respectively, distributed in a completely randomized design. In E1, a factorial design 5x2 (0.094; 0.194; 0.294; 0.394 and 0.494% aP x 0 and 300 phytase units â” PU) was used. In E2, a factorial design 3x4 (0.094; 0.294 and 0.494% aP x 0; 300; 600 and 1200 PU). Data collection was performed after six periods of 28 days each. In E1, there was no interaction between aP and PU levels. aP influenced in a quadratic fashion egg production (EP), egg mass (EM), plasmatic phosphorus (pP) and feed:egg mass ratio (FEMR) with the requirements estimated, respectively, in 0.29; 0.29; 0.49 and 0.31% aP. aP levels also stimulated linearly tibia ashes amounts (TA) and bone resistance (BR). Phytase addition elevated pP (from 4.034 to 4.784 mg/L) to reduce TA (from 4.151 to 42.90%) and BR (from 9.678 to 11.35 kgf·mm-1). In E2, EP and TA increased linearly following the increase in aP on diet. Phytase addition up to 1200 PU increased linearly aP, while TA presented a quadratic effect, with max level estimated with 567 PU on diet. There was interaction between aP and PU for EM, FEMR, feed:egg ratio (FEDR) and BR. BR increased linearly when basal diet was supply with 1200 PU max, and in the phytase-free diet, when aP levels were elevated up to 0.494%. In diets using 600 PU, the increase of aP improved linearly EM, FEMR and FEDR. Results suggest levels of 0.31% or 332mg of aP in diets without phytase for laying hens. Laying hens fed on diet with low aP improve their egg production by adding up to 1200 PU.

Key Words: Additive, Bone resistance, Egg production, Enzyme, Phytate


Two experiments were carried out aiming to determine sodium and chloride requirements for laying Japanese quails, based on birdsâ€™ performance evaluation. In each experiment, 120 quails 65 day-old were used, distributed in a completely randomized design, with four treatments, six replicates of six birds each. A basal diet was formulated for both experiments, with the proper nutritional levels for laying quails, except for Na and Cl. For the first experiment, basal diet was supplemented with sodium bicarbonate in order to provide the levels of 0.05, 0.15, 0.25 and 0.35% of Na. It was also added to every diet 0.25% of ammonium chloride to reach the level of 0.23% of Cl. For the second experiment, basal diet was supplemented with ammonium chloride, to provide the levels of 0.08; 0.18; 0.28 and 0.38% of Cl. additionally, it was included to the diets 0.259% of sodium bicarbonate to provide 0.20% of Na. There was a quadratic effect of Na levels on egg production, feed consumption, egg mass and feed:egg mass ratio, with the estimated requirements of 0.27; 0.22; 0.24 and 0.23% of Na respectively, whilst specific gravity decreased linearly as Na levels increased. As for Cl levels, there was a quadratic effect on egg production, feed:egg mass ratio and specific gravity. Estimated requirements for these parameters were 0.25; 0.26 and 0.21% of Cl respectively. No significant effects were found on remaining parameters. It is recommended, therefore, based on productive performance, 0.23% of sodium and 0.24% of chloride in diets for laying quails.

Key Words: Coturnix coturnix, Egg-production, Minerals, Requirements, Egg-shell quality

Amino acids methionine (Met) and cystine (Cys) are used by poultry in elevated amounts during body growth and frequently are the first limiting in diets for broiler chickens. According to Rostagno et al. (2005), the recommendation of digestible Met+Cys for broilers during pre-initial phase is of 0.944%, and its digestible lysine (Lys) ratio is 71%. The aim of this research was to estimate the requirements of digestible Met+Cys for male broiler chickens during pre-initial phase (1 to 7 days). The assay was performed at the Poultry Experimental Facilities of Animal Science Department of UFPB, in Areia, PB, Brazil, using 900 male broiler chicks Cobb, with initial weight of 44.9±0.6g, distributed in a completely randomized design, with six treatments and six replicates of 25 birds each. Treatments consisted in a basal diet, formulated according to Rostagno et al. (2005) recommendations, supplemented with DL-methionine in order to reach six levels of digestible met+cys (0.734; 0.794; 0.854; 0.914; 0.974 and 1.034%). Digestible Lys level used was previously determined (1.234%). The evaluated parameters were: feed consumption (FC), weight gain (WG) and feed:gain ratio (FGR). Results were submitted to variance analysis and polynomial regression using the computational program SAS. No significant effects were observed on FC and FGR, with mean values of 146.9 ± 140.2 g/bird-1, respectively. However, WG showed a quadratic effect, with the greatest WG at the level of 0.873% for FC and FGR, with mean values of 146.9 and 140.2 g/bird-1, respectively. However, WG showed a quadratic effect, with the greatest WG at the level of 0.873% for FGR. Using this level, digestible Met+Cys:Lys ratio was 71%, the same ratio estimated by Rostagno et al. (2005). It is recommended 0.873% of digestible Met+Cys for male broiler chickens during pre-initial phase.

Key Words: Aviculture, Ideal protein, Performance, Requirement, Sulfur amino acids

P192 The impact of phytase source, wheat middlings, and citric acid on broiler growth performance during the grower phase. T. O’Connor-Dennie*, V. Brewer, and J. L. Emmert, University of Arkansas, Fayetteville.

Emerging research shows that the inclusion of microbial phytase, in conjunction with citric acid (CA) may improve the nutritive value of wheat by-products; this coupled with the increase in ethanol production has made wheat by-products viable carbohydrate sources that can be supplemented to a corn-soybean meal diet. In the present experiment the effect of phytase source (E. coli, EP; or fungal, FP), wheat middlings (WM), and CA, were investigated during the grower phase of male broilers. Broilers were fed a P-adequate diet from d 0 to 20; on d 20 birds were weighed and allotted to 13 treatments with five replicates containing 20 male chicks. Treatments were: 1 to 4) corn-soybean diet (0.8% Ca and 0.13 % nPP) supplemented with 0, 0.04, 0.08, or 0.12% inorganic P (iP); 5 to 6) diet with 500 FTU/kg phytase (EP or FP); 7 and 8) diets 5 and 6 with 3% CA; 9) corn-soybean diet with 10% WM (0.8% Ca and 0.13 % nPP); 10 to 13) diet 9 with 500 FTU/kg phytase (EP or FP), and 3% CA, alone or in combination. At the termination of the grower phase daily gain (g/c), daily feed intake (g/c), feed efficiency, and feed conversion were calculated. Increasing iP and EP increased gain and feed intake (P < 0.05), whereas the inclusion of the FP had no effect on growth performance (P < 0.05). Broilers fed EP diets had better gain and feed efficiency compared to broilers fed FP diets (P < 0.05). Increasing the level of CA increase feed efficiency, while growth performance was not affected by WM (P < 0.05), combining the EP with WM or WM and CA increased gain and feed efficiency in broilers compared those fed diets 1 to 4, and diet 9 and 11 (P < 0.05). In conclusion, EP was more efficacious than FP and the inclusion of WM had no deleterious effects on growth performance.

Key Words: Phytase, Citric acid, Wheat middlings, Phosphorus


With the genetic advances of broiler chicken strains, amino acids nutritional requirements available in the NRC (1994) seem to be under estimated and Brazielian Tables of Nutritional Requirements (Rostagno et al., 2005) are currently used on poultry diets formulation in Brazil. In Rostagno et al. (2005) one can find the recommendation of 0.814% of digestible methionine+cystine (Met+Cys) during the initial phase and the digestible lysine (Lys) ratio is 71%. This research aimed to estimate digestible met+cys requirements for male broiler chickens during initial phase (8 to 21 days) considering its digestible lysine ratio. The assay was performed at the Poultry Experimental Facilities of Animal Science Department of UFPB, in Areia, PB, Brazil, using 720 male broiler chicks Cobb, with initial weight of 196.1±2.5g, distributed in a completely randomized design, with six treatments and six replicates of 20 birds each. Treatments consisted in a basal diet, formulated according to Rostagno et al. (2005) recommendations, supplemented with DL-methionine in order to reach six levels of digestible Met+Cys (0.604; 0.664; 0.724; 0.784; 0.844 and 0.904%). Digestible Lys level used was previously determined (1.084%). The evaluated variables were: feed consumption (FC), weight gain (WG) and feed:gain ratio (FGR). Results were submitted to variance analysis and polynomial regression using the computational program SAS. A linear effect was verified of digestible Met+Cys levels, and at each 0.06% a reduction of 19.1g on FC was estimated. WG and FGR presented a quadratic effect, with the highest WG (770.5g/bird) and the best FGR (1.402) estimated for the digestible met+cys levels of 0.706 and 0.755%, respectively, through the equations Y=−465.2 +3478.3x -2447.7x 2(r2=0.97) and Y=3.6582-5-0.775x+3.9571x²(r²=0.99). Considering the levels that provided the best FGR, digestible Lys ratio was 70%. Therefore, it is recommended for male broiler chickens 0.755% of digestible Met+Cys during the initial phase.

Key Words: Amino acids, Aviculture, Ideal protein, Performance, Requirement


Methionine (Met), lysine (Lys) and threonine (Thr) are the three first limiting amino acids on poultry diets. There is a wide range of information on Met and Lys requirement for broiler chickens, but Thr is less explored. According to NRC (1994), total Thr requirement for broiler chickens during initial phase is 0.800% of digestible Thr, while Rostagno et al. (2005) recommend 0.865% for pre-initial phase. The aim of this research was to estimate the requirements of digestible Thr for male broiler chickens during pre-initial phase (1 to 7 days). The assay was performed at the Poultry Experimental Facilities of Animal Science Department of UFPB, in Areia, PB, Brazil, using 720 male broiler chicks Cobb, with initial weight of 49.7 ± 0.6g, distributed in a completely randomized design, with six treatments and six replicates of 20 birds each. Treatments consisted in a basal diet, formulated according to Rostagno et al. (2005) recommendations, supplemented with L-threonine order to reach six levels of digestible Thr (0.655; 0.715; 0.775; 0.835; 0.895 and 0.955%). Digestible Lys and Met+Cys level estimated for the digestible met+cys levels of 0.706 and 0.755%, respectively, through the equations Y=−465.2 +3478.3x -2447.7x 2(r2=0.97) and Y=3.6582-5-0.775x+3.9571x²(r²=0.99). Considering the levels that provided the best FGR, digestible Lys ratio was 70%. Therefore, it is recommended for male broiler chickens 0.755% of digestible Met+Cys during the initial phase.

Key Words: Amino acids, Aviculture, Ideal protein, Performance, Requirement


Recently, a new phytase (Quantum™ Phytase; QP) has been selected and evolved using molecular techniques to reach a desired thermo-tolerance range through the feed processing system without the use of coating while maintaining high
enzymatic activity at the animals optimal body temperature. There are several factors within the conditioning and pelleting process of animal feed manufacturing that can negatively impact enzyme stability and these differences are present across different feed mill locations. It is also critical to have a robust and reliable technique to measure phytase activity in the feed to determine levels and potential limits in temperature tolerance. Thus the objective of the current research was to evaluate the thermo-tolerance range of QP using a new modified assay to accurately determine QP activity in complete feed. Several studies were conducted at different feed mill locations using the same range of pellet temperatures. The phytase was included in feed at commercial levels (200g/mt, equivalent to 500FTU/kg) and pelleted at temperatures ranging from 80-92° C at the pellet die. The feeds were assayed for phytase activity using a new procedure for the optimal reaction conditions for QP. The use of this optimal reaction conditions improved the sensitivity (signal-to-noise) of the phytase activity measurement compared to standard assay conditions. Results demonstrate that the non-coated thermo-tolerant QP can survive the rigors of normal feed pelleting conditions; however variation between manufacturing locations were observed. The optimized assay method provides a reliable extraction and assay procedure for phytase activity in pelleted and mash animal feed, and can be used with confidence for quality control of feed supplemented with QP.

Key Words: Phytase, Thermo-tolerant, Assay, Pelleting