

**1339 Effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather: I. Response under temperature-controlled in summer season.** G. Contreras\*<sup>1</sup> and R. Barajas<sup>1</sup>, <sup>1</sup>Universidad Autonoma de Sinaloa.

To determine the effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather under temperature-controlled in summer season, a completely randomized design experiment was conducted. Thousand two hundred eighty Japanese quail (960 females and 320 males), they were divided in 160 groups of eight (six females and two males), and were allocated in wire cages (25 x 30 cm); groups of four cages (32 quails) formed an observation. The avian were randomized assigned to consume diets (21% CP; 2.9 Mcal DE/kg), in that consist the treatments, containing one of four levels (0, 100, 200 and 400 ppb) of supplemental chromium from chromium-methionine (Microplex<sup>TM</sup>Zinpro, CO.MN). Chromium 100 ppb increased ( $P < 0.05$ )

the average daily feed intake with relation of the remainder treatments (36.9 vs 36.3 g/day). The hatching was not affect ( $P > 0.20$ ) by treatments (mean value = 78%); egg hatching was similar ( $P > 0.20$ ) across treatments (66%). Supplementation with level of 100 ppb of Cr increased ( $P > 0.05$ ) in 19% the number of newly born quails by day (81 vs 68), and hatchability in 22% (55 vs 67.5%) with respect to control (Cr 0 ppb). Levels of 200 and 400 ppb tended ( $P = 0.11$ ) to decrease in 18% the number of newly born quails by day (68 vs 56) respect to control. Chromium 200 and 400 ppb had similar ( $P > 0.20$ ) hatchability than control (55 vs 46%). It is concluded, that 100 ppb of supplemental Cr from Cr-Met, improve hatchability and newly born quails by day of Japanese quail in dry tropic weather under temperature-controlled in summer season.

**Key Words:** Japanese quail, Chromium, Hatchability

## PSA Nutrition: Amino Acids, Feed Ingredients, and Feed Processing

**1340 Digestible lysine levels in the diets of broilers from 1 to 21 days of age.** L. F. Araujo\*<sup>1</sup>, O. M. Junqueira<sup>1</sup>, C. S. S. Araujo<sup>1</sup>, and S. M. Baraldi Artoni<sup>1</sup>, <sup>1</sup>Universidade Estadual Paulista - UNESP/Jaboticabal - SP - Brazil.

The purpose of this experiment was to evaluate different levels of digestible lysine on performance of chickens from 1 to 21 days of age. A total of 1000 one day-old chicks was fed diets with 5 levels of digestible lysine (1.18%; 1.30%; 1.42%, 1.54% and 1.66%) in four replications of 50 birds each. The same ideal relationship of Lis:Met+Cis:Met:Thr (100:71:39:63) was maintained in all diets. The basal diet was formulated according to the recommendations of Rostagno et al. (2000) with 3,100 kcal ME/kg and 22% crude protein. At 21 days of age, the best results were observed in broilers fed the diet containing 1.18% digestible lysine. As the level of digestible lysine increased in the diet, there was a reduction in feed intake, affecting weight gain. So that, the 1.66% level of digestible lysine produced lower weight gain and poorest feed conversion. From the results obtained in this experiment, it is possible to conclude that 1.18% digestible lysine is enough to maintain the requirements of broilers from 1 to 21 days of age. Financial Support: FAPESP. Proc. 98/06355-3

**Key Words:** Broilers, Lysine, Performance

**1341 Dietary crude protein levels needed for broilers from three to six weeks of age as influenced by gender.** Q. Jiang\*, C. A. Fritts, and P. W. Waldroup, *University of Arkansas.*

Development of crystalline amino acids have allowed for a reduction in overall crude protein content in broiler diets. However at some point performance declines even though all nutrient recommendations are provided. The objective of this study was to determine the minimum level of CP that might be needed by broilers from three to six weeks of age. Because some studies have suggested that males and females may differ in their response to CP or amino acids, separate sex feeding of diets with different levels of crude protein was examined. Diets were formulated using corn and soybean meal of known composition to provide diets with 15 to 20% CP in increments of 1%. Crystalline amino acids were used to provide at least 100% of NRC (1994) recommendations. Dietary electrolyte balance was maintained at a minimum of 200 meq/kg. From one to 21 d of age chicks were fed 24% CP and then placed on test diets from 21 to 42 d. Body weight gain and feed conversion were determined and samples of birds processed at 42 d. Four pens of 25 males and four pens of 25 females were fed each CP level. Although males differed significantly from females in BW gain or feed conversion there were no significant interactions of gender and CP level. Diets with 17% supported BW and FCR that did not differ from that of birds fed diets with higher levels; lower CP levels resulted in a significant reduction in performance. Females had a higher percentage of breast meat and greater amounts of abdominal fat than males but there were no interactions between dietary CP and gender for any parts yield. A CP level of 17% supported breast yield equal to that of higher levels.

**Key Words:** Crude protein, Gender, Carcass yield

**1342 mRNA that encode for proteins capable of transporting L-methionine and/or dl-2-hydroxy-4-(methylthio) butanoic acid are present in the intestinal epithelium of broilers.** Y-X. Pan\*<sup>1</sup>, E. A. Wong<sup>1</sup>, J. J. Dibern<sup>2</sup>, and K. E. Webb, Jr. <sup>1</sup>, <sup>1</sup>Virginia Tech, Blacksburg, VA, <sup>2</sup>Novus International, Inc., St. Charles, MO.

The presence of mRNA that encode for proteins capable of transporting L-methionine (L-Met) and/or dl-2-hydroxy-4-(methylthio) butanoic acid (HMB) in broiler intestinal epithelium was examined. Total RNA was extracted from duodenal, jejunal, and ileal epithelium collected from male broilers (42 d old, BW 2.03 kg). Poly(A)<sup>+</sup> RNA was isolated and size-fractionated by sucrose-gradient centrifugation when needed. Healthy oocytes at stage V-VI were collected from *Xenopus laevis* and then microinjected with either water, poly(A)<sup>+</sup> RNA, or size-fractionated poly(A)<sup>+</sup> RNA. The ability of the injected oocytes to uptake either L-Met or HMB was examined by incubating oocytes with [<sup>3</sup>H]-L-Met or [<sup>14</sup>C]-HMB 3-6 d post-injection. A greater uptake of L-Met ( $P < 0.001$ ) and HMB ( $P < 0.05$ ) by oocytes injected with poly(A)<sup>+</sup> RNA from all three segments of the small intestine was observed compared with water-injected oocytes. The greatest ( $P < 0.05$ ) uptake occurred when poly(A)<sup>+</sup> RNA from the jejunum or ileum were injected. Injections from four different pools of sucrose gradient-fractionated poly(A)<sup>+</sup> RNA from all three intestinal segments induced more ( $P < 0.01$ ) L-Met uptake than did water injection. There were three, four, and four different pools of sucrose gradient-fractionated poly(A)<sup>+</sup> RNA from the duodenum, jejunum, and ileum, respectively, that induced more ( $P < 0.05$ ) HMB uptake than did water. Uptake of HMB was greater at pH 5.5 than at pH 7.5 and was independent of Na<sup>+</sup>. Uptake of L-Met induced by all four poly(A)<sup>+</sup> RNA pools decreased dramatically when Na<sup>+</sup> was removed from the uptake buffer, which indicated that the majority of L-Met uptake was Na<sup>+</sup>-dependent. These results indicate that there are multiple mRNA that encode for proteins capable of mediated transport of L-Met and/or HMB present in broiler intestinal epithelium.

**Key Words:** *Xenopus*, Chicken, Absorption

**1343 Effects of amino acids and calcium levels on radiographic density and calcium excretion in broilers from 1 to 21 days of age.** C. S. S. Araujo\*<sup>1</sup>, S. M. Baraldi-Artoni<sup>1</sup>, L. F. Araujo<sup>1</sup>, M. J. Q. Lousada<sup>2</sup>, and O. M. Junqueira<sup>1</sup>, <sup>1</sup>Universidade Estadual Paulista - UNESP/Jaboticabal - SP - Brasil, <sup>2</sup>Universidade Estadual Paulista - UNESP/Araatuba - SP - Brasil.

An experiment was conducted in broilers to determine the effects of amino acids (AA) and calcium (Ca) levels on bone development and calcium excretion from 1 to 21 days of age. A total of 540 one-day old Avian Farms male chicks were randomly assigned to 6 treatments in a 3x2 factorial arrangement, considering the factors AA levels (100, 125 and 150% NRC, 1994) and Ca levels (75 and 100% NRC, 1994), in three replications and 30 birds each. The AA analyzed were methionine, lysine and threonine. Diets and water were available free choice. Experimental diets were comprised primarily of corn and soybean meal and were formulated to be isocaloric and isoproteic. Requirement levels for AA were accomplished when necessary by adding crystalline AA. Bone development was determined through radiographic density and tibia variables (tibia weight, tibia length, compact bone thickness and spongy bone

thickness). Total fecal output was collected for 72 h from days 19 to 21 to determine the treatment effect on Ca excretion. Percentage Ca excretion was calculated as grams of Ca in feces divided by grams of Ca consumed in the 72-h period. At 21 days, two broilers from each pen were slaughtered and the left tibia of the birds were collected and analyzed according to radiographic density (mm Aluminium equivalent). There were interactions in the trial between AA level and Ca level for radiographic density ( $P < 0.05$ ). However, the results showed that AA or Ca levels did not affect tibia variables and Ca excretion. Acknowledgements: FAPESP for financial and technical support .

**Key Words:** Amino Acids, Calcium , Broilers

**1344 Effects of amino acids and calcium levels on radiographic density and calcium excretion in broilers from 22 to 42 days of age.** C. S. S. Araujo\*<sup>1</sup>, S. M. Baraldi-Artioni<sup>1</sup>, L. F. Araujo<sup>1</sup>, M. J. Q. Louzada<sup>2</sup>, and O. M. Junqueira<sup>1</sup>, <sup>1</sup>Universidade Estadual Paulista - UNESP/Jaboticabal, SP - Brazil, <sup>2</sup>Universidade Estadual Paulista - UNESP/Araatuba, SP - Brazil.

The purpose of this experiment was to evaluate different levels of amino acids (AA) and calcium (Ca) on radiographic density (mm Aluminium equivalent), tibia variables (tibia weight, tibia length, compact bone thickness and spongy bone thickness) and Ca excretion from 22 to 42 days of age. A total of 540 one-day old Avian Farms male chicks were randomly assigned to 6 treatments in a 3x2 factorial arrangement, considering the factors AA levels (100, 125 and 150% NRC, 1994) and Ca levels (75 and 100% NRC, 1994), in three replications and 30 birds each. The AA analyzed were methionine, lysine and threonine. Diets and water were available free choice. Experimental diets were comprised primarily of corn and soybean meal and were formulated to be isocaloric and isoproteic. Requirement levels for AA were accomplished when necessary by adding crystalline AA. Total fecal output was collected for 72 h from days 40 to 42 to determine the treatment effect on Ca excretion. Percentage Ca excretion was calculated as grams of Ca in feces divided by grams of Ca consumed in the 72-h period. At 42 days, two broilers from each pen were slaughtered and the tibia left of the birds were collected and analyzed according to radiographic density (mm Aluminium equivalent). The AA or Ca levels unaffected radiographic density, tibia variables and Ca excretion. There were found interactions between the two factors. Acknowledgements: FAPESP for financial and technical support .

**Key Words:** Amino Acids, Calcium, Broilers

**1345 Effects of amino acids and calcium levels on radiographic density and calcium excretion in broilers from 43 to 49 days of age.** S. M. Baraldi-Artioni<sup>1</sup>, C. S. S. Araujo\*<sup>1</sup>, L. F. Araujo<sup>1</sup>, O. M. Junqueira<sup>1</sup>, M. J. Q. Louzada<sup>2</sup>, and N. K. Sakomura<sup>1</sup>, <sup>1</sup>Universidade Estadual Paulista - UNESP/Jaboticabal, SP - Brazil, <sup>2</sup>Universidade Estadual Paulista - UNESP/Araatuba, SP - Brazil.

Male broiler Avian Farms (n=540) were used from 43 to 49 days of age were subjected to a 3x2 factorial design consisting of three levels of dietary amino acids (100,125 and 150% NRC, 1994) and two levels of dietary calcium (75 and 100% NRC, 1994) with a total of 6 treatments replicated three times per treatment. Radiographic density (mm Aluminium equivalent), tibia variables (tibia weight, tibia length, compact bone thickness and spongy bone thickness) and Ca excretion were evaluate. The AA analyzed were methionine, lysine and threonine. Diets and water were available free choice. Experimental diets were comprised primarily of corn and soybean meal and were formulated to be isocaloric and isoproteic. Requirement levels for AA were accomplished when necessary by adding crystalline AA. Total fecal output was collected for 72 h from days 47 to 49 to determine the treatment effect on Ca excretion. Percentage Ca excretion was calculated as grams of Ca in feces divided by grams of Ca consumed in the 72-h period. At 49 days, two broilers from each pen were slaughtered and the tibia left of the birds were collected and analyzed according to radiographic density (mm Aluminium equivalent). The AA or Ca levels unaffected radiographic density, tibia variables and Ca excretion. There were found interactions between the two factors. Acknowledgements: FAPESP for financial and technical support.

**Key Words:** Amino Acids, Broilers, Calcium

**1346 Effect of diets containing cashew nut meal and an enzyme complex on broiler performance.** M.F.F. Fuentes\*<sup>1</sup>, S.F. Militao<sup>1</sup>, E.R. Freitas<sup>1</sup>, and G.B. Espndola<sup>1</sup>, <sup>1</sup>Universidade Federal do Cear, Fortaleza, CE, Brasil.

An experiment was conducted to evaluate the effect of diets containing different levels of cashew nut meal (CNM) supplemented or not with an enzyme complex (Avizyme<sup>®</sup>) on broiler performance. One hundred and forty four day-old broiler chicks were allotted in individual cages during a period of 42 days. Birds were distributed in a randomized complete block design with six treatments and six replicates of four birds in each experimental unit. A factorial arrangement 3 x 2 (CNM x Enzyme) was applied. Diets used during the initial (1 to 21 days) and final (22 to 42 days) periods were isoproteic and isocaloric and contained 22% crude protein with 3,000 kcal ME/ kg and 20% crude protein with 3,100 kcal ME/ kg, respectively. Treatments were: T1 = 0% CNM; T2 = 0% CNM + 0.1% enzyme; T3 = 7.5% CNM; T4 = 7.5% CNM + 0.1% enzyme; T5 = 15% CNM; T6 = 15% CNM + 0.1% enzyme. Data were analyzed for the whole period (42 days). Results showed that the inclusion levels of CNM and the enzyme supplementation did not significantly ( $P > 0.05$ ) affect body weight gain or feed intake. CNM levels, however, significantly ( $P < 0.05$ ) affected feed conversion. Birds fed the diet containing 15% of CNM had better feed conversion than those fed the 0% and 7.5% CNM diets. Abdominal fat level in birds fed the diet with 7.5% of CNM was significantly ( $P < 0.05$ ) lower than that from birds fed 15% CNM diet. Enzyme addition, however, did not affect this variable. It is concluded that bird performance was influenced by the level of CNM but not by the addition of enzyme to the diet.

**Key Words:** Cashew Nut Meal, Enzymes, Feed Conversion

**1347 Dehydrated poultry meal as a replacement for soybean meal in broiler diets.** J.B. Hess\*<sup>1</sup>, J.P. Blake<sup>1</sup>, R.A. Norton<sup>1</sup>, K.M. Downs<sup>2</sup>, A. Kalinowski<sup>1</sup>, and A. Corzo<sup>1</sup>, <sup>1</sup>Poultry Science Department, Auburn University, Auburn, AL, <sup>2</sup>Middle Tennessee State Univ., Murfreesboro, TN.

An experiment was conducted to evaluate broiler live performance in birds fed varying levels of a locally-produced dehydrated poultry meal (DPM) in place of soybean meal (SBOM). This product was produced commercially from farm-frozen broiler mortalities. Six replicates of five dietary treatments were assigned to Petersime battery units at 10 birds/cage. Broilers were raised to 42d on a two-feed program. Starter diets (0-21d) had DPM levels added to reduce SBOM levels from 36% to 27, 18, 9 and 0% of the diet. Grower feeds (21-42d) had DPM added to reduce SBOM to 24, 18, 12, 6 or 0% of the diet. Live production performance was evaluated at 21 and 42 days of age. No differences were detected in body weight across treatment groups, although birds fed DPM in total replacement of SBOM showed numerically reduced body weights of 49g at 21d and 89g at 42d. Similar non-significant trends were seen in feed intake, with no relationship to diet noted in 21d (1.35) or 42d (1.73) feed conversion efficiency. No differences were recorded between treatments for mortality. Use of this product in broiler feeds did not increase mortality or unduly influence weight gain or feed conversion at levels that might be used in the field.

**Key Words:** Dehydrated Poultry Meal, Broilers, Farm Mortality Disposal

**1348 Biological evaluation of a phosphorus source prepared with a new process on broiler chicks.** H. Motallebi<sup>1</sup>, M. Masoumi Esfahani\*<sup>2</sup>, and A. Faghijnasirj<sup>3</sup>, <sup>1</sup>University of Mazandaran, <sup>2</sup>Telavang Co., <sup>3</sup>Deputy of Livestock Affairs.

This experiment was conducted to evaluate the quality of a phosphorous source produced from a phosphate rock. The phosphate rock obtained from Yard Asfordy mine in Iran and converted to dicalcium phosphate by using the direct process method. The process consisted of three main steps including: a) digestion, b) deflourination, and c) neutralization of the phosphorous rock. In a randomized design experiment the produced P was fed to a total of 450 day-old mixed sex broiler chicks up to 21 day of age. Meanwhile, a commercial dicalcium phosphate (DCP) was used as control and the performances of the 6 dietary treatments were compared among each of three replicates. Experimental diets contained adequate levels of all nutrients except for P. The basal control diet contained about .23 % available P and the same amount of Ca. The experimental diets were supplemented either with the standard source of DCP to provide P levels of 85, 90, 95, 100 % or with the new DCP at

two levels of 85 and 100 % of the recommended levels by NRC (1994). Calcium content of the diets was kept constant at about .9% during the experimental period. Biological value and relative biological value of P source and performance of broiler chicks was determined at 21-day age. Data reported here shows that the broilers performance was not significantly different ( $P>0.05$ ) among the two P sources tested. Likewise, the results of this experiment showed that the new P source was both desirable and more economical during the testing period. Although, reduction of P up to 15 % below the recommended NRC (1994) level had no significant effect on broiler performance ( $P<0.05$ ).

**Key Words:** Broiler, Phosphorous, Dicalcium Phosphate

**1349 Organ and body growth in full-fed and paired-fed chickens consuming raw and heated velvet beans (*Mucuna pruriens*).** L. B. Carew<sup>\*1</sup>, J. Weis<sup>1</sup>, A. G. Gernat<sup>2</sup>, F. A. Alster<sup>1</sup>, and E. I. Zakrzewska<sup>1</sup>, <sup>1</sup>University of Vermont, Burlington, VT/USA, <sup>2</sup>Escuela Agricola Panamericana, Tegucigalpa, Honduras.

The velvet bean plant (*Mucuna pruriens*) is used widely in tropical regions as a green manure cover crop. The beans harvested from this crop are used in both animal and human diets. We showed previously that feeding the raw, untreated beans to chickens causes changes in the growth of certain organs. The objective of this study was to determine if dry heating of the beans alters these effects. Triplicate groups of seven male broiler chicks were fed the control diet or diets containing 20% raw (RVB) or heated (HVB) velvet beans from 1-24 days of age in a completely randomized design. Beans were analyzed for nutrient content and substituted into a commercial-type broiler diet at the expense of corn and soybean oil meal. Essential amino acid content was almost identical among all diets. Groups of control chicks were pair-fed with chicks fed the velvet beans by using the same amount of control diet on a daily basis. Data were considered significant at  $p\leq 0.05$ . At 24 days, chicks were euthanized and heart, liver, pancreas, gizzard and proventriculus weighed. Lengths of small and large intestines and ceca were also measured. Feeding RVB but not HVB caused a reduction in body weight (-8%); feed intake was 9% less although not significant. Chicks fed RVB were smaller than pair-fed and free-fed controls. Weights of pancreas, gizzard and proventriculus relative to body weight were heavier as was cecal length in chicks fed RVB. However, their size was smaller in chicks fed HVB but larger than in full-fed controls. Pair feeding did not account for these differences. Small and large intestines were relatively longer in chicks fed RVB but not different from those fed HVB. Relative weights of liver, heart and thyroid were not significantly affected by feeding either RVB or HVB. We conclude that intake of RVB has marked effects on the growth of certain organs, and in some cases this is modified by heating the beans. This suggests that RVB contain a growth factor that is altered by heat. Heating may have reduced the weight of the pancreas due to destruction of the trypsin inhibitor present in RVB. Where heating of the beans was ineffective in altering organ growth, as with lengths of the small and large intestines, the effect may be due to the increased presence of fiber.

**Key Words:** Velvet bean, Intestinal length, Organ weight

**1350 Effect of moisture, polyamines, and iron concentration on the nutritional value of biosolids harvested from poultry processing effluent.** D.V. Maurice, S.F. Lightsey\*, Zulfan, D. Wicker, and J.E. Toler<sup>1</sup>, Department of Animal & Veterinary Sciences, <sup>1</sup>Department of Experimental Statistics, Clemson University, Clemson, SC 29634-0361.

Three experiments were conducted to determine the effect of moisture content, polyamines, and iron content of the protein fraction of biosolids (PFBS) on broiler performance and health. High moisture (30%) and low moisture (8%) PFBS were included in corn-soy diets at 0-10% and 0-5% respectively. Inclusion of high-moisture PFBS severely depressed growth, increased mortality, decreased plasma and hepatic vitamin E, and increased erythrocyte fragility and hepatic iron but treatment effects were not detected in bone ash, organ weights, and hepatic zinc and copper. The use of low-moisture PFBS in chick diets had no adverse effects and differences were not detected in tissue elemental profile and serum glycoprotein. The effect of polyamines was evaluated in a 2 x 2 factorial experiment with PFBS included at 0 and 5% and with and without a cocktail of polyamines (4.8, 49, 197, and 131 mg/kg of phenylethylamine, putrescine, cadaverine, and histamine respectively). Neither a diet x polyamine interaction nor treatment effect was detected

in growth, feed efficiency, organ weights, condition of the gastrointestinal tract, and inflammation. The response to iron was ascertained by inclusion of low-Fe (0.6%) and high-Fe (2.42%) PFBS at 0, 2 and 4% on a nutrient basis in practical corn-soy diets to market age. Birds fed diets with the low-Fe PFBS were slightly heavier and ate more feed ( $p<0.05$ ) than birds fed diets with high-Fe PFBS. Significant treatment effects were not detected in hepatic vitamin E, plasma ascorbic acid, abdominal fat, and organ weights. The results clearly indicated that moisture content is the major determinant of the nutritional value of heat-treated PFBS. Neither polyamines nor iron content of the PFBS induced adverse biochemical effects that impacted performance. The small advantage in favor of the low-Fe meal may be ascribed to its higher fat content.

**Key Words:** DAF Sludge, Biosolids, Chickens, Polyamines, Iron, Vitamin E

**1351 Utilization of spent hen meal in diets for laying hens.** C. A. Fritts\*, J. A. Kersey, and P. W. Waldroup, University of Arkansas.

Hens at the end of their laying cycle were processed at three conventional rendering facilities to produce a high-protein spent hen meal (SHM). Meals were analyzed for nutrient content and amino acid digestibility determined using cecectomized cockerels. Diets were formulated to digestible amino acid (DAA) requirements using 0, 5, 10, and 15% of each meal. The DAA requirements were set at a minimum of 95% of the total amino acid requirements for hens consuming 100 g/day (NRC, 1994). This resulted in a total of ten dietary treatments (0 control, 3 levels of SHM x 3 locations). Each diet was fed to six groups of 12 individually caged hens (Hyline W-36) for 84 d beginning at 26 wk of age. At the end of each 28 d period eggs were weighed and shell thickness determined. Hen-day egg production, feed consumption, and mortality were determined for each 28 d period. Compared to the group with 0% SHM, the inclusion of up to 15% SHM had no significant effect on daily feed intake, feed consumed per dozen eggs, Haugh units, or eggshell thickness. Rate of egg production and egg weight declined when SHM from one of the three sources increased above 5% of the diet. However, it was difficult to ascertain the reason for the reduced performance of hens fed this source of SHM. Results of the study indicate that SHM is an acceptable ingredient for use in layer feeds but more information is needed regarding potential factors that may inhibit production.

**Key Words:** Spent hens, High protein meal, Laying hens

**1352 Nutritive and economic values of High Oil Corn in laying hen diets.** D. J. Kim and B. D. Lee\*, Chungnam National University, Daejeon, South Korea.

A layer feeding trial was conducted in Korea for 15 wks to demonstrate the nutritive and economic values of high oil corn (HOC). A corn-soybean meal based commercial diet was chosen as the control diet. The yellow dent corn in the control diet was replaced with HOC to give an iso-caloric diet, or replaced with HOC on 1:1 basis to give a high energy diet. A total of 510 23-wk-old ISA Brown layers were allotted to the 3 dietary treatments with 5 replicates per treatment. In order to measure the ME values of typical corn and HOC, two metabolism trials were carried out with layers and adult roosters. The HOC used in this trial contained approximately 94% higher crude fat (6.60% as-fed basis) compared to typical corns. The GE, AMEN, and TME values of HOC are 5.7-7.7% higher than those of typical corns, indicating that the energy utilization of each corn were similar. HOC feeding, on an iso-calorie basis or on 1:1 replacement with typical corn, did not exert any effect on various laying performances, including the physical quality of egg. This reflects the quality of the commercial diet chosen as the control diet, which was already fairly good, such that the performance was already maximal. The polyunsaturated fatty acid content in yolk from hens fed HOC were higher than that from hens fed typical corn. If used alone replacing typical corn completely in a layer diet, the acceptance price of HOC was estimated to be 154 won/kg when the price of typical corn was 131 won/kg (118:100). When both corns were allowed to be used, the acceptance price of HOC increased up to 184 won/kg (140:100), indicating that a lot cheaper diet can be formulated when both HOC and typical corn are used in laying hen diet formulation.

**Key Words:** High Oil Corn, Laying Hen, Economic Value

**1353 Effect of treated ervil (*Vicia ervilia*) diets on the performance of laying hens.** M. T. Farran\*, W. S. Halaby, F. T. Sleiman, M. G. Uwayjan, and V. M. Ashkarian, *American University of Beirut, Beirut, Lebanon*.

Two experiments were conducted to study the effect of water and acetic acid (AA) soaked ervil seeds in layer diets on the performance and egg quality parameters. In one experiment, ground ervil seeds, soaked in water (10:1, vol/wt) at 40 C for 72 h with water change every 12 h, and in 1% AA at room temperature (RT) and at 40 C for 24 h, and dried at RT. Isocaloric and isonitrogenous diets containing 60% raw or treated ervil were fed to 100 individually caged SCWL Layers of similar age, body weight, and production rate for a period of 42 d. Birds fed the untreated ervil had the highest BW loss and least feed intake and egg production rate. All ervil diets resulted in a significantly lower feed intake, egg production, and BW and in higher feed conversion rate, compared to the control. Hens fed the treated ervil seed diets, produced eggs with significantly higher Haugh Unit score and poorer shell thickness compared to control. Yolk color scores of treated ervil diets except for RTAA were lower than those of the control. In another experiment, diets containing 0, 10, 20, and 30% ervil seeds soaked at 40 C in 1% AA, and 30% raw ervil seeds were fed to hens for 56 d. Performance and egg quality parameters of birds fed all levels of treated ervil seeds were comparable to those of the control. A level as high as 30% of acetic acid treated ervil seeds can be used in layer diets.

**Key Words:** *Vicia ervilia*, Acetic acid soaking, Laying hens

**1354 The effect of Eggshell 49<sup>TM</sup> and mussel shell on performance and eggshell quality of laying hens.** Ruedi Hadorn<sup>1</sup>, Hans Wiedmer<sup>1</sup>, and Peter Spring\*<sup>2</sup>, <sup>1</sup>*Swiss Poultry Husbandry School, Zollikofen, Switzerland*, <sup>2</sup>*Swiss College for Agriculture, Zollikofen, Switzerland*.

The aim of the present study was to evaluate the effect of Eggshell 49 and mussel shell on eggshell quality and performance of laying hens during the late phase of production. The trial was setup as a 2x2 factorial design with Eggshell 49 (0 and 1 kg/t) and mussel shell (no access and offered *ad libitum* during the afternoon) as experimental factors. The 20-week trial was conducted with 10 groups of White Lohmann Leghorn hens (176 hens per group). Hens were 49 weeks of age at the beginning of the trial. Hens were housed during their entire production cycle in floor pens. Each pen (23 m<sup>2</sup>) was equipped with a family nest box for egg laying. Feed (crumbles) and water were provided *ad libitum* in round feeders and on nipple drinkers, respectively. Birds received two different feeds (phase 1: 49-60 wks of age; 11.9 MJ UE, 18.0% CP, 3.75% Ca), phase 2: 61-68 wks of age; 11.6 MJ UE, 16.5% CP, 3.90% Ca) with nutrient contents meeting Swiss commercial diets. Egg production and mortality were determined daily. Egg classification was conducted once per laying period (28 d) while egg weight distribution was determined twice per laying period. In week 49, 58, and 66 thirty eggs per treatment were analyzed for specific weight, shell thickness and eggshell quality. Data were analyzed as a 2 x 2 factorial design with Eggshell 49 and mussel shell as experimental factors. Average egg production over the entire trial period was 86.1% and average daily feed intake was 136.0 g. Both egg production and feed intake were not affected by treatment. However, mortality over the entire trial period was significantly (P<0.05) reduced by the addition of Eggshell 49 (3.2 vs. 1.8%). Dietary supplementation with Eggshell 49 led to a change in egg size distribution. The percentage of regular size eggs (53-65g) was increased by 5%-points (38.6 vs. 43.6 %) and the proportion of large eggs (>65g) was decreased by 5 %-points (61.3 vs. 56.3 %) with Eggshell 49 supplementation (P<0.05). Eggshell quality and percentage of cracked eggs were not affected by treatment. In the present study *ad libitum* access to mussel shell had no effect on performance and eggshell quality in laying hens. However, Eggshell 49 changed egg size distribution and significantly reduced hen mortality.

**Key Words:** Eggshell 49, Mussel shell, Mortality

**1355 High oleic acid corn in turkey diets: carcass composition and parts yield of market tom turkeys.** T. Ergul\*<sup>1</sup>, P.B. Addis<sup>1</sup>, J. Brannon<sup>1</sup>, M.L. Endres<sup>2</sup>, and S.L. Noll<sup>1</sup>, <sup>1</sup>*University of Minnesota, St. Paul, MN/USA*, <sup>2</sup>*Mycogen Seeds, Inc., Eagan, MN/USA*.

Male market turkeys (Large White, Nicholas strain) were evaluated to determine the effect of feeding high oleic acid corn (HOAC) on carcass

composition and parts yield. Poults (450) were randomly assigned to 45 pens at day of age and fed one of five different dietary treatments (TRT) varying in source of corn to 20 wks of age. TRT 1 (Control) diets contained a conventional corn hybrid. TRTs 2, 3, 4 and 5 had 25, 50, 75 and 100% of the control corn replaced with HOAC, respectively. Diets were isocaloric and formulated based on NRC (1994) requirements. The experimental design was a randomized complete block design. Birds were weighed individually at 20 wks, and one turkey per pen (nearest the mean pen weight) was selected for carcass measurements. Live body weight, carcass weight (RTC without neck), parts yield weight and percentage of carcass parts (boneless and skinless breast, drums, thighs, wings, rack) were obtained. The carcass was ground once through a 3/4-inch diameter sieve and twice with a 3/16-inch diameter sieve. Homogenous samples were taken and freeze dried. Proximate analyses were conducted (DM, CP, gross energy, crude fat, ash). No significant differences were detected among the five TRTs for live weight, carcass weight and parts weight. Breast meat yield (% of carcass weight) was significantly affected by TRT (P < 0.05), with TRT 5 having a greater yield in comparison to other TRTs. Carcass composition test results indicated that percentage CP, fat, DM and amount of gross energy were not influenced by TRT. Inclusion of HOAC corn significantly (P < 0.05) lowered ash content of carcasses from turkeys fed TRTs 2 and 4 compared with Control. Inclusion of HOAC in place of normal corn in isocaloric and isonitrogenous diets produced equivalent carcass composition except for ash and carcass yield and also equivalent carcass yield except for breast meat in market tom turkeys.

**Key Words:** Turkey, Corn, Composition

**1356 Evaluation of chachafruto (*erythrina edulis*) foliage meal as a source of protein in laying diets for Japanese quails.** H Collazos\* and L.E. Davila, *Universidad Nacional Abierta y a Distancia, UNAD, Departamento de Zootecnia*.

Chachafruto is a legume native to the Interandean valleys from Venezuela to Bolivia. It is a multipurpose tree valuable in subsistence and sustainable agriculture. An 8 week trial was designed to determine the influence of chachafruto foliage meal and its influence to laying quail performance, egg yields, and egg shell quality. 128 8 week-old Japanese laying quails were allotted in a completely randomized design with four treatments (0, 10, 20, and 30% of chachafruto foliage meal), four replicates and 8 birds per replicate. Birds were reared in a quad/deck cage in an environmentally controlled house. Diets were formulated to meet or exceed NRC recommendations. Water and feed were provided *ad libitum*. Feed intake, egg weight, specific gravity, egg shell thickness, egg shell breaking strength and egg shell percentage were not affected by treatment (P>0.05). Egg production percentage and feed conversion (kg/dz) were affected by treatment (P<0.05). Haugh units were significantly improved (P<0.05) by the higher rate of supplementation.

**Key Words:** Chachafruto, Quail, Haugh Units

**1357 Cholecalciferol, 25-hydroxycholecalciferol and vitamin C for laying hens during the initial phase of the cycle of lay.** Douglas Faria\*<sup>1</sup>, Daniely Salvador<sup>1</sup>, Monica Mazalli<sup>1</sup>, Samir Correa<sup>1</sup>, and Diogo Ito, *Faculdade de Zootecnia e Engenharia de Alimentos, Pirassununga, SP, Brasil*.

An experiment was conducted to evaluate the influence of two sources of vitamin D (cholecalciferol and 25-hydroxycholecalciferol) at three levels of vitamin C (0, 100 and 200 ppm) on performance and internal and external egg quality characteristics. Total blood calcium and ionic calcium concentrations were determined. The basal level of cholecalciferol was 2,756 IU/kg corresponding to 5.51 g of Hy.D<sup>®</sup> per ton of feed, as the source of 25-hydroxycholecalciferol. Two hundred and eighty eight Isa Babcock B-300 commercial laying hens 23 weeks of age were used during the 12-week study. A 2 x 3 factorial arrangement with eight replicates of six hens each was utilized. Feed intake, egg production, egg weight and egg mass were not influenced by treatments. An interaction (P≤.01) was observed for improved feed conversion when vitamin C was not added and 25-hydroxycholecalciferol was fed. Haugh units and yolk index were not altered but interactions were verified for improved albumen percent (P≤.01) and yolk percent (P≤.05) with 200 ppm of vitamin C. Eggshell percent, total and ionic calcium were not modified by the factors studied. It was concluded that, for laying hens during the initial phase of the cycle of lay, feed conversion could be improved by

using 25-hydroxycholecalciferol and that the inclusion of vitamin C was not beneficial.

**Key Words:** Ascorbic acid, Cholecalciferol, 25-hydroxycholecalciferol

**1358 Effect of formulation density and feed moisture type additives on feed manufacturing and pellet quality.** J.S. Moritz\*, K.J. Wilson, K.R. Cramer, R.S. Beyer, L.J. McKinney, and W.B. Cavalcanti, *Kansas State University, Manhattan, KS.*

Moisture addition to corn soybean-based diets at the mixer has been shown to increase pellet durability, decrease pellet mill energy consumption and improve adjusted broiler performance. These results were directly related to moisture addition being the sole treatment difference. Moisture added at the mixer can result in a diluted nutrient profile for diets originally formulated to NRC specifications. Diets of diluted nutrient profiles are not economically practical for feeding poultry. The primary objective of the current study was to clarify the relationship between moisture addition and formulation density and how the two factors influence the feed manufacturing process. A secondary objective was to compare different types of moisture additives for potential use in broiler feeds. Treatments consisted of different moisture type additives (water/surfactant solution vs. water) and formulations of different nutrient densities (NRC density vs. adjusted -high density). Negative control treatments, which consisted of the two diets of different nutrient densities without moisture additives were also produced. Each of the six treatments were applied to four 1,000 lb (454 kg) replicate batches. Improved pellet quality, defined as increased pellet durability ( $P = 0.0001$ ) and decreased fines ( $P = 0.001$ ), was established for both NRC and adjusted -high density formulations when moisture additives of either type were applied. Adjusted -high density treatments that included moisture had slightly higher yet statistically similar pellet quality parameters compared to the NRC negative control treatment. Pellet mill production rates were increased for adjusted -high density treatments compared to NRC treatments, although differences were not statistically significant. These results conclude that adjusted -high density broiler diets may increase pellet mill production rates, and with the addition of moisture maintain similar pellet quality compared to NRC diets.

**Key Words:** Feed Manufacturing, Diet Density, Moisture

**1359 Influence of expander conditioning and feed form on broiler performance.** K. J. Wilson, K. R. Cramer\*, J. S. Moritz, W. B. Cavalcanti, and R. S. Beyer, *Kansas State University.*

The objective of the following two experiments was to evaluate the effects of expander conditioning and feed form on broiler performance in the starter phase. The treatments consisted of an unprocessed mash which served as a negative control, and 5 treatments conditioned at 180° F (82° C) but at different expander cone pressure levels. The expander cone pressure levels included 0, 100, 200, 300, and 400 lbs/in<sup>2</sup> (0, 7, 14, 21, 28 kg/cm<sup>2</sup>). The 6 treatments were used in both experiments. The expansion conditioning was performed using a Amandus Kahl model OE 15.2 annular gap expander and pellets were produced using a CPM pellet mill equipped with a 5/32-inch x 1 1/4-inch (4mm x 32mm) pellet die. The pellets were crumbled using a roll gap width of 2.2 mm. The chicks were housed in grower cages during both of the experiments. The diet was a standard NRC corn-soy starter ration. In experiment 1 all of the diets were reground and fed as a fine ground mash. This was performed to test for a potential nutritional effect due to the expansion process and to eliminate the confounding effect of feed form. The feed was reground using a Prater Pulverizer hammermill equipped with a 1/8-inch (3.18 mm) screen. The 6 treatments were fed to 10 replicate pens containing 10 chicks (day-old) in each pen. Broilers fed the unprocessed mash treatment had higher weight gain ( $P=0.0001$ ), feed intake ( $P=0.0227$ ), and improved feed efficiency ( $P=0.0499$ ) compared to all of the thermally processed diets. In experiment 2 the crumbles were screened using a Tyler number 12 sieve (1.41 mm openings) in order to remove the fines. The screened crumbles and mash control was fed to 7 replicate pens with 10 chicks (day-old) in each pen. Broiler weight gain increased linearly ( $P=0.0075$ ) and feed efficiency was improved ( $P=0.0001$ ) as the level of

expander cone pressure increased. Based on the results of these experiments changes in broiler performance appear to be due to the effect of feed form.

**Key Words:** Feed Form, Expander Conditioning, Crumbles

**1360 Effect of increasing level of fines in a crumbled starter diet on broiler performance.** K. J. Wilson\*, J. S. Moritz, K. R. Cramer, R. S. Beyer, and W. B. Cavalcanti, *Kansas State University.*

Fines are feed particulates, which do not remain in a bonded pellet or crumble form. There are a number of factors that can influence the amount of fines generated during and following the feed manufacturing process. In past research increasing levels of fines in pelleted diets has negatively influenced broiler performance. The majority of this research has been conducted during the grower and finisher phases when diets are fed in the pellet form. The objective of this experiment was to determine the level of fines at which broiler performance would be negatively influenced when fed a crumbled starter diet. Crumbles were manufactured from pellets of high durability. A conditioning temperature of 180° F (82° C) and expander cone pressure level of 200 lbs/in<sup>2</sup> (14 kg/cm<sup>2</sup>) was used for the pelleting process. The expansion conditioning was performed using a Amandus Kahl model OE 15.2 annular gap expander and pellets were produced using a CPM pellet mill equipped with a 5/32-inch x 1 1/4-inch (4mm x 32mm) pellet die. The pellets were crumbled using a roll gap width of 2.2 mm. The crumbles were then screened using a Tyler number 12 sieve that had openings of 1.41 mm. The fines were produced by grinding pellets through a Prater Pulverizer hammermill that was equipped with a 3/32-inch (2.38 mm) screen. The pellets used for the production of the crumbles and fines were from the same source. The fines were then mixed with the sifted crumbles in order to have 0, 25, 50, 75, and 100 percent fines inclusion. The fines and crumbles were combined together using a Hobart mixer with a mix time of 30 seconds and at the lowest speed setting. The 5 treatments were fed to 7 replicate pens containing 10 chicks (day-old) per pen. The chicks were housed in grower cages during this experiment. The diet was a standard NRC corn-soy starter ration. Broiler weight gain, feed intake, and feed efficiency were negatively influenced by increasing levels of fines (Linear,  $P=0.0001$ ). Based on the results of this experiment a level of fines exceeding 25 percent can negatively affect broiler performance in the starter phase.

**Key Words:** Crumbles, Fines, Broiler Starter Phase

**1361 Impact of increasing levels of expander cone pressure on feed manufacturing characteristics of a broiler starter ration.** K. J. Wilson\*, L. J. McKinney, K. R. Cramer, J. S. Moritz, W. B. Cavalcanti, R. S. Beyer, and K. C. Behnke, *Kansas State University.*

The objective of this experiment was to evaluate how increasing levels of expander cone pressure impacts the feed manufacturing characteristics of a broiler starter ration. The feed milling characteristics that served as the response criteria included pellet and crumble durability, pellet and crumble bulk density and specific electrical energy consumption for both the annular gap expander and pellet mill. This experiment was arranged as a randomized complete block design with treatment processing order as the blocking criterion. Five levels of expander cone pressure consisting of 0, 100, 200, 300, and 400 lbs/in<sup>2</sup> (0, 7, 14, 21, and 28 kg/cm<sup>2</sup>) were evaluated in this experiment. Each of the five treatments was replicated three times. A conditioning temperature of 180° F (82° C) was used for all treatments. The expansion conditioning was performed using an Amandus Kahl model OE 15.2 annular gap expander and pellets were produced using a CPM pellet mill equipped with a 5/32-inch x 1 1/4-inch (4mm x 32mm) pellet die. The pellets were crumbled using a roll gap width of 2.2 mm. The diet was a standard NRC corn-soy starter ration. Raising the expander cone pressure level improved both pellet ( $P=0.0001$ ) and crumble durability ( $P=0.0031$ ). Pellet ( $P=0.0150$ ) and crumble ( $P=0.0217$ ) bulk density improved as the level of expander cone pressure increased. There was a linear ( $P=0.0001$ ) increase in specific electrical energy consumption for the expander as cone pressure level increased. There was a linear ( $P=0.0001$ ) decrease in energy required to pellet the broiler ration as expander cone pressure level increased. Based on the results of this experiment the pellet and crumble durability can be improved by increasing the level of pressure applied to the feed via the annular gap expander. The crumble and pellet bulk densities can

also be improved by increasing the level of cone pressure. A reduction in the energy required to pellet feed was obtained by raising the expander cone pressure, however total electrical energy usage increased with each corresponding rise in cone pressure level. To economically justify using an expander the benefits must offset the higher capital and operational expenses.

**Key Words:** Crumble Durability, Expander Cone Pressure, Pellet Durability

**1362 Effect of crumble quality on broiler performance.** K. J. Wilson\*, R. S. Beyer, J. S. Moritz, K. R. Cramer, W. B. Cavalcanti, L. J. McKinney, and K. C. Behnke, *Kansas State University*.

In a previous feed manufacturing experiment crumble durability was improved by increasing the level of expander cone pressure. Crumble durability is one method used to define the physical quality of the crumbled feed. The objective of the following two experiments was to determine the effect of crumble quality on broiler performance. The diet used in these experiments was a standard NRC corn-soy starter ration. The treatments consisted of an unprocessed mash which served as a negative control, and 5 treatments conditioned at 180° F (82° C) but at different expander cone pressure levels. The 6 treatments were used in both experiments. The expander cone pressure levels included 0, 100, 200, 300, and 400 lbs/in<sup>2</sup> (0, 7, 14, 21, 28 kg/cm<sup>2</sup>). The expansion conditioning was performed using an Amandus Kahl model OE 15.2 annular gap expander and pellets were produced using a CPM pellet mill equipped with a 5/32-inch x 1 1/4-inch (4mm x 32mm) pellet die. The durability of the pellets improved from 27.43 percent up to 87.76 percent as the expander cone pressure level increased. The fines were not separated from the pellets prior to crumbling. The pellets were crumbled using a roll gap width of 2.2 mm. A durability test was conducted to provide descriptive information related to the quality of the crumbles. The crumble durability values were improved by increasing the expander cone pressure level indicating an improvement in crumble quality. In both experiments the six treatments were fed to 5 replicate floor pens containing 40 chicks (day-old) per pen. Feeding mash compared to the thermally processed treatments resulted in inferior (P<0.05) weight gain and feed efficiency in both experiments. Within the thermally processed treatments there were slight differences (P<0.05) in broiler weight gain for experiment 1 but not for experiment 2. Feed efficiency improved in both experiments as the level of cone pressure increased (P<0.05) and was most likely due to improvements in crumble quality. Based on the results of these two experiments broiler performance may be influenced by crumble quality. The initial durability of the pellets plays a direct role in determining the quality of the crumbles.

**Key Words:** Crumble Quality, Pellet Durability, Expander

**1363 Effect of *Aspergillus* sp and bacterial phytase containing broiler diets on body weight, gastrointestinal transit time and the crop and cecum pH of the broiler chick.** G Nava\*<sup>1</sup>, N Ledesma<sup>1</sup>, A Priego<sup>2</sup>, C Priego<sup>2</sup>, L Sutton<sup>3</sup>, and G Tellez<sup>1</sup>, <sup>1</sup>*Departamento de Produccion Animal: Aves, Facultad de Medicina Veterinaria y Zootecnia, UNAM-Mxico*, <sup>2</sup>*Productos Quimicos-Agropecuarios S.A. de C.V. Mexico*, <sup>3</sup>*PetAg Inc, Hampshire, IL 60140 USA*.

Both enzyme (bacterial phytase) and prebiotic (*Aspergillus* sp) have been used to improve broiler performance but the specific mechanism of action is not well known. A trial was conducted to determine the effects of adding 0.2% prebiotic, 0.04% enzyme and the combination on body weight (BW), gastrointestinal transit time (GTT) and pH changes in crop and cecum of the broiler chick. This experiment employed a completely randomized design. All of the sorghum plus soybean (S/S) diets were isocaloric and isonitrogenous and consisted of four diets with two replicates of 30 birds each (n = 240). The four experimental diets were: 1).Control S/S diet; 2).Control plus prebiotic; 3).Control plus enzyme; and 4).Control plus prebiotic and enzyme. On days 1, 9, 16 and 27, ten chicks from each diet were weighed. GTT was evaluated on days 15 and 26 using ten chicks from each diet. Crop and cecal content pH were performed on days 10 and 20 using ten chicks from each diet. There were no significant differences (P>0.05) between diets for body weight. The dietary effect was not significant for the GTT measurements at day 15 (results: 135.20<sup>a</sup>, 168.60<sup>a</sup>, 152.40<sup>a</sup> and 152.20<sup>a</sup> minutes for diet one through four, respectively). The dietary effect upon GTT at day 26

was significantly longer (P<0.05) for the prebiotic diet (results: 161.9<sup>b</sup>, 193.20<sup>a</sup>, 187.20<sup>ab</sup> and 178.80<sup>ab</sup> minutes for diet one through four, respectively). The cecum pHs were modified (P<0.05) at days 10 by the enzyme diet and the prebiotic diets (results: 6.06<sup>a</sup>, 5.79<sup>ab</sup>, 5.40<sup>b</sup> and 5.82<sup>ab</sup> pH units for diet one through four, respectively). The prebiotic and enzyme may function as a bacterial substrate that modify the intestinal microflora resulting in changes in the intestinal physiology and bacterial metabolite production.

**Key Words:** Prebiotic, Enzyme, Transit

**1364 Effect of *Aspergillus* sp and bacterial phytase containing broiler diets on intestinal villi size and blood chemistries of the broiler chick.** G Nava\*<sup>1</sup>, N Ledesma<sup>1</sup>, A Priego<sup>2</sup>, C Priego<sup>2</sup>, L Sutton<sup>3</sup>, and G Tellez<sup>1</sup>, <sup>1</sup>*Departamento de Produccion Animal: Aves, Facultad de Medicina Veterinaria y Zootecnia, UNAM-Mxico*, <sup>2</sup>*Productos Quimicos-Agropecuarios S.A. de C.V. Mexico*, <sup>3</sup>*PetAg Inc, Hampshire, IL 60140 USA*.

The addition of enzyme (bacterial phytase) and prebiotic (*Aspergillus* sp) to the broiler chick diet improve gastrointestinal microbial activity causing an increase of fatty volatile acid (VFA). The increase of VFA has been related to the nutrient absorption process. A trial was conducted to determine the effects of adding 0.2% prebiotic, 0.04% enzyme and the combination on the intestinal villi size and blood chemistries of the broiler chick. This experiment employed a completely randomized design. All of the sorghum plus soybean (S/S) diets were isocaloric and isonitrogenous and consisted of four diets with two replicates of 30 birds each (n=240). The four experimental diets were: 1)Control S/S diet; 2)Control plus prebiotic; 3)Control plus enzyme; and 4)Control plus prebiotic and enzyme. On day 10 and 20, ten serum samples per experimental diet were analyzed for glucose, calcium, phosphorus and alkaline phosphatase. From the same chicks samples of the ileum and cecum were fixed in 10% formaline and subsequently microscopically evaluated for morphological changes. There were no significant dietary effects (P>0.05) on the blood parameters analyzed. The intestinal villi size of the ileum and cecum of the 10 day-old broiler chick demonstrated no dietary effect (P>0.05). The intestinal villi size of the ileum of the 20 day-old broiler chick demonstrated significant dietary effect (P<0.05) due to the prebiotic addition (results: 392.4<sup>b</sup>, 768.0<sup>a</sup>, 505.<sup>b</sup> 2 and 411.6<sup>b</sup> microns for diet one through four, respectively). There were no significant dietary differences (P>0.05) in the length of the cecum villi in the 20 day-old chick (results: 233.40<sup>a</sup>, 249.60<sup>a</sup>, 199.20<sup>a</sup> and 233.40<sup>a</sup> microns for diet one through four, respectively). The prebiotic supplementation in neonatal broiler chick diets may improve the intestinal microflora activity and bacterial metabolite production (VFA) as related to the increase of 20 day-old ileum villi length.

**Key Words:** Apergillus meal, Phytase, Ileum villi

**1365 Effect of phytase, organic trace minerals and age at photostimulation on performance of brown eggshell laying hens.** T. Ao\*, N. D. Paton, A. H. Cantor, A. J. Pescatore, M. J. Ford, and C. A. Smith, *University of Kentucky*.

The effects of supplementing a low-phosphorus basal diet with phytase (Alltech, Nicholasville, KY) and organic forms of Mn, Zn and Cu (ES49) (Eggshell 49, Alltech) and of age of pullets at photostimulation on egg production variables were studied. Using a commercial strain of laying hens (Hy-Line) producing brown shelled eggs, 18 replicate groups of 12 hens, housed two per cage, were assigned to each of four dietary treatments. Hens were housed and subjected to photostimulation at 15, 16 or 17 wk of age. The basal diet was fed alone or supplemented with phytase (11,500 ptu/kg diet) or ES49 (providing 4.5 mg Mn, 7.5 mg Zn and 1 mg Cu per kg diet as proteinates) in a factorial arrangement. Calculated nutrient values of the basal diet were: 2900 kcal AME/kg, 16.6% CP, 0.47% Met, 3.75% Ca and 0.17% available P. A trace mineral supplement used in all diets provided 51 mg Mn, 60 mg Zn and 8 mg Cu per kg diet as inorganic salts. Production variables were measured during a 52-wk period, starting at 17 wk of age. Feed intake during the 52-wk period was unaffected by diet, but responded linearly (P < 0.05) to age at housing. Hens housed at 15, 16 and 17 wk of age consumed 104, 105 and 107 g/hen/d, respectively. Hen-day egg production for the 52-wk period (mean = 81.5%) was unaffected by both age at housing and diet. Housing at 17 wk (*vs.* 15 and 16 wk) increased average egg weight (61.6 g *vs.* 60.5 and 60.4 g) but decreased average per cent shell

(8.93% vs. 9.18 and 9.12%). Phytase significantly increased the breaking strength of the humerus, but not the tibia, measured after 45 wk of production. These results indicate that early photostimulation decreases egg weight and feed intake and increases per cent shell, and that the levels of available P, Mn, Zn and Cu in the basal diet are adequate to support layer performance. However, the increased humerus breaking strength due to phytase suggests that the level of P was marginal for maintaining bone strength.

**Key Words:** Phosphorus, Phytase, Photostimulation

**1366 Sources and levels of total phosphorus in the diet of broilers from 2 to 28 days of age.** L. F. Araujo\*<sup>1</sup>, O. M. Junqueira<sup>1</sup>, D. Mucke<sup>2</sup>, R. Knoop<sup>2</sup>, and C. S. S. Araujo<sup>1</sup>, <sup>1</sup>Universidade Estadual Paulista - UNESP/Jaboticabal - Brazil, <sup>2</sup>Burge Fertilizantes S/A - Sao Paulo - Brazil.

One experiment was conducted to evaluate the performance of broilers receiving various sources and levels of phosphorus from 2 to 28 days of age. Four hundred chickens, 2 days of age, were distributed in a 4 x 2 factorial design (4 sources of phosphates - fine dicalcium phosphate (FDP); granulate dicalcium phosphate (GDP); a mixture of dicalcium phosphate + sodium (DPS); defluorinated phosphate (DFP) and two total phosphorus levels - 0.60% and 0.70%) with 8 treatments and 5 replications of 10 birds each. At the end of the experiment, two birds of each pen were slaughtered to obtain the tibia bone for phosphorus, calcium, magnesium and fluorine. There were no interactions between the treatments. The best weight gain and feed conversion were found in the birds receiving the diet containing GDP in the presence of 0.70% total phosphorus. The worst weight gains and poorest feed conversions were from birds fed the diet with DPS and 0.70% total phosphorus. The highest feed intakes were from diets containing GDP and 0.70% total phosphorus. There was no difference in the tibia calcium, phosphorus and magnesium between studied treatments. However, broilers fed the diets containing DPS and DFP showed, respectively, higher and lower tibia fluorine. According the results obtained, it is concluded that the best performance was from broilers fed diet with GDP and the level of 0.70% total phosphorus. The tibia fluoride level was lower in DFP diets. Acknowledgements: Burge Fertilizantes S/A Brazil for technical support.

**Key Words:** Phosphorus Sources, Phosphorus Levels, Tibia Minerals

## ASAS/ADSA Animal Health

**1368 *In vitro* aflatoxin binding characteristics of an esterified glucomannan product.** J.W. Evans\* and M. Kudupojje, *Alltech Biotechnology Inc., Nicholasville, KY.*

Mycotoxin binders have been shown to reduce the deleterious effects of aflatoxin in animals. A series of experiments were conducted to examine the binding characteristics of an esterified glucomannan (EGM) derived from the yeast cell wall of *Saccharomyces cerevisiae*. The EGM has been shown to reduce the toxic effects of aflatoxin in livestock. In the first study, an *in vitro* binding assay was used to determine the saturation point of aflatoxin binding by EGM in water or phosphate buffer. The binder (0.1%) was mixed with increasing concentrations of toxin (2,4,6,8 and 10 ppm in water/18, 20, 22, 24 and 26 ppm in buffer), centrifuged and unbound toxin concentrations were determined in the supernatant. The saturation point was defined as the minimum binder concentration at which maximum binding is reached. The saturation point for aflatoxin binding was greater in phosphate buffer than in water (8 vs. 24 ppm). In addition, aflatoxin binding responded to phosphate concentrations in a quadratic fashion ( $P < 0.001$ ). Another trial was conducted to determine binding strength in water and phosphate buffer. Aflatoxin (1 ppm) and EGM (0.1%) were mixed, incubated at 37°C for 1 h, and centrifuged. Toxin concentrations were determined in the supernatant and pellet after three methanol extractions. Binding was stronger in the phosphate buffer than in water as indicated by lower aflatoxin recovery in the buffer (568 vs. 279 ppb,  $P < 0.001$ ). A third study compared the saturation points of the EGM and a clay binder (CB). Both binders were mixed in water with increasing toxin concentrations until saturation was reached. The binding capacity of EGM in water was more than four times higher than CB (5.2 vs. 1.2

**1367 Total phosphorus (TP) requirements of meat chickens from 3 to 7 weeks of age.** A. Abudabos\*, D. V. Maurice, S. F. Lightsey, and W. C. Bridges, Jr.<sup>1</sup>, *Animal & Veterinary Sciences, <sup>1</sup>Department of Experimental Statistics, Clemson University, Clemson, SC.*

We previously reported that dietary phytate P is utilized and TP could be decreased without impairment in productivity and substantial reduction in P excretion. However, the variation in body weight between birds on the same treatment prompted us to examine the response of birds, sorted by weight, to dietary TP. The aim of this experiment was to determine the effect of dietary TP in birds sorted into 2 groups: heavy (H) and light (L) at 3 wk. of age; then each group received 4 different diets. Corn-soybean diets were formulated, based on assayed TP values checked with standard reference materials, to contain 0.5, 0.55, 0.6 and 0.65% TP from 3-6 weeks and 0.38, 0.55, 0.6, and 0.65% TP from 6-7 weeks of age. Each diet was fed to 3 pens of each weight group. We measured the effects of TP, gender, and weight groups on growth, breast muscle yield, serum P, bone ash and measures of bone integrity, and intestinal phytase activity. Interactions were not detected and neither dietary TP or weight group had a significant effect on feed intake, body weight gain, feed conversion, breast muscle yield, and intestinal phytase at 6 weeks. Serum P was decreased in birds fed 0.5 % TP when compared to those fed the other three diets ( $P < 0.001$ ). The responses at 7 weeks were similar to those observed at 6 weeks except that gender and weight group effects were detected. Serum P was a function of the amount of inorganic P in the diet ( $P < 0.0001$ ). Phytase activity was dramatically affected by diet ( $P < 0.02$ ); birds that received the 0.38% TP diet (no inorganic supplement) had the highest activity. Bone ash decreased ( $P < 0.0001$ ) as dietary TP was lowered but femoral and tibial length, weight, cross-sectional area, polar moment of inertia, and area moment of inertia were not affected by diet. The results show that dietary P can be lowered from 3 to 7 weeks without loss in performance and reduction in mechanical properties of long bones.

**Key Words:** Dietary Phosphorus, Intestinal Phytase, Growth, Bone Integrity

$\mu\text{g}/\text{mg}$  binder,  $P < 0.001$ ). This series of studies showed that EGM is able to bind aflatoxin and not mask or destroy it. In addition, aflatoxin binding by EGM is phosphate dependent and more efficient at binding aflatoxin than binding by the CB tested.

**Key Words:** *In vitro* binding, Aflatoxin, Esterified glucomannans

**1369 Growth and immune function of calves fed milk replacer with added nitrate.** S. T. Franklin, R. O'Carra, R. J. Harmon, D. M. Amaral-Phillips, and J. A. Jackson, *University of Kentucky, Lexington, KY.*

A concentration of 10 - 20 ppm nitrate-N in water is considered a health risk for humans and may cause methemoglobinemia. Little is known, however, of the effects of nitrate-N on health and immune function of neonatal dairy calves. Thus, 24 calves (4 Jersey and 20 Holstein; male = 12 and female = 12) were assigned to treatments of 0, 10, 20, or 40 ppm nitrate-N (as potassium nitrate) added to reconstituted milk replacer. Calves were moved to individual calf hutches and assigned to treatments at an average of approximately 5 d of age. Milk replacer (20% protein and 20% fat) was reconstituted in water to provide 0.45 kg of solids daily and fed in two equal feedings. Nitrate-N was added to reconstituted milk replacer at each feeding. Milk replacer intake was recorded at each feeding and starter consumption was determined daily. At 5 wk of age, milk replacer was fed once daily and calves were weaned at 6 wk of age. Calves were weighed when moved to hutches and weekly thereafter. Blood samples were obtained at 2 wk intervals for total white blood cell counts, neutrophil function assays, and proliferation assays. There was no effect ( $P > 0.05$ ) of nitrate-N addition to milk replacer on