

which can detect fecal contamination on meat animal carcasses. Although diet can influence the fluorescent signal obtained, instruments have been designed with adequate sensitivity for the detection of feces from animals consuming a variety of commercial feedlot rations. This imaging technology has been developed through intellectual property protection and technology transfer into commercially produced instru-

ments, which are currently being manufactured and used by the meat processing industry. These instruments augment more time consuming microbiological testing methods and can assist slaughter plant operators and meat inspectors in their efforts to minimize contamination on meat.

Key Words: Feces, Fluorescence, Carcass Inspection

PSA - Nutrition 1

T12 Consequence of meeting non-phytin phosphorus (nPP) requirements with or without feed additives on broiler performance, litter P concentration and processing losses. A. S. Dhandu*¹, R. Angel¹, and W. W. Saylor², ¹Department of Animal and Avian Sciences, University of Maryland, College Park, ²Department of Animal and Food Sciences, University of Delaware, Newark.

Male Ross 308 broilers (56 birds/pen) were raised from hatch to 49 d of age in floor pens containing built up litter from two previous trials of identical design and dietary treatment (DT) allocation. Four feed phases were followed: starter, 1 to 18 d; grower, 18 to 32 d; finisher, 32 to 42 d; and withdrawal, 42 to 49 d. Six DT were tested (9 or 10 pens/DT). The nPP levels of DT 1 were in accordance with NRC (1994) recommendations: 0.45, 0.35, 0.35 and 0.30% nPP in the four feed phases. Following Univ. of Maryland recommendations, the nPP levels for DT 2 were 0.45, 0.31, 0.23 and 0.18%. In DT 3 and 4, nPP levels in the four phases were DT 2 levels reduced by 0.064 and 0.09%, respectively. For DT 5, the DT 1 nPP levels were lowered by 0.1%. The negative control was DT 6 and contained $\leq 90\%$ of DT 2 nPP levels. All diets in DT 3, 4 and 5 contained 600 U of phytase/kg diet. In addition, DT 4 contained 70mg of 25-hydroxycholecalciferol/kg diet. Pine shavings were weighed into pens before the first trial and litter was weighed out after the third trial. At 49 d of age, 22 birds per pen were selected at random, caught and transported by a commercial catching crew and then processed at a commercial plant following existing plant protocols. Tibiae and femurs of processed birds were analyzed for dry-defatted ash. The 49 d BW of birds fed DT 1, 2, 3 and 5 were greater ($P \leq 0.05$) than those fed DT 6. The total P excreted (per bird) by broilers fed DT 3 (12.73 g) and DT 4 (11.37 g) was lower ($P \leq 0.05$) than that of birds fed either DT 1 (19.53 g) or DT 5 (14.68 g). There was no effect ($P > 0.05$) of reducing dietary nPP on carcass yield, incidence of broken wings and legs or bruised back, breast, wings and legs. Tibia and femur ash of birds fed DT 1 was greater ($P \leq 0.05$) than that of those fed DT 6. Lowering dietary nPP concomitant with supplementation of feed additives achieved maximum reduction in litter total P without any negative impact on performance or on processing losses.

Key Words: Broilers, Phosphorus, Processing Loss

T13 The use of low-phytate soybean meal to reduce phosphorus excretion from poultts raised to 18 days of age. J. L. Godwin*, J. L. Grimes, A. G. Gernat, and M. J. Wineland, North Carolina State University, Raleigh.

An experiment was conducted to determine if feeding genetically modified low-phytate (LP) soybean meal (SBM) to turkey poultts would support growth performance equal to or better than those fed diets containing normal SBM and reduce phosphorus (P) excretion from poultts raised to 18d. A phytase enzyme (E) (Alltech; Kentucky) was also incorporated into the trial. One hundred and eighty eight Nicholas male turkey poultts were housed in Petersime batteries with 30 pens (6 birds per pen) at day of hatch with 5 pens per treatment. Five starter rations were fed to poultts in mash form. Treatments consisted of normal SBM+Ca and P at 100% of recommended NRC values (SBM100), LP+Ca and P at 100, 85, and 70% of recommended NRC (LP100, LP85, LP70, respectively) and LP70+enzyme (LP70E). Feed and water were provided ad libitum for 18d. The following parameters were measured; growth performance, AMEn, and apparent nitrogen retention (ANR). Feed consumption and feed to gain, by pen, and individual BW were determined at 6 day intervals to 18d. Also measured at 18d: percent toe and tibia ash, tibia breaking strength, and P levels in fecal samples. Neither mean BW, feed conversion, cumulative feed conversion, toe ash nor tibia ash were significantly affected by treatment. There was a significant linear decrease in tibia breaking strength and increase in AMEn as diets containing LP decreased from 100 to 70%. Tibia breaking strength for LP70E was not different from LP100. ANR and fecal P were significantly affected by

treatment. Fecal P decreased as NRC Ca and P level decreased in LP diets. Fecal P for SBM100 was higher than for LP100 while fecal P for LP70 and LP70E were not different. Using LP resulted in performance equal to SBM while providing reduced fecal P.

Key Words: Low-Phytate SBM, Phosphorus, Turkey Poultts

T14 Phytase activity and phytate hydrolysis along the digestive tract of broiler chicks: A comparative study of two phytase sources. E. M. Onyango*¹, M. R. Bedford², and O. Adeola¹, ¹Purdue University, West Lafayette, IN, ²Zymetrics Inc., Marlborough, Wiltshire, UK.

Residual activity of an *Escherichia coli*-derived phytase and a commercially available *Peniophora* phytase along the digestive tract of broiler chicks was compared in order to evaluate their relative resistance to hydrolysis in the digestive tract. Seventy two 7-d-old male broiler chicks were grouped by weight into six blocks of 3 cages with four birds per cage. Three corn-soybean meal-based diets were randomly assigned to cages within each block. The three diets were a low P diet containing 3.9 g P/kg diet; and low P diet plus either *Escherichia coli*-derived phytase or the *Peniophora* phytase at 1000 units/kg of feed. The chicks were fed experimental diets from 8 to 22 d of age. At the end of the study, chicks were killed and contents from the crop, proventriculus and gizzard, jejunum and ileum were collected, freeze-dried, ground and analyzed for phytase activity and phytate content. *Escherichia coli*-derived phytase had more residual activity at the crop ($P < 0.01$), proventriculus and gizzard ($P < 0.05$), jejunum ($P < 0.001$) and ileum ($P < 0.0001$) when compared with the *Peniophora* phytase. Less phytate remained in the digesta collected from the proventriculus and gizzard ($P < 0.05$), jejunum ($P < 0.01$) and ileum ($P < 0.05$) in birds fed *Escherichia coli*-derived phytase compared with those fed *Peniophora* phytase. The *Escherichia coli*-derived phytase may be more resistant to hydrolysis in the digestive tract when compared with the *Peniophora* phytase, and may be related to the superior phytate hydrolysis observed.

Key Words: Broiler Chick, *Escherichia coli* Phytase, Residual Phytase Activity

T15 Requirement of methionine of broilers during finishing period. F. Liu*, Z. Niu, and S. Zhai, College of Science & Technology, Northwest Sci-Tech University of Agriculture & Forestry.

The objective of this experiment was to evaluate the requirement of broilers during four to six weeks of age. Five hundred male broiler chicks from Arbor Acres commercial strains were divided into five groups, each of five replicates. The diets were based on corn-soybean meal which the level of methionine was 0.25%, 0.30%, 0.35%, 0.40%, 0.45% respectively. Each group of birds was fed one kind of the five diets above for two weeks. The results showed that there were significant effects of different levels of dietary methionine on growth performance and plasma uric acid content. BW and FC were significantly decreased at lower methionine (0.25% 0.30%), but uric acid level of plasma increased significantly. The BW and FC were not increased significantly at higher dietary level, but uric acid content was greatly increased. This study indicated that the requirement of methionine of broilers during finishing stage was 0.35% 0.40% in the diet.

Key Words: Methionine, Growth Performance, Broiler

T16 Impact of methionine source and excess choline on growth performance of broilers during the starter period. P. B. Pillai*¹, A. C. Fanatico¹, J. C. Townsend¹, K. W. Beers², and J. L. Emmert¹, ¹University of Arkansas, Fayetteville, ²Safe Foods Corporation, Rogers, AR.

Experiments were conducted to assess the impact of excess choline (CHO) or betaine (BET) on growth performance of broilers fed graded levels of DL-methionine (DLM) or 2-hydroxy-4-methylthiobutanoic acid (HMB) during the starter period. In experiment 1, a corn-peanut meal diet deficient in methionine (MET; 0.23% digestible) and cysteine (CYS; 0.25% digestible) was fed; treatments consisted of graded levels (0, 0.04, or 0.08%) of MET from DLM or HMB (additions adjusted for 88% purity) that were fed in the presence or absence of excess isomethyl CHO (0.25%) or BET (0.28%). In the experiment 2, identical treatments were used, but the basal diet was adequate in CYS (0.42% digestible). There was no overall impact of CHO or BET on growth performance in experiments 1 and 2 ($P > 0.05$); a significant improvement ($P < 0.05$) in weight gain and feed efficiency did occur with CHO and BET addition to basal diet in experiment 2. In both experiments, weight gain increased linearly ($P < 0.05$) with the addition of graded levels of DLM or HMB. Slope ratio methodology was used to assess HMB efficacy. In experiment 1, efficacy was 64.7% when HMB was fed without excess CHO or BET. Efficacy was significantly improved ($P < 0.05$) by excess CHO (79.2%) and numerically improved by excess BET (74.1%). In experiment 2, presence of adequate CYS improved HMB efficacy to 92.1%; addition of excess BET did not impact HMB efficacy (90.7%). However, addition of excess CHO to the CYS-adequate diet significantly reduced ($P < 0.05$) HMB efficacy (77.3%). In conclusion, excess CHO and BET appeared to improve HMB efficacy when added to a diet deficient in both MET and CYS, but not when added to a diet deficient in MET only. Further, presence of adequate CYS appeared to improve HMB efficacy relative to chicks fed a diet deficient in both MET and CYS. These data suggest that levels of CHO and BET and type of SAA deficiency impact HMB efficacy.

Key Words: Choline, Betaine, Sulfur Amino Acids

T17 The effect of dietary factors on induction of fatty liver-hemorrhagic syndrome and its diagnosis methods with use of serum and liver parameters in laying hens. M. Yousefi*¹, M. Shivazad², and I. Sohrabi Hafhdooost³, ¹Ph.D Student of Islamic Azad University, Science & Research Campus, Tehran, Iran, ²Department of Animal and Poultry Science, University of Tehran, Karaj, Iran, ³Department of Pathobiology, Islamic Azad University, Science & Research Campus, Tehran, Iran.

An experiment was conducted to determine: The effect of dietary factors on induction of fatty liver-hemorrhagic syndrome (FLHS) and its diagnosis methods with use of selected serum enzymes on Hy-Line W-36 hens. The experiment was conducted in completed random design (CRD) with 6 dietary treatments and 4 replicates pen each with ten hens from 94 to 106 wk of age. Three 28-d periods used from different dietary factors including: 1) control (C) 2) Low Methionine (LM) 3) Low Linoleic Acid (LLA) 4) High Energy (HE) 5) Low Methionine, Linoleic Acid, Choline and High Energy (LM-LLA-LCH-HE) and 6) Low Choline (LCH). Feed intake, body weight, egg production (EP), egg weight, egg quality, serum and liver parameters were measured the end of each 28-d periods. Overall feed intake was significantly ($P < 0.05$) lower for the hens fed HE diets compared to the control. Body weight was lower for all dietary treatments throughout the experiment compared to the control. Overall egg weight was significantly ($P < 0.05$) lower for the hens fed LM and LM-LLA-LCH-HE compared to the control. EP and egg quality were not significantly affected by dietary treatments. Overall liver hemorrhage score (LHS) was greater for the hens fed all dietary treatments except HE diet compared to the control. LHS was positively correlated ($P < 0.05$) with liver weight. Serum enzyme activities including: aspartate amino transferase (AST), alanine amino transferase (ALT), lactate dehydrogenase (LDH) were not significantly affected by dietary treatments. Although the AST enzyme activity was not significantly different, but it was numerically higher for all dietary treatments except HE diet. The results showed the effectiveness dietary factors on induction of FLHS in laying hens. AST enzyme activity could be used for diagnosis of FLHS in laying hens.

Key Words: Fatty Liver Hemorrhagic Syndrome, Dietary Factors, Enzyme

T18 The effect of dietary treatments flaxseed, yeast, soy fatty acid on fatty liver-hemorrhagic syndrome in laying hens. M. Yousefi*^{1,3}, M. Shivazad², and I. Sohrabi Hafhdooost³, ¹Department of Animal and Poultry Science, Islamic Azad University of Saveh, Saveh, Iran, ²Department of Animal and Poultry Science, University of Tehran, Karaj, Iran, ³Department of Pathobiology, Islamic Azad University, Science & Research Campus, Tehran, Iran.

An experiment was conducted to determine: 1) The effect of dietary treatments on fatty liver-hemorrhagic syndrome (FLHS) in Hy-Line W-36 hens. The experiment was conducted in completed random design with 6 dietary treatments and 4 replicates pen each with ten hens from 106 to 110 wk of age. In experiment: different dietary treatments including: 1) Control (C)- 4% Soy Fatty acid + Methionine (4% SFA)- Linoleic Acid (LA)- 0.05% Yeast (*Saccharomyces Cerevisiae*) + Balanced Energy (0.05% SC)- Methionine + Linoleic Acid + Choline + Balanced Energy (M + LA + CH + BE) - 5% Flaxseed + Choline (5% FS) were compared for treatment of FLHS during 28-d period. In experiment: Body weight was lower for the hens fed all dietary treatments compared to the control. Egg weight was significantly ($P < 0.05$) lower for the hens fed 5% FS compared to the control. Liver weight was lower for the hens fed 0.05% SC and 5% FS compared to the control. Liver hemorrhage score was positively correlated ($p < 0.05$) with liver weight. The results showed body weight and liver weight are 2 of the inducing factors for FLHS that which were decreased by yeast and flaxseed.

Key Words: Fatty Liver-Hemorrhagic Syndrome, Dietary Treatments, Liver

T19 Efficiency of folate deposition in eggs throughout the production cycle of Hyline W98 and W36 laying hens. K. Hebert*¹, J. D. House, and W. Guenter, University of Manitoba, Winnipeg, MB, Canada.

With previous research to document that supplementing diets with 4 mg crystalline folic acid/kg yielded 90% maximal egg folate concentrations, a study was designed to determine the age and rate of production effects of laying hens on egg folate level, and the potential for differences due to strain of birds. Hyline W36 and W98 hens ($n = 156$ /treatment) received a barley-based ration, containing 0 and 4 mg/kg of crystalline folic acid for eleven 4-week periods. Response criteria included production parameters, egg quality measurements and measures of egg folate content. There was no significant difference ($P < 0.05$) in performance parameters or egg quality measurements due to folate supplementation. Hyline W98 had significantly ($P < 0.05$) higher feed consumption (FC), egg weight, yolk weight, body weight and lower percent yolk of egg weight than the W36 strain. Throughout the production cycle egg production (EP) and feed efficiency (FE) increased to peak and then decreased. FC, egg weight, yolk weight and percent yolk of egg weight significantly ($P < 0.05$) increased, and specific gravity significantly ($P < 0.05$) decreased throughout the production cycle. A significant ($P < 0.05$) ration x strain interaction was evident for EP and FC, as Hyline W98 hens exhibited higher EP and FC than W36 with supplementation level of 4 mg/kg. A significant ($P < 0.05$) strain x period interaction was evident for EP, FC, FE, egg weight and yolk weight. A significant ($P < 0.05$) ration x period interaction was evident for FC and FE. Overall, performance was not affected by long-term folate supplementation.

Funding: Manitoba Egg Producers, CEMA, Clark Hy-line Inc.

Key Words: Folate, Egg

T20 Effects of supplemental dietary Vitamin E and selenium from two sources of egg production and vitelline membrane strength in laying hens. D. Monsalve*, G. Froning, M. Beck, and S. E. Scheideler, University of Nebraska, Lincoln.

Separation of the egg yolk from the albumen is extremely important in order to avoid yolk contamination; the strength of the vitelline membrane (VMS) is a key factor in this step. Information concerning effects of vitamin E and selenium (Se) supplementation in hens on VMS, whipping performance, and production parameters during heat stress is limited. Two hundred eighty eight, 26 wk old Bovan laying hens were assigned to 48 cages (6 hens/cage) in a 3x2x2 factorial arrangement of 3 levels supplemental α -tocopherol E (50 or 100 or 150 IU/Kg), 2 levels of Se (0.25 ppm or 0.50 ppm), and 2 sources of Se (inorganic or organic) added to corn-soybean meal based diets. Birds were maintained

at environmental temperatures during the summer months of July, August, and September. Egg production, feed intake were recorded daily, egg weights were determined weekly, and body weight on a monthly basis. Eggs collected from each treatment were analyzed for vitamin E and Se content in the yolk, yolk pH, albumen pH, angel cake volume, foam stability, yolk viscosity, and Haugh units. An Instron universal testing machine (4500 series) equipped with back-extrusion food cell, with a 2-kg tension load and crosshead speed 10mm/min, was used to measure VMS of fresh and aged (2 weeks) eggs. Results showed that hens fed diets with 0.50 ppm of Se laid 1.68% more eggs, weighed 19 more grams, and consumed 2.58 g more feed than those fed the same diets with 0.25 ppm of Se. Addition of 150 UI/kg vitamin E in the diet significantly ($P \leq .05$) increased VMS of fresh eggs by 0.05 and 0.08 kg/mm, respectively, in contrast to 100 and 50 UI/kg vitamin E in the diet. A similar trend was observed with aged eggs, in which VMS was significantly ($P \leq .05$) greater for eggs from hens on diets supplemented with 150 UI/kg compared to 100 and/or 50 UI/kg vitamin E. This study suggests that addition of vitamin E and Se diets during summer time improved VMS for both fresh and aged eggs.

Key Words: Vitelline Membrane, Vitamin E, Selenium

T21 Performance of broilers fed diets containing 2-hydroxy-4-methylthiobutanic acid at different inclusion rates. A. B. Batal¹, J. L. Emmert², P. B. Pillai², B. L. Lumpkins*¹, and M. E. Blair³, ¹University of Georgia, Athens, ²University of Arkansas, Fayetteville, ³Adisseo, Alpharetta, GA.

Three experiments were conducted to evaluate the effects of feeding different methionine sources, 2-hydroxy-4-methylthiobutanic acid (RhodimetTM AT88, Adisseo) or DL-methionine (RhodimetTM NP 99, Adisseo) to broilers on performance and carcass yield. AT88 was added to the experimental diets on a weight basis according to assigned efficacy values (88, 82, and 70% in Experiment 1; 88, 82, 75, and 70% in Experiments 2 and 3). As the AT88 efficacy value decreased, the level of supplemented AT88 increased to meet the methionine requirement (e.g. DLM, 0.27%; AT88-88%, 0.307%; AT88-70%, 0.39%). Each of the dietary treatments was fed to 6 replicate pens of 45 (Experiment 1) or 25 chicks per pen (Experiments 2 and 3). Experiments 2 and 3 followed the same experimental design, protocol, and diets were mixed simultaneously at one location while the experiments were conducted at two different research facilities. A methionine-deficient basal diet was manufactured for each of the feeding periods; Experiment 1, 3 periods, starter (0-22 d), grower (22-42 d) and finisher (42-56d); Experiments 2 and 3, 4 periods starter (0-16 d), grower (16-32 d), finisher (32-40 d), and withdrawal (40-50 d). The basal diet was based upon the current Agri Stat commercial baseline values for nutrients, with supplemental methionine omitted (practical-type diet). In Experiment 1, growth rate and carcass yield of birds fed AT88 with an efficacy value of 88% was similar to birds fed DLM. However, birds fed AT88 with an efficacy value of 70% (such that more AT88 is added to the diet) had slightly reduced weight gain through out the study and numerically lower carcass yield relative to birds fed DLM or AT88 with an efficacy value of 88%. In Experiments 2 and 3, no effect on performance, carcass or breast meat yield were observed due to any AT88 efficacy level employed. The results suggest that even at a calculated efficacy of 88%, growth rate and carcass yield of broilers fed AT88 was similar to that of birds fed DLM and that lowering the efficacy of AT88 may depress carcass yield (Experiment 1).

Key Words: Methionine hydroxyl analog (AT88), DL-methionine, Broiler chicks

T22 The effects of dietary herbal extracts for broiler chickens. M. R. Lewis*¹, S. P. Rose¹, A. M. Mackenzie¹, and J. Smith², ¹National Institute of Poultry Husbandry, Harper Adams University College, UK, ²Braes Feed Ingredients Limited, UK.

Limitations concerning the use of antibiotics in poultry feed in Europe have stimulated the search for alternatives in order to remain competitive. Herbs contain many active components that have a wide range of pharmacological properties. However, as yet limited data have been presented to support their efficacy or elucidate mode of action in practical poultry diets. Initial screening experiments investigated the effects of 6 herbs (garlic, yarrow, horseradish, milk thistle, juniper and oregano) on growth performance. Birds fed yarrow supplemented diets (1800mg/kg) showed improved FCE ($P < 0.05$) in the latter growth stage (17-27 days

of age) compared with birds fed the unsupplemented control diets. Further experiments have focused on how yarrow exerts its performance effects. It was thought that antibacterial components found in yarrow (such as 1,8-cineole) might exert a positive effect on gut microflora. A large floor pen experiment was therefore conducted, and caecal populations of *Escherichia coli*, *Bacteroides fragilis* group and lactic acid bacteria were enumerated anaerobically. Consistent performance effects were seen in birds fed diets containing yarrow: higher weight gains, $P < 0.001$ and increased feed intake $P < 0.05$ relative to unsupplemented controls; 18-36 days of age. However, no differences were observed in caecal microflora populations, indicating that yarrow does not mediate its effects through moderation of gut flora. The latest in this series of experiments has concentrated on the effects of yarrow on nutrient digestibility in chicks fed adequate and diluted (10% less nutrient dense) diets with and without yarrow. There was a diet x yarrow interaction: birds fed diluted diets supplemented with yarrow showed higher feed intake ($P < 0.05$) and a tendency for higher weight gain ($P = 0.08$) than their non-supplemented counterparts. Initial evidence indicates that both diet dilution and yarrow supplementation increase pancreas weights. More detailed measurements of ileal pancreatic enzyme activity are currently underway. These data should provide a valuable insight into the *in vivo* mode of action of yarrow.

Key Words: Herbal, Yarrow, Digestibility

T23 Effects of organogermanium on performance and immune response in broilers. Z. Niu*, X. Liang, F. Liu, M. Xie, and Y. Wang, College of Animal Science & Technology, Northwest Sci-Tech University of Agriculture & Forestry, Yangling, China.

The objective of this experiment was to study the effects of carboxyethyl germanium sesquioxide (Ge-132) on the growth performance and immune response of broilers. 240 Avian broiler chicks were assigned to one of four dietary treatments which was supplemented with 0mg/kg, 30mg/kg, 80mg/kg, and 120mg/kg Ge-132 resp.. The birds were reared for 7 weeks. The result of the experiment indicated that: (1) There were no significant efficacy of supplemented with Ge-132 in diets on body weight, feed intake, growth rate, and feed efficiency of broilers at 49 days old of age; (2) The weight of immune organs, including bursa of Fabricius, thymus, and spleen, weren't affected significantly by supplementation of Ge-132, but the level of the antibody of NDV was significantly higher as compared with the control group at 28 days of age.

Key Words: Germanium, Immune Function, Growth Performance

T24 Justifying effects of grain particle size on broiler performance and carcass quality. A. S. Parsons* and J. S. Moritz, West Virginia University, Morgantown.

Corn particle size has been suggested to affect broiler performance. However, a specific understanding of particle size effects has not been determined. In a previous study, experimental treatments consisted of five similarly formulated mash diets varying in corn particle size (781 μ m, 950 μ m, 1042 μ m, 1109 μ m, 2242 μ m). Each of these diets was fed to 13 replicate floor-pens of 21 straight-run 308x344 Ross broilers during the growing period. Regression analysis showed an increasing trend in feed intake ($P = 0.0016$) and gizzard weight ($P = 0.0001$) as particle size of mash diets increased; however, feed efficiency ($P = 0.0058$) and percent breast yield ($P = 0.0250$) decreased. The objective of the current study was to explain these trends via true metabolizable energy (TME), particle size preference and passage rate studies using similar diets. Regression analysis of a six replicate TME study showed a quadratic trend ($P = 0.0049$) as dietary particle size increased. Particle size preference was determined by feeding diets to broilers (4.5 wk) over a 12 hr period with particle size determined at 3 hr intervals. Preference varied due to a treatment by time of collection interaction ($P = 0.0282$). Diet particle size either significantly or numerically increased during the initial 3 hr period, while remaining similar to initial diet particle size for the second 3 hr period ($P \geq 0.05$). Particle size of diets containing fine, small or coarse corn (864 μ m, 927 μ m, 1515 μ m respectively) decreased over the final 3 hr period ($P \leq 0.05$) suggesting that size preference decreased as availability of larger particles decreased. Particle size of diets containing medium or large corn (943 μ m and 1065 μ m respectively) decreased for the remaining 6 hr period ($P \leq 0.05$) suggesting again, there was a preference for larger particles. Despite an initial preference for smaller

particles, it was necessary for birds in the floor-pen study to also consume larger particles to allow replenishment of feed in the trough. Diets containing larger particles showed a decrease in TME, which may explain the increase in FI and the decrease in FE observed in the floor-pen study.

Key Words: Particle Size, TME, Preference

T25 Effects of pelleting protein concentrate pellets on feed mill throughput and electrical efficiency. P. M. Clark* and K. C. Behnke, *Kansas State University, Manhattan.*

The efficacy of blending cracked corn and a pelleted protein concentrate to improve feed mill throughput, with emphasis on electrical consumption and pellet quality, was studied. A complete, pelleted corn-soybean meal-based broiler grower diet (Diet 1) was compared to pelleted protein supplements blended with two levels of cracked corn (15% and 30%; Diet 2 and Diet 3, respectively). All diets were formulated to be isocaloric and isonitrogenous. No. 2 yellow dent corn was cracked on a Roskamp three-high roller mill. Roll gaps were set at 2.46 mm for the top rolls with the bottom two sets of rolls being left open to achieve a particle size of 75% of the corn + #10 U.S. screen. The roller mill and hammer mill were set for equivalent production rates and electrical consumption was collected on both machines. The sifted fines from the cracked corn were then returned to the diet as part of the corn fraction. The complete diet and protein pellets were formed on a CPM pellet mill using a 4 mm x 32 mm (5/32" x 1") die, conditioned at 82 °C (180 °F). Treatment comparisons were analyzed by ANOVA using the Proc Mixed procedure of SAS (2001). The roller mill consumed 4.4 kWh/ton less electricity than the hammer mill. This can be calculated to be approximately \$0.28/ton. The pelleted protein concentrates, Diet 2 and 3, were not significantly different ($P < .05$) than Diet 1 in pellet durability (PDI), % fines produced, and electrical energy consumption. PDI for Diets 1, 2, and 3 were 80.19, 80.74, and 82.49 respectively. Fines percentages for the diets were 7.1, 6.96, and 6.56% for Diets 1, 2, and 3. Electrical consumption of the pellet mill was 3.19, 3.19, 3.36 kWh for Diets 1, 2, and 3, respectively. Overall, throughput in a feed mill can be increased to approximately 20% without sacrificing pellet quality with minimal influence on electrical energy consumption.

Key Words: Pellet Quality, Electrical Consumption

T26 Effects of feeding blends of grains naturally-contaminated with *Fusarium* mycotoxins on performance and metabolism of turkeys. S. R. Chowdhury* and T. K. Smith, *University of Guelph, Guelph, ON, Canada.*

There is a lack of information in the literature regarding the effect of feeding turkeys grains naturally-contaminated with *Fusarium* mycotoxins. Studies were conducted, therefore, to characterize the toxicity to turkeys of grains naturally-contaminated with *Fusarium* mycotoxins and to determine the efficacy of a polymeric glucomannan mycotoxin adsorbent (GMA). Two hundred and twenty-five day-old male turkey poults were fed corn, wheat and soybean meal based starter (0-3 wks), grower (4-6 wks), developer (7-9 wks) and finisher (10-12 wks) diets for 12 wks. The diets included: (1) control (2) contaminated grains (3) contaminated grains + 0.2% GMA. The feeding of contaminated grains decreased weight gain compared to controls in the starter, developer and finisher period. Weight gains increased, however, when contaminated grains were fed in the grower period. Supplementation of contaminated grains with GMA, moreover, increased body weight gain compared to unsupplemented contaminated grains throughout the experiment. There were no significant effects of diet on feed consumption. Feed efficiency increased in the grower period but decreased in the developer period compared to controls when birds were fed contaminated grains. Plasma concentrations of calcium, total protein, albumin, globulin, and uric acid were decreased after 4 wks of feeding contaminated grains compared to controls. The feeding of contaminated grains increased plasma cholesterol concentration and decreased bilirubin and uric acid concentrations after 8 wks compared to controls. Plasma phosphorus concentrations increased after 4 wks, however, decreased after 8 and 12 wks of feeding contaminated grains compared to controls. It was concluded that turkeys are sensitive to the feeding of combinations of *Fusarium* mycotoxins as seen in the reductions in performance and the alterations in

plasma chemistry and that the feeding of GMA could largely prevent the mycotoxicosis from occurring.

Key Words: Turkey, *Fusarium* Mycotoxins, Performance and Metabolism

T27 Effect of Avizyme® 1502 on increasing protein and energy retention when feeding to Bovans White pullets. C. Troche*¹, X. Sun¹, C. Novak¹, and J. Remus², ¹*Virginia Tech, Blacksburg,* ²*Danisco Animal Nutrition.*

Bovans white leghorn pullets (n = 768) were used to determine the effect of Avizyme® 1502 (AZ 1502) on protein (PR) and energy retention (ER). Diets were formulated according to the management guide for the starter (S -0 to 6 wks), grower (G -6 to 10 wks), developer (D -10 to 15 wks) and pre-lay (P -15 to 18 wks) periods. The 18-wk 2 x 2 x 2 factorial experiment consisted of 2 levels of energy (ME 2980, 2970, 2960, 2842 kcal/kg for S, G, D, P vs 3% energy reduction per period), dietary protein (CP 20, 18, 16, 15 % for S, G, D, P vs 1% unit protein reduction per period) and AZ 1502 (w/wo). Enzyme was added at 0.05 % to 8 wks and at 0.0375 % from 9 to 18 wks. Each trt was replicated 8 times (12 birds per replicate pen). During the D period, feed consumption was reduced ($P < 0.05$) by the inclusion of enzyme (2205.4 vs 2141.6 g/b/period). No differences were seen in cumulative weight gain at 18 wks, while cumulative F:G was improved ($P < 0.05$) by the supplementation of AZ 1502 (4.64 vs 4.72). Pullets fed the high energy diets had superior ER ($P < 0.05$) in the S (82.8 vs 81.7%) and D periods (79.1 vs 76.3%), but reduced ($P < 0.05$) ER (82.0 vs 80.9%) during the G period compared to pullets fed the reduced energy diets. Pullets consuming high protein diets had improved ER ($P < 0.05$) in the S (83.0 vs 81.4%) and G periods (82.0 vs 80.9%) compared to the reduced protein group. AZ 1502 supplementation increased ER ($P < 0.003$) in the S (82.7 vs 81.8%) and G periods (81.8 vs 81.1%), but reduced ($P < 0.05$) it during the P period (77.7 vs 76.3%). PR also improved in the S and G periods with AZ 1502 addition but decreased in P. Feeding various levels of protein and energy w/wo enzyme had no affect on most growth performance criteria evaluated, but did influence nutrient retention. When evaluating production cost, AZ 1502 supplementation decreased overall cost by as much as \$0.01/kg of gain, making enzyme supplementation a worthwhile consideration for raising pullets.

Key Words: Corn-Soy Enzymes, Retention, Pullets

T28 Fermenting sludge from a broiler processing plant: Effect of different levels of cane molasses . R. Sanabria León*, S. Pagán Riestra, A. A. Rodríguez, H. Santiago, and M. Pagán, *University of Puerto Rico, Mayagüez Campus, Mayagüez, PR.*

An experiment was conducted to determine the optimum level of addition of cane molasses as carbohydrate source on the fermentation characteristics of sludge from a broiler processing plant (SBPP). The SBPP was inoculated with lactic acid-producing bacteria applied at 106 cfu/g of fresh material. Inoculated SBPP was mixed with 5 five levels of cane molasses (0, 5, 10, 20, and 30%, w/w), placed into 1 kg capacity silos fitted with valves for gas release, and maintained at room temperature (28-30°C). Three silos per treatment were opened after 6 fermentation periods (0, 4, 7, 9, 14 and 21 d) and silage was analyzed to determine pH, chemical composition, and fermentation products. A completely randomized design with a 4 (levels of cane molasses) x 6 (fermentation periods) factorial arrangement of treatments was used for the correspondent statistical analysis. Mean separation was performed by Bonferroni t-test. Control sludge had higher ($P < .05$) pH than SBPP fermented with cane molasses. Sludge treated with 10, 20 and 30% cane molasses had lower pH (4.46, 4.49, and 4.58, respectively) than SBPP ensiled with a 5% level during the complete fermentation period. Also, dry matter and organic matter were higher ($P < .05$), and crude protein was lower ($P < .05$) as the levels of cane molasses increased. For all fermentations, lactic acid production was higher ($P < .05$) for treatments containing 10, 20 and 30% cane molasses. Propionic acid content was lower ($P < .05$) for treatments with a 20 and 30% cane molasses as compared to the other mixtures. Butiric acid content was higher ($P < .05$) for a 5% cane molasses treatment than sludge with a 0, 10, 20, and 30%. These results suggest that it is possible to ferment SBPP using cane molasses as a carbohydrate source. Levels higher than 10% of the sugar did not result in a better fermentation.

Key Words: Sludge, Cane Molasses, Fermentation Characteristics

T29 The amino acid ideal pattern for Pekin ducks during early growing period. Y. Wang*, Z. Niu, and F. Liu, *Northwest Sci-Tech University of Agriculture & Forestry, Yangling, China.*

Five experiments were conducted to set up the ideal pattern of amino acid requirement of Pekin ducks. In experiment 1, the digestibility of some amino acids in the basal diet were determined, including lysine (Lys), methionine (Met), tryptophan (Trp), threonine (Thr), and isoleucine (Ile). In experiment 2, the growth performance was investigated to effect of different levels of Lys, Met, and Trp, and their interaction under a 3×3 factorial arrangement. The experiment 3 was conducted to evaluate the influence of different levels of Trp, Thr, and Ile, and their interaction. The experiment 4 was carried out to investigate the efficacy of different levels of Trp, Thr, and Ile in a lower protein-diet. In experiment 5, based on the results above, six amino acid models were used to test in order to select a ideal model. The results showed that Lys, Met, Trp, Thr, and Ile requirement of Pekin ducks during 0-2 week was 1.10%, 0.46%, 0.24%, 0.42%, and 0.53% resp., and the digestive amino acid requirement was 1.02%, 0.44%, 0.21%, 0.38%, and 0.47% resp. The total amino acid ideal pattern for duckling was: Lys:Met:Trp:Thr:Ile=100:41:21:38:48, and the digestive amino acid ideal pattern was: Lys:Met:Trp:Thr:Ile=100:43:21:37:46.

Key Words: Pekin Duck, Amino Acid, Ideal Pattern

Nonruminant Nutrition: Grow/Finish - Energy & Protein

T31 Advantages of formulating diets based on net energy on pig performance, carcass characteristics and production economics. M. Rademacher*¹ and L. Hagemann², ¹Degussa AG, Hanau, Germany, ²State Office for Consumer Protection and Agriculture of Brandenburg, Teltow, Germany.

The objective of this study was to determine the effect of dietary energy formulation system on performance, carcass quality and production cost. A total of 126 pigs were used in a three phase-feeding program (phase I: 32 to 50 kg, phase II: 50 to 80 kg, phase III: 80 to 112 kg) in the weight range 32 to 112 kg. Pigs were housed in groups of 14 on a partially slatted floor. Feed was offered ad libitum via a FIRE system (Feed Intake Recording Equipment). Water was provided from low pressure nipple drinkers. Wheat-barley-rye and soybean meal based diets were formulated. Within each growth phase (Phase I, II and III), three diets (A, B, C) were formulated to provide similar digestible amino acid contents. Diets A within each phase were formulated on ME basis and standard dietary CP levels. Diets B were reduced CP diets formulated on ME basis. Diets C were formulated to the same CP contents as Diets B but taking into account the net energy (NE) values of the ingredients. During the overall growing-finishing period, feed intake and feed efficiency were not affected ($P>0.05$) comparing the 3 experimental groups. Growth rate was significantly affected ($P<0.05$) with group B having a lower ADG compared with group C (836 vs 868 g/d) and group A (854 g/d) being intermediate. Lean gain of groups A, B and C was 422, 411 and 432 g/d ($P>0.05$), respectively. The economic impact of comparing group A with group C resulted in a reduction in feed cost per pig by 0.63 EUR (30.62 vs 29.99 EUR), carcass value was improved by 1.10 EUR (109.63 vs 110.73 EUR) and carcass value minus feed cost was improved by 1.73 EUR per pig. Dietary CP can be reduced in growing-finishing diets without affecting growth rate, feed intake, feed efficiency and carcass quality as long as diets are formulated based on the NE concept in combination with digestible amino acids and limiting amino acids supplemented according to the ideal protein concept. This will further result in higher profit due to improved pig performance, better carcass quality and savings in feed costs.

Key Words: Pigs, Energy Systems, Performance

T32 The effects of dietary oil inclusion and oil source on apparent digestibility, fecal volatile fatty acid concentration and manure ammonia emission. A. G. B. Leek¹, V. E. Beattie², and J. V. O' Doherty*¹, ¹Department of Animal Science and Production, University College Dublin, Dublin, Ireland, ²Devenish Nutrition Ltd., Belfast, North Ireland.

An investigation was conducted to test the hypothesis that dietary oil inclusion increases ammonia nitrogen (NH₃-N) emission from the ma-

T30 Transgenic chickens expressing beta-galactosidase hydrolyze lactose in the intestine. S. Pophal*^{1,2}, P. Mozdziak¹, S. Borwornpinyo¹, and J. Petite¹, ¹North Carolina State University, Raleigh, ²Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

Chickens do not possess the necessary enzymes to efficiently hydrolyze lactose into glucose and galactose. The bacterial enzyme beta-galactosidase can convert lactose into glucose and galactose. Transgenic chickens that carry the E. coli lacZ gene and express beta-galactosidase could potentially employ lactose as an energy source. The objective of this study was to determine the ability of the small intestinal mucosa from transgenic chickens to hydrolyze lactose into glucose and galactose. Lactase activity was examined in the intestinal mucosa from wild-type chickens and two lines of chickens that carry the lacZ gene and express beta-galactosidase. Lactase activity was significantly ($P < 0.05$) higher in both transgenic lines compared to wild-type birds. The presence of the beta-galactosidase enzyme was revealed via X-gal staining in the intestine of transgenic chickens, while it was not present in the wild-type chickens. Overall, it appears that inserting the lacZ gene, which encodes beta-galactosidase has resulted in a chicken that can utilize lactose as an energy source. This study demonstrates that transgenic technology can be used to modify nutrient utilization in domestic poultry.

Key Words: LacZ, Lactase, Transgenic

nure, due to a negative effect of either unsaturated or saturated oil on microbial activity in the intestine. Dietary oil was included at 45 g/kg, as either crude palm oil (PO), soya oil (SO) or a 50:50 PO:SO blend (OB), to a basal barley-soya-wheat diet (control) at the expense of dextrose and maize starch. Diets were formulated to contain 13.2 MJ DE/kg and 11.0 g/kg lysine. Four boars were assigned to each dietary treatment, and were transferred to metabolism crates (mean live weight, 74.0 kg ± 2.89) following 14 days dietary acclimation. Urine and feces were collected separately over a 5-day digestibility/nitrogen (N) balance period and a 2-day manure collection period. Inclusion of dietary oil increased apparent digestibility of oil ($P < 0.01$) and decreased the apparent digestibility of dry matter ($P < 0.01$) and gross energy ($P < 0.05$). Dietary oil did not affect the apparent nitrogen, acid detergent fibre, neutral detergent fibre or hemicellulose digestibility. Apparent digestibility of oil was lower when oil was included as PO compared to SO and OB ($P < 0.001$). The concentration of faecal volatile fatty acid (VFA) was similar in all treatments, although the acetic:propionic acid was lower when oil was included as PO and OB compared to SO ($P < 0.05$). N balance, manure N concentration and NH₃-N emission was not affected by oil inclusion or oil source. In conclusion, dietary oil inclusion reduced apparent dry matter and energy digestibilities, although no effect on fermentation was indicated by digestibility of fibre or faecal VFA content. Consequently, ammonia emission was not affected by dietary oil included at 45 g/kg.

Key Words: Pigs, Oil, Ammonia

T33 Influence of lipid source in diets on the performance, meat quality and lipid profile for finishing pigs. R. V. de Sousa¹, E. T. Fialho*¹, J. A. F. Lima¹, P. V. R. Logato¹, and J. I. A. Leite², ¹University Federal of Lavras - UFLA- Brazil, ²University Federal of Minas Gerais-UFMG-Brazil.

Two experiments were conducted to evaluate lipid sources for finishing pigs. Exp. 1 utilized a total of 44 barrows and 44 gilts (LD × LW; 68.5 ± 1.45 kg BW) while Exp. 2 used a total of 66 hybrid barrows (33 with 73.65 ± 1.56 kg initial BW and 33 with 88.50 ± 1.11 kg initial BW). The experiments were conducted to evaluate different sources of lipids at 2% (soybean oil, canola oil, linseed oil and commercial PUFA oil) in Exp. 1 and different levels (2.0, 2.5, 3.0 and 3.5%) of canola oil in Exp. 2 upon lipid metabolism, growth, carcass characteristics and meat quality. Experimental diets were isocaloric, isoprotein and isolysinic, and formulated with corn and soybean meal as base ingredients. There were no effects of sources and levels of canola oil tested on the performance. However, lean meat percentage and longissimus muscle area was improved ($P<0.01$) by the addition of 2% linseed oil in the diet. The pigs fed diets with linseed and canola oil had higher content of protein and ash in longissimus muscle in comparison with those fed diets with