

Monday, January 23
Nutrition I
Room: B313

S-M16 Commercial levels of SAA could be underestimated for modern broiler strains. L. Rubin, A.M.L. Ribeiro*, C.W. Canal, A.M. Kessler, L.R. Kratz, and A.P. Santos, *Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.*

Immunoregulatory actions have been suggested for a variety of nutrients. However, reports of immunonutritional interactions in broilers fed practical diets are limited to a few published experiments. Methionine is the first limiting amino acid for poultry and because it has widespread functions, beyond muscle accretion, it could play an important role in challenged broilers. The present trial aimed to test if there is an optimum level of digestible sulphur amino acids for immunological effects. The immune stress included a strong vaccination program, in order to simulate field conditions. Three levels of digestible sulphur amino acids (DSAA)–0.72; 0.82; 0.92 from 1 to 21-d and 0.65; 0.75; 0.85% from 22 to 42d of age–based on HMTBA supplementation and two vaccination schedules (VSA or VSB) were used. One-d-old Cobb male broilers, submitted to VSA were vaccinated against infectious bronchitis, Marek's disease and Avian Pox. On the 14th day, this group was vaccinated against Gumboro. The VSB was a positive control without vaccination. Freund's adjuvant was injected at 28 d of age, in a 0.5mL dose, intramuscularly, in all treatments. At 40d of age 0.1 mL of avian tuberculin was injected in one wattle and 24 h later a qualitative analysis was done measuring its diameter. It was assumed that HMTBA contained 88% of methionine. The experiment was statistically analyzed as a 3x2 factorial with 6 treatments and 6 replicates. No interactions between DSAA and VS were observed. Birds receiving 0.92/0.85% DSAA had greater weight gain (WG) at 42d. Poorest feed conversion was seen for 0.72/0.65% DSAA diets. Vaccinated birds showed lower WG and feed intake until 21 days of age. At 28d of age, no more differences in performance were observed between VS groups. No differences in wattle diameter were seen across DSAA levels or VS. The results show that commercial levels of SAA could be underestimated for modern broiler strains.

Key Words: 2-hydroxy-4-methylthio butanoic acid, immunological stimulus, broilers

S-M17 Methionine sources, sodium and potassium levels impact broilers performance under Brazilian summer conditions. A.M.L. Ribeiro*, A.M. Kessler, T.H. Viola, I.C.M. Silva, L. Rubin, M. Raber, and L.F. Lecknieski, *Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.*

Considerable controversy exists concerning the relative efficacies of DL-methionine (DLM) and 2-hydroxy-4-methyl thio butanoic acid (HMTBA). The composition of the diet may influence their relative efficacies. Sodium (Na) and potassium (K) play a major role in maintaining acid-base balance in the body and could influence methionine (Met) usage. Two experiments (EXP) were conducted to study three Na levels (0.15;0.20;0.25/0.12;0.17;0.22% from 7 to 21 and 21 to 49 days) and two Met sources (DLM and HMTBA) at 0.84/0.75% of digestible TSAA (EXP1) and three K levels (0.9;1.0;1.1/0.8;0.9;1.0% from 8 to 21 days and 22 to 49d) and same Met sources and levels (EXP2), added equimolar. In EXP1 vegetal diets (corn-soy) were used and in EXP2, meat and bone meal was included in order to achieve lower levels of K.

Both EXPs were performed under Brazilian summer conditions. The EXPs were analyzed as a 3x2 factorial, 6 treatments, 7 replicates. In EXP1, no significant interactions between Met sources and Na levels were found. A positive response for HMTBA, compared to DLM, was found across Na levels for weight gain (WG) (P=0.05) and feed conversion (FC) (P=0.02) at 49 days. Regarding Na, there was no response for WG and feed intake (FI), but birds fed the higher levels had the best FC (P=0.03). The idea that vegetable diets can lead to feathering problems, because of lower cystine level in feed was not evidenced in this trial. Also, Met sources did not influence feathering. In EXP2, K levels showed a consistent interaction with Met sources for FI: the highest level of K showed greater FI in HMTBA birds, but such effect was not seen when DLM was used. The highest FI was not followed by greater WG. In the starter period (7 to 21d), the lowest K level also resulted in better FC for HMTBA birds. From 8 to 49 days, low and intermediate K levels resulted in better FC (P=0.03) compared to higher K levels. No differences in litter humidity were observed among K levels. HMTBA used in equimolar amount to DLM resulted in equal bird performance.

Key Words: methionine, 2-hydroxy-4-methylthio butanoic acid, broilers, heat stress

S-M18 Influence of phytase and glucanase of the ileal digestible energy of corn and soybean meal independently. M. Leslie*¹, E. Moran¹, and M. Bedford², ¹*Auburn University, Auburn, Alabama,* ²*Syngenta Animal Health, Beckhampton, United Kingdom.*

Efficient use of exogenous enzymes requires accurate determination of their influence on energy availability. A trial was performed to determine the effect of a glucanase and phytase on the live performance and ileal digestible energy (IDE) of corn and soybean meal (SBM). A 2x2x2 factorial use either 0 or 500 FTU phytase, 0 or 500 units glucanase activity with diets composed entirely of either corn or SBM. Feedstuffs were pelleted prior to the addition of the enzymes. Treatments were imposed over three age ranges: 7 to 9 days of age representing an immature GIT (phase 1), 14 to 16 days representing a transitional GIT (phase 2), and 21 to 23 days representing a developed GIT (phase 3). Each treatment was represented by six replicates of 10 broilers at each age. Contents of the duodenum and pancreas were also removed and analyzed for amylase and trypsin activity in order to determine the influence of practical levels of phytate on these enzymes. During phases 1 and 2, birds fed SBM alone had higher BW gain and lower feed intake compared to those fed corn, resulting in a lower feed conversion. Phytase improved feed intake of corn diets and feed conversion with SBM during phase 2, while reducing feed intake in SBM diets during phase 1. Glucanase reduce feed intake only in SBM diets during phase 3. Phytase supplementation had no effect on IDE at any age regardless of feedstuff, but improved DM digestibility only in corn during phase 3. Glucanase supplementation improved IDE of both corn and SBM at all ages between 2.4 and 7.2%. Glucanase also improved DM digestibility of corn by 3.1 to 4.7% during all phases, and SBM diets by 5.6% in SBM in phase 2. There was no consistent effect of either enzyme on amylase or trypsin activities of either pancreas or duodenal digesta to suggest that practical levels of phytate do not inhibit enzyme activity. While phytase

supplementation did not influence the available energy in corn or soybean meal, the glucanase improved IDE in both feedstuffs.

Key Words: broilers, phytase, glucanase, ileal digestible energy, enzymes

S-M19 Effect of xylanase or phytase alone or in combination on the growth performance and nutrient digestibility of chicks.

O.A. Olukosi^{*1}, A.J. Cowieson², and O. Adeola¹, ¹*Purdue University, West Lafayette, Indiana*, ²*Danisco Animal Nutrition, Wiltshire, United Kingdom*.

The effect of adding xylanase or *Escherichia coli*-derived phytase (ECP) alone or in combination on growth performance and nutrient digestibility of chicks receiving corn-soybean based diet was investigated. Six hundred day-old chicks were randomly allocated to 5 dietary treatments. The treatments were: positive control with supplemental inorganic P (PC), negative control (NC) with low levels of P and energy, NC plus xylanase added at 650 U/kg, NC plus ECP added at 1,000 FTU/kg, and NC plus xylanase added at 650 U/kg and ECP added at 1,000 FTU/kg. Digestibility data for week 1 are presented. Low energy and P in the NC depressed weight gain and feed:gain ($P < 0.001$). Xylanase alone did not affect performance. Chicks fed diet supplemented with ECP had higher body weight and weight gain ($P < 0.001$). Chicks receiving supplemental ECP and xylanase also had higher ($P = 0.001$) weight gain and feed:gain than NC. The treatments had no effect on the DM and energy digestibility. Phosphorus digestibility was higher in PC than the NC. Xylanase alone increased P digestibility to a level similar to the PC ($P < 0.001$). Phytase alone further increased ($P < 0.001$) P digestibility to a level higher than in the PC. Combination of xylanase and phytase increased ($P < 0.001$) P digestibility above the PC but not as high as when phytase alone was added to the diet. Phytase alone, or combined with xylanase increased Ca digestibility ($P < 0.001$). In conclusion, combination of phytase and xylanase improved the performance of chicks, but it is likely that the improvement comes from the effect of phytase. Apparent total tract digestibility of P in one-week old chicks was improved with the combination of phytase and xylanase. The P digestibility data suggest an interaction of xylanase with phytase and a possibility that the improvement seen when combination of xylanase and phytase are added to the diet was from phytase.

Key Words: chicks, digestibility, growth performance, phytase, xylanase

S-M20 Feeding of unground pearl millet to laying hens. N.M. Dale and A.R. Garcia^{*}, *University of Georgia, Athens*.

Pearl millet has gained increased interest as an alternative feed ingredient for poultry. While having approximately the same metabolizable energy as yellow corn, pearl millet has a substantially higher level of protein (11-12%), and a far higher level of lysine (0.38-0.41%). A major impediment to the use of pearl millet is that most feed mills do not have more than one post-grinding storage bin. Previous studies with broilers indicated that it is not necessary to grind millet prior to incorporation into mixed feeds. Three studies were conducted to investigate whether unground pearl millet is also a satisfactory feed ingredient for laying hens. In the first study, 5, 10, 20, 30, or 40% whole millet was incorporated into practical laying hen rations. After a 7 day acclimation period, for a period of 24 hours feed intake was measured and excreta quantitatively collected and screened under a light water spray for the presence of whole millet. In all treatments, the disappearance of whole millet

exceeded 98%. In the second study, starch digestibility was determined in diets containing 15% of either ground or whole millet. Digestibility of starch was slightly, but significantly, improved when whole millet was incorporated into the diet. This suggests that intact millet grains may enhance gizzard function. A third study measured relative feed intake over 4 weeks when 10% millet was incorporated into the feed in either whole or ground form. After the first week acclimation period, no differences in feed intake were detected. While the number of hens used per treatment (48) was limited, a consistent improvement was noted in egg production in groups receiving whole as opposed to ground millet. It is concluded that unground, whole millet is a satisfactory feed ingredient for laying hens.

Key Words: pearl millet, starch, digestibility, whole grain

S-M21 Evaluation of pearl millet in combination with flaxseed in laying hen diets. K. Amini^{*} and C. Ruiz-Feria, *McGill University, Ste-Anne-de-Bellevue, QC, Canada*.

An experiment was carried out to evaluate Canadian Pearl Millet (PM) in combination with flaxseed (FS) in laying hen diets. Six different diet treatments were used for seven weeks, with 24 White Leghorns per treatment (three birds per cage, eight cage replicates). Control diet (treatment 1) was a Corn-Soybean meal diet. Treatments 2, 3, 4, 5 and 6 contained 2, 4, 8 and 12 percent of flaxseed respectively with decreasing inclusion levels of Pearl Millet without any inclusion of corn. All control and experimental diets were formulated to be isocaloric and isonitrogenous (2750 kcal AME/kg and 16% CP). Five eggs were randomly collected from each group by the end of each week, and the egg-related traits (average egg weight, shell weight, yolk weight, albumen weight, shell thickness) were recorded. Body weight of the birds and feed consumption were recorded weekly, and number of eggs and egg mass produced were recorded on a daily basis. Yolk pigmentation was scored using Roche color fan. The flock performance results including number of eggs per bird per day, egg mass produced per bird per day, feed conversion ratio and feed consumption per bird per day were calculated using the data collected from flock. At the end of the experiment, all the hens were euthanized to determine liver integrity. Data were analyzed using one way analysis of variance (SigmaStat). Egg and flock performance parameters were not statistically different among treatments ($P = 0.05$) except at week five, where birds fed treatment diet 6 produced eggs significantly smaller than hens fed diet treatment 2 and 3. Yolk pigmentation scores were consistently lowest for the PM and PM+2%FS diets (1.60 ± 0.24 and 1.80 ± 0.20 respectively), but increased with higher levels of FS (2.75 ± 0.47 for PM+12%FS diet) although did not reach control levels (6.00 ± 0.01). No significant difference ($P = 0.05$) was observed between diets in regard to liver hemorrhage. Further research is being conducted to evaluate fatty acid profiles of eggs produced using PM and low levels of FS.

Key Words: White Leghorns, pearl millet, flaxseed, flock performance, liver hemorrhage

S-M22 The effect of dietary source and concentration of copper on growth, tissue concentrations and copper excretion in broilers. C.R. Schnek^{*}, J.H. Skaggs, M.E. Persia, and W.W. Saylor, *University of Delaware, Newark*.

An experiment was conducted to determine the effect of Cu source and concentration in a corn-SBM diet fed to straight-run broiler chicks from

1-35d. Diet treatments were: 1) BAS: basal diet (no added Cu) 2) 25IN: basal + 25 mg/kg inorganic Cu ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) 3) 25OR: basal + 25 mg/kg organic Cu (Bioplex™ Cu 10%) 4) 250IN: basal + 250 mg/kg inorganic Cu; and 5) 250OR: basal + 250 mg/kg organic Cu. Two hundred 1-day-old chicks (Ross 308) were assigned to one of the five diets, 8 pens of five chicks per diet until d 7 when numbers, were reduced to 4 birds/pen. On d 21, birds were moved to grower batteries; two replicate pens per treatment were combined into one grower pen of 8 birds/pen until d 35. Performance data were collected on d 7, 21, and 35. On d 35 plasma, liver, and duodenal mucosa were collected for mineral analysis. Excreta were collected on d 8-21 and d 29-35 for total and water soluble mineral analysis. Body weight gain for birds fed 250OR averaged 38% lower ($P < .05$) at 21 and 35 d of age than that of birds fed the other diets. Liver and mucosa Cu in 250OR birds increased 7-fold ($P < .001$) and plasma Cu increased 1.5 fold ($P < .01$) above that of birds fed BAS or diets with lower Cu additions. Birds fed 250IN had liver, mucosa and plasma concentrations intermediate to, but not different from, those fed 250OR and the other diets. At 21 d, total Cu in excreta from birds fed 250IN and 250OR was increased ($P < .001$) 6- and 10-fold, respectively, over that of the other diets, while soluble Cu increased ($P < .05$) only 2.5-fold in birds fed the 250-supplemented diets compared to the others, regardless of source. By 35 d, total excreta Cu from birds fed 250IN and 250OR was increased ($P < .001$) 25- and 37-fold, respectively, over that of BAS. In this study high diet Cu fed as an OR form caused severe growth depression not observed in those fed the same concentration as an IN salt. While feed intake was reduced in birds fed 250OR, the reduction did not account fully for the reduction in weight gain.

Key Words: broiler, copper, liver, mucosa, excreta

S-M23 PrimaLac®, direct fed microbial supplement, decreases energy expenditures in young broilers. M. Chichlowski*, J. Croom, M. Koci, G. Davis, and L. Daniel, *North Carolina State University, Raleigh.*

A direct-fed microbial (DFM) is a live-microbial food supplement that improves health and performance, in broilers and other animals, by enhancing intestinal health. No studies have described their effects on whole-animal and intestinal metabolism as expressed by O_2 consumption. This study investigated whole-body O_2 consumption, intestinal O_2 consumption and intestinal mucosal cytokine production on broiler chicks fed the DFM, PrimaLac®. One hundred and eight, 1 day-old broiler chicks were randomly assigned to one of three experimental diets: standard pullet diet (control;SPD); SPD+salinomycin (SPDS), and SPD+ PrimaLac® (SPDP). Birds were housed in two separate rooms, the SPD and SPDS treatments in one room and the SPDP in another. Water and feed were provided ad libitum and body weights and feed intakes recorded. Intact ileal and cecal samples were collected on days 19, 20, and 21 after whole-body oxygen measurements using indirect calorimetry. O_2 uptake of ileal tissue was measured using an in vitro O_2 probe. Analysis of immune status of chicken broilers was measured by the relative differences in mRNA of both pro- and anti-inflammatory cytokines: IL-1beta, IL-6, and IL-10 using Real-Time RT-PCR. Ileal tissue was sampled for examination by scanning electron microscopy (SEM) and digesta samples from the jejunum, ileum and cecum were frozen for subsequent bacterial fermentation product analyses. Broilers exhibited a 6-16% decrease in whole-body energy expenditures ($p < 0.05$) and a 47-55% decrease ($p < 0.05$) in ileal energy expenditures. RT-PCR data demonstrated that this DFM consortium decreased both pro- and anti-inflammatory cytokines within the ileum of day-19 post-hatch broilers. Preliminary SEM indicate that bacterial components of

PrimaLac® colonize ileal crypts and the surfaces of ileal, villi goblet cells. These data suggest the direct-fed microbial, PrimaLac®, increases metabolic efficiency via changes in intestinal physiology and whole-body metabolism.

Key Words: direct fed microbial, energetics, cytokines, broilers

S-M24 Plant phenolics (lignin) and prebiotics (biomos) as alternatives to antibiotics in poultry production. B. Baurhoo*, C.A. Ruiz-Feria, and L. Phillip, *McGill University, Ste Anne de Bellevue, QB, Canada.*

Sub-therapeutic antibiotics in poultry feed are under scrutiny due to potential development of antibiotic resistance of pathogenic bacteria in humans. The objective of this experiment was to evaluate AlCell Lignin and BioMos using antibiotic free feeds on flock health and productivity. Growth performance, feed efficiency, gut and litter pH and gut development were assessed.

800 day-old male Cobb 500 broilers were raised under a Completely Randomised Design with 5 treatments replicated 4 times. A basal isoenergetic (ME Starter = 3150 KCal/kg and Grower = 3200 Kcal/kg) and isoproteinic (CP Starter = 22.5% and Grower = 20.0%) diet was used. Five dietary treatments (DT) were used: DT1: basal + antibiotic (11 mg/kg virginiamycin); DT2: basal only; DT3: basal + 1.25% Lignin; DT4: basal + 2.5% Lignin; and DT5: basal + 0.01% BioMos. Results were analysed by one way ANOVA using Sigma Stat. Birds grown on DT2 had higher BW at day 42 (3047.45 ± 43.48 g; $P < 0.05$) compared to the other DT. However, BW was not statistically different among other DT. At day 21, cumulative feed intake was not statistically different (mean = 2415.67g) among DT. However, birds on DT 2 had higher FI than others (5107.12 ± 100.63 g $P < 0.05$) at day 42. Feed Conversion Ratio (mean = 1.66) was not statistically different among DT at day 42. Similarly, tissue mass of duodenum (mean = 4.12g), jejunum (mean = 11.45g), ileum (mean = 12.19g) and caeca (mean = 4.18g) were not different at day 42, as a measure of trophic effect due to DT. Digesta pH in duodenum (mean = 6.25), jejunum (mean = 6.175), ileum (mean = 6.98) and caeca (mean = 6.77) were not different. Hence, indication of putrifying bacteria suppression due to DT were comparable. No difference was found in litter pH among DT (mean = 8.0) at day 42. Further research is being carried out determining microbial load (Lactobacilli, Bifidobacteria, E.Coli and Salmonella) in caecal digesta, VFA levels in jejunum digesta and histology of jejunum.

Under the research conditions, birds grown on antibiotic free DT had comparable performance than birds grown on commercial diet with antibiotic.

Key Words: Alcell Lignin, BioMos, antibiotics, prebiotics, gut

S-M25 Growth performance and organ weights of broiler chickens fed a yeast beta-glucan. K. Budgell* and B. Rathgeber, *Nova Scotia Agricultural College, Truro, NS, Canada.*

Growth promoting antibiotics have traditionally been included in broiler chicken diets to improve broiler health and growth performance. Concerns over the development of antibiotic resistant strains of bacteria generated by animal agriculture have lead to development of numerous alternatives to these feed ingredients. A yeast beta-glucan (YBG) prod-

uct marketed as a potential replacement for antibiotics in broiler diets has shown promise. The mode of action of this product has been suggested to involve stimulation of the bird's immune system. The objective of this study was to determine the impact of this YBG on immune system components and evaluate it as a replacement for antibiotics. Three trials were conducted with 912 day-old chicks for each trial. Chicks were randomly assigned to 24 pens (38 birds /pen) and one of three dietary treatments, which were no growth promotant (control), YBG or virginiamycin. Starter YBG diets contained 40g/tonne YBG and the grower and finisher diets contained 20g/tonne. The birds were fed starter from 0 to 14 days (d), grower from 14 to 24 days and finisher from 24 to 38 days. All birds were manually weighed on days 0, 14, 24, and 38 and feed consumed was monitored throughout the study. At 14 and 38 days of age, 48 broilers (2/pen) were euthanized and the spleen and bursa of Fabricius removed and weighed. Blood samples from 21 and 35 days of age were fixed to slides for differential staining. Organ weights as a proportion of body weight and white blood cell counts were not different between treatment groups. The feed efficiency for each dietary treatments were not different throughout the rearing period. Birds given antibiotics were larger (818g) than birds given YBG (771g) and controls (752g) by day 24. However, by day 38 the birds given YBG were no longer smaller (1987g) than the antibiotic group (2009g). The control birds had lower body weights (1934g; $p > 0.05$) than the other two treatments at the end of the growth period. These results indicate that this YBG is as effective in promoting growth of broiler chickens as a commonly used antibiotic.

Key Words: broiler chickens, yeast beta-glucan, growth performance, organ weights, antibiotic

S-M26 The efficacy of Quantum phytase in a 40 week production trial using White Leghorn laying hens fed corn-soybean meal based diets. A.L. Hughes^{*1}, H.L. Classen¹, and C.L. Wyatt², ¹*University of Saskatchewan, Saskatoon, SK, Canada*, ²*Syngenta Animal Nutrition, North Carolina*.

Microbial phytase is now the prominent feed enzyme used in animal diets but there is relatively little information on its use in laying hen diets. In this experiment, Quantum phytase (Syngenta Animal Nutrition) was evaluated for its efficacy in a 40 week laying hen production trial. A total of 1,080 hens of two White Leghorn strains (540 Shaver White, 540 Bovan) were fed mash corn-soybean meal based diets containing 0.35% (positive control, PC), 0.25% (negative control, NC1) or 0.15% (NC2) available phosphorus. Phytase was added to NC1 and NC2 diets at 200, 400 and 600 U/kg. Each dietary treatment x strain subclass was replicated four times with five adjoining cages per replicate (three hens per cage) in a randomized complete block design. Production performance was measured from 21 to 61 wks of age. Only minor differences in production characteristics were found between the PC and NC1 treatments regardless of phytase addition, indicating that 0.25% AP resulted in P intake that was at or above the hen's requirement. In contrast, egg production, feed to egg mass ratio, egg quality (% soft shelled, % cracked and % broken eggs) and mortality were significantly poorer for the NC2 hens in contrast to the PC treatment. Addition of phytase to the NC2 diet improved these production characteristics to levels equal or better than the PC. These results indicate that Quantum phytase is efficacious in corn-soybean diets fed to White Leghorn laying hens and can be used to reduce or eliminate diet supplementation with inorganic phosphorus.

Key Words: phytase, efficacy, laying hens, production performance, phosphorus

S-M27 The effect of dietary phosphorus level and phytase supplementation on growth performance, bone breaking strength, and phosphorus excretion in broilers. S. Powell^{*}, S. Johnston, L. Gaston, and L. Southern, *Louisiana State University Agricultural Center, Baton Rouge*.

The objective of this research was to determine the effects of feeding different nonphytate P (nPP) levels with and without phytase (PHY) supplementation on broiler growth performance, bone breaking strength (BBS), and P excretion. An experiment with 4 trials was conducted with Ross x Ross straight run broilers. For each trial, 1,960 broilers were allotted on d 0 to 4 treatments with 7 pens per treatment and 70 broilers per pen. The broilers were fed a 4 phase feeding program consisting of starter (0 to 14 d), grower (14 to 32 d), finisher (32 to 41 d), and withdrawal (41 to 50 d) periods. For each trial, the same pen was used continuously for each treatment/replication combination, and the litter was not removed between trials. Broilers were fed a control diet (0.43, 0.40, 0.36, or 0.32% nPP in the starter, grower, finisher, and withdrawal phases, respectively), a low Ca and P (LCaP) diet with a 0.05 % reduction in nPP in each phase (Ca:P maintained), and these two diets supplemented with 600 PHY units/kg (nPP was reduced by 0.10% in diets with PHY). Diet did not affect ($P > 0.10$) broiler growth performance in the starter or withdrawal phases. Generally, both PHY addition and the LCaP diet decreased some aspects of growth performance during the grower and finisher phases. There was no main effect of PHY on BBS, but BBS was decreased in the broilers fed the LCaP diet with PHY addition (nPP x Phy, $P < 0.01$) in the grower phase, and BBS was decreased in the finisher ($P < 0.02$) and withdrawal ($P < 0.01$) phases for broilers fed the LCaP diet. Total P (TP), soluble P (SP), and reactive soluble P (RSP) were decreased ($P < 0.04$) in litter of broilers fed the LCaP diet. Total P was decreased ($P < 0.01$) in litter of broilers fed PHY, but SP and RSP were not affected ($P > 0.1$) by PHY. These data indicate that PHY supplementation at 600 FTU/kg reduces growth during some phases, and that PHY reduces total P but not soluble P in litter.

Key Words: broiler, phytase, phosphorus, excrete

S-M28 Evaluation of the efficacy of high levels of a microbial 6-phytase on broiler performance, bone ash, and litter phosphorus. C. Walk^{*1}, D. Ledoux¹, J. Broomhead¹, E. Guaiume¹, and I. Kühn², ¹*University of Missouri, Columbia*, ²*AB Enzymes GmbH, Darmstadt, Germany*.

An experiment was conducted to evaluate the efficacy of high levels of microbial phytase on broiler performance, bone ash, and litter phosphorus. Seven hundred 1-day old male broilers were weighed, wing-banded, and randomly assigned to dietary treatments in floor pens. Dietary treatments for the first 3 weeks consisted of (1) positive control NRC diet (0.45% npP and 1.00% Ca), (2) industry standard diet with 500 PPU/kg phytase (0.35% npP and 0.90% Ca), (3) negative control basal diet (0.20% npP and 0.85% Ca), (4) 3 + 250 PPU/kg phytase, (5) 3 + 500 PPU/kg phytase, (6) 3 + 10,000 PPU/kg phytase, and (7) 3 + 20,000 PPU/kg phytase. From 4 to 6 weeks, the Ca and npP levels were reduced by 0.1% in diets 1 and 2, and Ca was decreased by 0.05% in diet 3. Supplemental phytase levels were identical to the starter period. Chicks fed diets 1 and 2 had similar ($P > .05$) growth performance, whereas chicks fed diet 3 had lower ($P < .05$) feed intake (FI) and body weight gain (BWG) compared with all other dietary treatments. FI, BWG, and tibia ash increased ($P < .05$) with phytase supplementation and birds fed the two highest levels of phytase (diets 6 and 7) had FI, BWG, and tibia ash equivalent to the positive control and industry

standard diets (diets 1 and 2, respectively). Litter P was significantly lower ($P < .05$) for all treatments, compared to treatment 1. Birds fed diets 3, 6, and 7 had significantly lower litter P ($P < .05$) compared to all other diets, with diets 6 and 7 having a litter P of 0.73% and 0.74%, respectively, compared to 1.56% for diet 1. Phytase addition to industry standards led to the same growth performance as the positive control diet. Phytase was effective in improving phytate P utilization, and this improvement occurred even at the lowest level (250 PPU/kg) of supplemental phytase.

Key Words: phytase, broilers, floor pens, litter phosphorus

S-M29 Effect of dietary non-phytate phosphorus concentration and phytase source on production traits of Hy-line W98 laying hens. D.M. Karcher^{*1}, C.L. Wyatt², and T.J. Applegate¹, ¹*Purdue University, West Lafayette, Indiana*, ²*Syngenta Animal Nutrition Inc., Research Triangle Park, North Carolina*.

An experiment evaluated the effect of dietary non-phytate phosphorus (NPP) concentration and two phytase sources on production traits in laying hens over a 44 wk period. The experiment was conducted with W-98 Hy-line hens from 23 wk of age with two birds/cage (780²/hen). Ten experimental diets were formulated using a corn-soy meal basal with NPP concentrations of 0.16, 0.24, 0.32, and 0.40%. The 0.4% NPP was the positive control (PC) diet, while the other NPP concentrations consisted of a negative control (NC) without phytase, Quantum™ Phytase (QP; 200 U/kg), or Natuphos™ Phytase (NP; 400 U/kg). Each experimental diet was fed to 15 pens (average BW = 1.55 kg/bird). Birds were fed ad libitum from 23 to 43 wk of age and restricted to 100 g/bird (average BW = 1.74 kg) from 43 to 67 wk of age. Production traits of egg weight (EW), specific gravity (SG), BW, percent shell (PS), egg production (EP), and feed consumption (FC) were measured monthly. At 67 wk of age, the left femur and tibia were collected from each bird for determination of ash content. The EP of hens fed the PC was 7.15 and 18.17 %-unit greater than from hens fed the 0.16 % NPP NC at wk 43 and 63 wk of age, respectively ($P = 0.05$) resulting in 18 less eggs. Dietary NPP and phytase did not affect SG, EW, and PS at 43 and 63 wk of age. The tibia and femur ash weight and percent ash indicate the PC ($P = 0.05$) was significantly different from 0.24 NC, 0.16 NC, and 0.16 QP at 67 wk of age. No significant differences were noted for bone ash from hens fed either phytase, but both phytases were different ($P = 0.05$) from each NC. Within hens fed the NC diets, the tibia and femur ash from hens fed 0.32% NPP were greater than those fed 0.16 % NPP but not 0.24% NPP ($P = 0.05$). Therefore, the data strongly indicates the

concentration of NPP will affect EP and bone ash of laying hens over a 44 wk lay period with 0.16% NPP being less than birds fed the 0.40% NPP diet. The response to phytase was similar, though QP inclusion was lower.

Key Words: laying hen, phosphorus, phytase

S-M30 Effects of thyroxine-based molting treatments on performance of Bovan White Leghorn laying hens during a first molt and to peak egg production. P.D. Bass^{*1}, D.M. Hooze², and E.A. Koutsos¹, ¹*California Polytechnic State University, San Luis Obispo*, ²*Hooze Consulting Service, Eagle Mountain, Utah*.

The effects of several thyroxine-based molting treatments were compared to feed withdrawal (FWD) to induce a first molt in Bovan White Leghorns. Hens were housed in a two-story environmentally controlled commercial style facility. In a completely randomized design (n=15 hens/rep; 6 reps/treatment; 64 in2/bird), the FWD treatment was compared to five alternative molting diets; birds were fed a basal diet (2750 kcal/kg; 11% CP) plus either 40 mg thyroxine/kg (HT), 20 mg thyroxine/kg (LT), 40 mg thyroxine from thyroactive iodinated casein/kg (TIC), 40 mg TIC + 1000 mg Mg/kg (TIC+Mg), or 40 mg TIC + 1.86 g Na-salicylate/kg (TIC+Sal). Birds (except FWD) were offered 100 g feed/b*day until egg production reached 0%. Then, all birds were offered 1st (20 d) and 2nd post-molt (26 d) diets, and peaking diet. Egg production reached 0% for all treatments, but the FWD treatment reached 0% egg production more quickly than other treatments ($P < 0.01$), and FWD birds had significantly reduced body weights compared to all other treatments ($P < 0.01$). Body weight gains during the 1st post molt period were greater for birds on FWD, such that body weights of FWD were greater than all other treatments ($P < 0.01$). Shell thickness of eggs laid during the molt period tended to be affected by treatment ($P = 0.06$) and was greater for LT, TIC, TIC+Mg, and TIC+Sal vs. FWD ($P < 0.05$ for each). Also, during the molt period, iodine in eggs was reduced from birds fed HT or LT compared to FWD birds ($P < 0.01$). When hens reached 50% production, egg weights tended to be affected by treatment ($P = 0.10$), and were greater for birds fed HT or TIC+Sal compared to FWD ($P < 0.05$ for each), whereas shell thickness was reduced in birds fed TIC+Mg compared to FWD ($P < 0.01$). Data demonstrate that thyroxine-based supplementation can be an effective substitute for conventional feed withdrawal for molt induction in Bovan White Leghorns without dramatic body weight losses.

Key Words: molt, thyroxine, laying hen, egg production