The present study is conducted to determine the effect of cysteine protease to reduce use of soybean meal and improve performance of Kadaknath birds. The indigenous Kadaknath breed is well known in India for its characteristic black beak, feathers, comb, and shanks, and for its delicious black flesh. The bird is very popular due to its aphrodisiac properties, adaptability to local environment, resistance to certain diseases, meat quality, and many other criteria specific to the breed type. It has been neglected commercially because of its poor production potential. In an experiment lasting 12 wk, 100 day-old Kadaknath broiler chicks were randomly divided into 5 treatment groups with 4 replicates under completely randomized complete block design. Experimental diets for pre-starter, starter, and finisher birds consisted of maize, soybean meal, and feed additives. One of the 2 diets was supplemented with cysteine protease (130,000 PU/gm) at level of 250 g per ton with 5% reduction of crude protein, lysine, and methionine. The metabolizable energy was reduced at the level of 50 kcal/kg of diet to meet the requirement of the birds as per BIS (2007). Approximately 20 kg of soybean meal (45% CP) was reduced in the cysteine protease supplemented diet per ton. The feed intake was significantly ($P < 0.05$) lower in the cysteine protease supplemented group. The body weight gain and FCR were statistically similar in both groups. Profitability was significantly ($P < 0.05$) higher in the cysteine protease group due to reduction of soybean meal in the diet. In the above study, it was concluded that cysteine protease is an economic enzyme to improve performance of birds and fulfill scarcity of high protein ingredients such as soybean meal.

**Key Words:** cysteine protease, Kadaknath, enzyme, soybean meal, profitability

This study was planned to probe the effect of different proteases with varied pH (acid, neutral) range on performance, nutrient digestibility and carcass response in broilers fed poultry by-product meal-based diets. The dose rate for enzymes in the diet was 80, 160 and 120 g per ton for acid, neutral and combination (50:50), respectively. The birds (n = 200) were divided into 5 treatment groups with 4 replicates under completely randomized design. Five isoenergetic and isonitrogenous diets (ME 2850; CP 20) were formulated on digestible amino acid basis and fed to the experimental birds ad libitum from d 1 to 35. A corn-soybean meal based diet with no poultry by-product meal served as negative control (NC). All other diets including positive control (PC) contained poultry by-product meal at 3% level supplemented with acid (PC-A) or neutral proteases (PC-N) and or in combination (PC-C). Feed intake was not affected ($P > 0.05$) in any of the dietary treatments throughout the trial while body weight gain was significantly improved ($P < 0.05$) during d 1 to 35. Feed conversion ratio was improved ($P < 0.05$) by acid protease during starter phase (d 1–21) while it was improved significantly ($P < 0.05$) with diet containing combination of acid and neutral proteases from d 1 to 35. Apparent digestibility coefficient for nitrogen, AME, $N_{ret}$ and AMEn were significantly improved ($P < 0.05$) by combination of acid and neutral proteases. However, carcass traits remained unaffected ($P > 0.05$) in all the dietary treatments. It was noted that diet supplemented with combination of acid and neutral proteases resulted in better growth performance and nutrient digestibility as compared with diets supplemented with acid and neutral proteases individually.

**Key Words:** exogenous protease, broiler, growth performance, nutrient digestibility

**Evaluation of increasing levels of phytase in diets containing variable levels of amino acids on male broiler performance and processing yields.** Kyle A. Smith*, 1Austin T. Jasek1, Craig Wyatt2, and Jason T. Lee1, 1Texas A&M AgriLife Research, College Station, TX; 2AB Vista, Stilwell, KS.

The objective of the current study was to evaluate the influence of increasing levels of (super-dosing) phytase with 3 levels of amino acids (AA) on performance and breast yield. The experimental design was a randomized complete block with a 3 × 3 factorial of 3 levels of phytase at 500, 1,500, and 3,000 FTU/kg respectively, and 3 AA densities. The first level of AA density represented a typical industry diet that met breeder recommendations (100%) with a 5 (95%) and 10% (90%) reduction for a total of 9 treatments. Each treatment included 7 replicate pens with 45 Cobb 500 males placed per pen. The AA densities were formulated at 1.20, 1.14, and 1.08% digestible lysine in the starter diet for the 100, 95, and 90% diets respectively. The dietary program consisted of 3 phases including the starter through d 18, grower through d 30, and finisher through d 44. Broilers were weighed and feed consumption determined on d 18, 30 and 44. On d 45, 5 broilers per replicate pen were processed to determine breast, tender, abdominal fat pad and carcass yield. The inclusion of super-doses (1,500 and 3,000 FTU/kg) of phytase increased ($P < 0.05$) body weight (BW) at d 18; however, 3,000 FTU/kg was needed for significant separation on d 44 when compared with the 500 FTU/kg level. Similar responses were observed for feed conversion ratio (FCR) as both elevated levels of phytase improved FCR in the starter phase; however, 3,000 FTU/kg was needed to improve ($P < 0.05$) FCR in later stages of growth and from d 1 to 44. Inclusion of elevated levels of phytase increased ($P < 0.05$) breast yield compared with the 500 FTU/kg level. The reduced levels of AA (5 and 10%) decreased ($P < 0.05$) BW, BW gain, and FCR compared with the industry level AA treatments; while the 10% reduction in AA also reduced ($P < 0.05$) breast weight and yield and increased fat pad yield. Throughout the trial there were no significant interactions between levels of phytase and levels of AA; however, these data support the idea that “super-dosing” phytase can improve broiler performance and breast meat yield presumably through the elimination of over 90% of dietary phytate leading to improvements in nutrition retention.

**Key Words:** phytase, amino acid, broiler
28 Efficacy of a novel protease provided to broiler chicks in diets that vary in composition and degree of processing. Danielle A. Reese* and Joseph S. Moritz, West Virginia University, Morgantown, WV.

Exogenous enzymes added at the mixer should demonstrate activity post-pelleting and improve bird performance to justify use in the broiler industry. Past research has shown that diet substrate and the pelleting process can effect enzyme efficacy. The objective of the study was to evaluate the feeding value of a novel protease in unprocessed mash and pelleted diets that were composed of all vegetable protein or an inclusion of animal protein. Treatments were arranged in a 2 x 2 x 2 factorial within a randomized complete block design. Protease inclusion was either 0 or 2%. Diet composition was either all vegetable protein or an 8% porcine meal and bone meal inclusion. Diets were fed as unprocessed mash or ground pellets that were steam conditioned at 70°C and extruded through a 4 x 45 mm pellet die. Pellets were ground before feeding to eliminate potentially confounding feed form effects. All diets were formulated to be 85% of crude protein and digestible amino acid recommendations for young broilers. Dietary treatments were fed to 9 replicate raised wire cages of 8 straight-run Hubbard x Cobb broiler chicks for 21 d. Protease activity was confirmed post pelleting and expressed in tyrosine releasing units that compare the absorbance of tyrosine liberated by protease digested casein to a standard curve generated by a tyrosine dilution. Protease and degree of processing interacted to effect chick weight gain and feed conversion ratio (FCR) (P < 0.05). Protease applied to pelleted diets improved 21 d weight gain by 57g and decreased 21 d FCR by 0.07. Similar improvements were not observed in unprocessed mash diets. Linear contrasts clarified that protease applied to pelleted diets was most beneficial for all vegetable protein compositions (P < 0.05). Diet composition and degree of processing interacted to effect FCR (P < 0.05). Meat and bone meal inclusion increased feed conversion ratio in unprocessed mash diets but not pelleted diets. Protease efficacy was influenced by diet composition and degree of processing.

Key Words: protease, activity, pelleting, broiler, performance

29 Effects of dietary phytase on production, eggshell quality, and bone traits in laying hens from 55 to 74 weeks of age. Koonphol Pongmanee* and Douglas R. Korver, University of Alberta, Edmonton, AB, Canada.

Phosphorus and calcium are essential for bone health of laying hens late in production. Since little research has been done on phytase use in laying hens over 55 wk of age, the efficacy of an Escherichia coli 6-phytase was determined in laying hens from 55 to 74 wk. The experiment was a completely randomized design. Dietary treatments began at 1 d of age; results to 54 wk of age have been previously reported. At 55 wk of age, individually caged white egg layers (n = 172) remained on their respective treatments. The positive control (PC) diet in each phase was based on breeder management guide levels for available P (aP), Ca, and Na. The negative control (NC) diet for each phase was reduced by 0.15, 0.16, and 0.035% units for aP, Ca, and Na, respectively. Dietary treatments from 55 to 74 wk were PC (0.40% aP, 3.73% Ca, and 0.16% Na); NC (0.25% aP, 3.57% Ca, and 0.13% Na); and the NC plus either 300, 600, or 1,200 FTU phytase/kg feed. Body weight, feed intake, egg production, egg weight, eggshell weight, and eggshell quality were determined at 5 wk intervals. At 64 and 74 wk, the right femur was excised from 8 birds/treatment and bone breaking strength (BBS) and ash determined. Data were analyzed using the mixed procedure of SAS; differences were considered significant at P < 0.05. From 55 to 74 wk, there were no treatment effects on feed intake (112.0 ± 0.64 g), feed conversion ratio (1.45 ± 0.01 kg feed/dozen eggs), or egg production (92.24 ± 0.54%). At 74 wk, phytase did not affect egg specific gravity (1.0793 ± 0.0011) or eggshell breaking strength (3.34 ± 0.28 kgf). However, hens fed NC+1,200 had the highest egg mass (60.52 ± 0.78 g). BBS and bone ash in NC+600 hens were nearly significantly higher (P = 0.062) and higher (P = 0.031) than NC and NC+300 hens, respectively. Although low dietary aP and Ca did not have a profound effect on hen performance, phytase supplementation tended to increase bone quality in late production. Further reductions of dietary aP and Ca with phytase supplementation might still be possible.

Key Words: phosphorus, phytase, bone breaking strength, bone ash, laying hen

30 The efficacy of two phytases on inositol phosphate degradation in different segments of the gastrointestinal tract and bone quality of broilers. Abiodun Bello*1, Yueming Dersjant-Li2, and Douglas R. Korver1, 1Department of Agricultural, Food, and Nutritional Science, University of Alberta, Edmonton, AB, Canada, 2Danisco Animal Nutrition, DuPont Industrial Bioscience, Marlborough, United Kingdom.

The anti-nutritional (ANF) effects of various inositol phosphates (IP3-6) have been well recognized; IP6 is a much more potent ANF than the lower esters. The efficacy of Butiauxella sp. (BP) and Citrobacter sp. (CP) phytases were evaluated on IP6 concentration in the digesta of the proventriculus + gizzard (P+G) and distal ileum (DI), and IP6, DI disappearance (ID) at 22 d (n = 693) and bone quality at 8, 22, and 33 d (n = 126 per age) in broilers. Female Ross 308 broilers [n = 1,890 (30 birds x 7 diets x 9 replicates)] were fed corn-soy based diets. Treatments were nutritionally adequate positive control diet (PC), the PC with available P and Ca reduced by 0.146 and 0.134% units (NC1) or by 0.174 and 0.159% units (NC2); the NC1+BP or CP at 500 FTU/kg (NC1+BP500 and NC1+CP500); and the NC2+BP or CP at 1,000 FTU/kg (NC2+BP1000 and NC2+CP1000). A completely randomized experimental design was used; data were analyzed using Proc Mixed and means compared by LSD (SAS). Compared with the respective controls, NC2+BP1000 increased DI IP3 by 90% while each phytase treatment increased DI IP4 and decreased P+G and IP3 (P < 0.001). However, NC1+BP500 and NC2+BP1000 decreased P+G IP3 by 90% and 91%, respectively, and NC1+CP500 and NC2+CP1000 by 65 and 77%, respectively (P < 0.05). Also, DI IP3 was lowered by 46% for BP vs CP at 1,000 FTU/kg and by 29% at 500 FTU/kg (P < 0.05). Dietary BP at 1,000 FTU/kg more efficiently degraded phytate (IP6, IP5, and IP4) than at 500 FTU/kg. At d 33, NC2+BP1000 increased (P < 0.05) femur breaking strength and ash content vs NC2+CP1000 and controls. Hence, BP at 1,000 FTU/kg in broiler diets effectively reduced the ANF effects of IP esters, particularly IP6, to increase bioavailability of P and bone strength. Efficacy of phytase in liberating phytate-bound P depends on source and inclusion levels.

Key Words: broiler, Butiauxella sp. phytase, Citrobacter sp. phytase, inositol phosphates

31 Influence of a super-dose of a novel microbial phytase on growth performance and tibia ash in broilers raised under two light intensities. Maurice Frost*1, Karen D. Christensen1, and Craig Wyatt1, 1University of Arkansas, Fayetteville, AR, 2AB Vista, Stillwell, KS.

An experiment was conducted to evaluate the extra phosphoric effects of a microbial phytase on performance and tibia ash in broilers raised...
under 2 light intensities. Male Cobb 500 broilers (n = 2,304) were placed in 4 commercial houses with 24 pens per house using a randomized complete block design. Three experimental diets: control (C) a corn/soy diet with a phytase credit for minerals (lower AvP, Ca and Na), C+500 U/kg microbial phytase (C+500) and C+1500 U/kg microbial phytase (C+1500) were fed for 35 d. Body weights, feed intake and daily mortality were recorded. Cumbled starter diets were fed to 24 birds/pen (16 reps/treatment; 32 reps for main effect of phytase dose) to d 13. On d 13, birds and feed were weighed, 2 birds/pen were euthanized for collection of left tibias for ash. From d 13 to 35, pelleted grower diets were fed. On d 35, birds and feed were weighed and 2 birds/pen were euthanized for collection of left tibias for ash. Statistical analyses were performed with JMP 12. Throughout the trial, there was a main effect of light intensity affecting feed (FCR) conversion with birds exposed to high intensity having a significantly poorer FCR. At d 13, bird weights were higher in the C+1500 trt (P < 0.05) than the C+500 and C treatment and the weight of the C+500 was higher than the C (P < 0.05). At d 13, no differences in feed conversions (FC) was found, however, the C+1500 tibia ash was higher (P < 0.05) than C+500 and C. Also C+500 showed a higher (P < 0.05) tibia ash than C. At d 35, bird weights were higher in C+1500 than C+500 (P < 0.05) and C (P = 0.0001). Feed conversions were lower (P < 0.05) in C+1500 and C+500 than C. Tibia ash was higher (P < 0.05) in C+1500 and C+500 than C. Percent tibia ash by C+1500 was significantly higher at d 13 than C+500 and C, whereas, at d 35, % tibia ash showed no statistical difference between normal and super-dose of phytase. This may be attributed to a higher capacity of phosphorus deposition in the bone during the first days of life. The improvement in production parameters (FC and weight gain) with the super-dose of phytase may be attributed to phytate destruction beyond P.

Key Words: phytase, super-dose, lighting, bone ash

32 Evaluation of the effect of dietary fat inclusion on xylanase efficacy in broiler diets. Kyle D. Brown*1, Rocky E. Latham1, Omar Gutierrez2, and Jason T. Lee1, 1Texas AgriLife Research, College Station, TX, 2Huvepharma Inc., Peachtree City, GA.

An experiment was conducted to evaluate the effect of dietary fat inclusion on xylanase efficacy in reduced energy diets on male broiler growth performance. The experimental design included a 2 (fat inclusion) × 2 (xylanase inclusion) factorial with the inclusion of a reference diet representing an industry control diet (PC). The 2 diets varying in fat content were formulated on an iso-nitrogenous and iso-caloric basis with a 110 kcal/kg reduction in AME and a reduction of 2% in amino acids compared with the PC diet. The first of the reduced energy diets (NC1) was formulated with a maximum of 0.5% supplemental fat inclusion while the other reduced energy diet (NC2) was formulated with a minimum of 1.5% supplemental fat. Each treatment included 9 replicates with 53 broilers randomly placed per replicate (2,385 total chicks placed). The dietary program consisted of 4 phases including the starter through d 13, grower through d 28, finisher through d 40, and withdrawal through d 49. Inclusion of xylanase increased (P < 0.05) early body weight at 13 and 28 d of age. During the starter phase, broilers fed the low fat diet exhibited elevated body weight and improved feed conversion ratio (FCR) compared with the higher fat diet. This trend reversed during the grower phase with the higher fat diet exhibiting a lower (P < 0.05) FCR compared with the lower fat diet. Factorial analysis indicated that xylanase reduced (P < 0.05) cumulative FCR through 28 d as compared with the control. At the conclusion of the experiment, broilers reared on the 2 reduced-energy diets had similar body weight and feed conversion ratio indicating that supplemental fat content in the diet did not affect growth performance. Additionally, the NC1 and NC2 fed broilers had a weight-adjusted feed conversion ratio higher (P < 0.05) than that of PC fed broilers. However, inclusion of xylanase in both the NC1 and NC2 diets reduced weight-adjusted feed conversion ratio to levels similar to that of the PC, indicating that xylanase inclusion improves growth performance in broilers regardless of dietary fat inclusion.

Key Words: xylanase, fat, broiler, performance

33 Amylase improves digestibility of pelleted diets. Vinicius Gonzales Schramm*1, Jean Fagner Durau1, Andreia Massuquetto1, Vitor Augusto Bernardini Zavelinski1, Vitor Barbosa Fascina2, and Alex Maiorka1, 1Federal University of Paraná, Curitiba, Paraná, Brazil, 2DSM Nutritional Products, São Paulo, São Paulo, Brazil.

This study was conducted to evaluate the effect of amylase and pelleted diets on crude protein and starch digestibility. Eighty 1-d-old male chicks Cobb 500 were allocated in a completely randomized design in factorial arrangement (2 × 2). The treatments were with or without amylase (80 KNU/kg feed of Ronozyme HiStarch) and mash or pelleted diets, totalizing 4 treatments, with 10 replicates of 2 broilers each. Birds were placed in boxes with water and feed ad libitum. At 47 d of age all birds were euthanized and the ileal content was collected. Diets and ileal content were analyzed to dry matter (DM), crude protein (CP), available starch (AS), resistant starch (RS), total starch (TS), and ileal amylase (80 KNU/kg feed of HiStarch) and mash or pelleted diets. The pelleted diets reduced 47; P < 0.05) than mash and the super-dose of phytase may be attributed to phytate destruction beyond P.

Key Words: phytase, super-dose, lighting, bone ash

32 Evaluation of the effect of dietary fat inclusion on xylanase efficacy in broiler diets. Kyle D. Brown*1, Rocky E. Latham1, Omar Gutierrez2, and Jason T. Lee1, 1Texas AgriLife Research, College Station, TX, 2Huvepharma Inc., Peachtree City, GA.

An experiment was conducted to evaluate the effect of dietary fat inclusion on xylanase efficacy in reduced energy diets on male broiler growth performance. The experimental design included a 2 (fat inclusion) × 2 (xylanase inclusion) factorial with the inclusion of a reference diet representing an industry control diet (PC). The 2 diets varying in fat content were formulated on an iso-nitrogenous and iso-caloric basis with a 110 kcal/kg reduction in AME and a reduction of 2% in amino acids compared with the PC diet. The first of the reduced energy diets (NC1) was formulated with a maximum of 0.5% supplemental fat inclusion while the other reduced energy diet (NC2) was formulated with a minimum of 1.5% supplemental fat. Each treatment included 9 replicates with 53 broilers randomly placed per replicate (2,385 total chicks placed). The dietary program consisted of 4 phases including the starter through d 13, grower through d 28, finisher through d 40, and withdrawal through d 49. Inclusion of xylanase increased (P < 0.05) early body weight at 13 and 28 d of age. During the starter phase, broilers fed the low fat diet exhibited elevated body weight and improved feed conversion ratio (FCR) compared with the higher fat diet. This trend reversed during the grower phase with the higher fat diet exhibiting a lower (P < 0.05) FCR compared with the lower fat diet. Factorial analysis indicated that xylanase reduced (P < 0.05) cumulative FCR through 28 d as compared with the control. At the conclusion of the experiment, broilers reared on the 2 reduced-energy diets had similar body weight and feed conversion ratio indicating that supplemental fat content in the diet did not affect growth performance. Additionally, the NC1 and NC2 fed broilers had a weight-adjusted feed conversion ratio higher (P < 0.05) than that of PC fed broilers. However, inclusion of xylanase in both the NC1 and NC2 diets reduced weight-adjusted feed conversion ratio to levels similar to that of the PC, indicating that xylanase inclusion improves growth performance in broilers regardless of dietary fat inclusion.

Key Words: xylanase, fat, broiler, performance

33 Amylase improves digestibility of pelleted diets. Vinicius Gonzales Schramm*1, Jean Fagner Durau1, Andreia Massuquetto1, Vitor Augusto Bernardini Zavelinski1, Vitor Barbosa Fascina2, and Alex Maiorka1, 1Federal University of Paraná, Curitiba, Paraná, Brazil, 2DSM Nutritional Products, São Paulo, São Paulo, Brazil.

This study was conducted to evaluate the effect of amylase and pelleted diets on crude protein and starch digestibility. Eighty 1-d-old male chicks Cobb 500 were allocated in a completely randomized design in factorial arrangement (2 × 2). The treatments were with or without amylase (80 KNU/kg feed of Ronozyme HiStarch) and mash or pelleted diets, totalizing 4 treatments, with 10 replicates of 2 broilers each. Birds were placed in boxes with water and feed ad libitum. At 47 d of age all birds were euthanized and the ileal content was collected. Diets and ileal content were analyzed to dry matter (DM), crude protein (CP), available starch (AS), resistant starch (RS), total starch (TS), and ileal amylase (80 KNU/kg feed of HiStarch) and mash or pelleted diets. The pelleted diets reduced DM and RS digestibility (80 vs 78 P < 0.05) and RS digestibility (75.36 vs 81.47; P < 0.05). The pelleted diets reduced DM (78.74 vs 77.13; P < 0.05) and RS digestibility (80.45 vs 76.38; P < 0.05) when compared with mash diet. There was no effect of amylase or diet physical form on AS and TS digestibility. It was concluded that amylase improved DM and RS digestibility in diets. Furthermore, amylase improved CP digestibility in pelleted diets.