251 Growth performance and intestinal morphometric responses of broilers to xylanase supplementation in wheat-based diets. Gemma González-Ortiz1, Marta Martínez-Mora2, David Sola-Oriol2, José F. Perez2, and Michael R. Bedford1, 1AB Vista, Marlborough, United Kingdom, 2Servei de Nutrició i Benestar Animal (SNiBA), Departament de Ciencia Animal i dels Aliments, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.

The objective of this study was to evaluate the effect of xylanase supplementation on performance and intestinal morphometric in broiler chickens. Two hundred eighty-eight Ross 308 broiler chicks (1 d old) were placed in 3 experimental treatments: PC, NC (−150 kcal/kg) and XYL (the NC supplemented with 32,000 BXU/kg of xylanase). Each treatment had 8 replicates, with 12 animals each. Starter and grower diets, based on wheat and soybean meal, and water were available ad libitum. Body weight gain (BWG) and feed intake (FI) were measured from 0 to 42 d and feed efficiency was corrected for mortality (FE). The relative weights of the empty gastrointestinal tract (GIT) and all the compartments were recorded at the end of the study. Statistical comparisons were performed using a one-way ANOVA and multivariate correlations between FE and morphometric measurements were analyzed (JMP Pro 12). The reduction of energy resulted in lighter birds (PC: 2,710 vs. NC: 2,546 g; \( P = 0.030 \)) and xylanase supplementation increased gain by 84 g compared with the NC (\( P = 0.229 \)) with no effects in FI. Feed efficiency increased by 15 points when the NC was fed (\( P = 0.076 \)), and xylanase supplementation returned FCR to PC levels in 7 points difference (\( P = 0.424 \)). No treatment effects were observed in any of the morphometric measurements with the exception of the gizzard (\( P = 0.036 \)) and the ileum (\( P = 0.088 \)). In both sections, XYL had higher relative weights compared with NC and PC. Significant correlations were observed between GIT and FCR (\( r = -0.47; \ P < 0.0001 \)) which was likely due to the high development of the upper part of the GIT (crop, proventriculus and gizzard). Supplementation of broiler diets with xylanase influenced performance, which may be due to a reduction in digesta viscosity and better utilization of nutrients, nonetheless the better development of gizzard and ileum may correspond to an adaptive response of birds when it is presumed high levels of nutrients may be available in the GIT.

Key Words: xylanase, performance, wheat, intestinal morphometric, gizzard

252 Dietary enzymes prepared at ensiling (ZADO) affects productivity and enzyme activity in laying hens. Hosam M. Safaa1, Hany R. Elsherif1, Mourad H. Elsanhoury2, Ahmed M. Fouad1, Mohamed A. Elmenawey1, and Ahmed O. Abass1, 1Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt, 2Poultry Production Department, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

A total of 280 Hisex Brown at 48 wk of age were used to evaluate the effects of exogenous xylanases, cellulases, protease and α-amylase enzyme preparations at ensiling (ZADO) on the productive performance and enzymes activity. Hens were divided randomly into 5 treatments (hens basal diets supplemented with 0.00, 0.25, 0.50, 1.00 or 2.00 g/kg diet with ZADO) and housed in individual cages at an open house system under the same managerial conditions. Hens’ performance traits were measured every 4 wk and enzyme activity parameters for xylanase, cellulase, protease and α-amylase were measured at the end of the experiment (64 wk of age). Results indicated numerical but not significant effects of dietary ZADO levels of laying hens productivity. Egg production rate was 92.1, 92.5, 93.9, 93.1, and 93.2% and feed conversion ratio was 1.919, 1.860, 1.895, 1.909, and 1.853 g of diet/g of eggs for birds fed diet supplemented with 0.00, 0.25, 0.50, 1.00 or 2.00 g/kg diet with ZADO, respectively. Moreover, enzymes supplementation increased enzymes activity in digesta of both proventriculus and ileum (\( P < 0.05 \)). For example, α-amylase activity records were 0.70, 1.50, 2.26, 19.08, and 11.96 (\( P = 0.037 \)) in proventriculus digesta and 90, 108, 282, 407, and 287 (\( P = 0.013 \)) in ileum digesta for the 5 treatment groups, respectively. It could be recommended from this study to supplement ZADO to laying hen diets to enhance enzyme activity, which might result in a slight increase in hens’ productivity.

Key Words: laying hen, productive performance, enzyme activity, ZADO

253 Evaluation of Cibenza DP100 protease enzyme on apparent ileal amino acid digestibility of full fat extruded soybeans in broilers. Karen Wedekind* and Jeffery Escobar, Novus International Inc., St. Charles, MO.

Soybean products are the most important source of dietary protein for poultry in the United States and much of the world. Variation in protein quality among soy ingredients can occur due to processing. Full fat extruded soybeans (FFES) are an alternative to conventional solvent-extracted soybean meal (SBM), but may have higher levels of trypsin inhibitors (TI). The use of exogenous protease in poultry diets may improve amino acid digestibility and was evaluated in diets containing 25% FFES, which contained 5.8 mg/g of TI vs 3.1 mg/g TI for SBM. 288 Ross 308 male broilers were fed a corn-SBM diet (positive; POS) or corn-SBM with 25% FFES (negative; NEG) or the NEG+ Cibenza DP100 protease (300 U/g diet, Novus International) for a total of 3 treatments with 12 reps/treatment. A common corn-SBM starter diet was fed to all chicks from d 0 to 16. Experimental test diets (20% CP) containing 0.4% of TiO\(_2\) as digestibility marker were fed from d 16 to 21, ileal digesta was collected on d 21. LSD multiple pair-wise comparison procedures using a one-way ANOVA analyses were used to compare treatment means. Relative pancreatic weight was numerically increased by FFES addition, but was significantly decreased with addition of protease (\( P < 0.05 \)). Apparent ileal amino acid (AIAA) digestibility was decreased by addition of FFES (\( P < 0.05 \)), but addition of protease returned AA digestibility for Arg, Asp, Glu, Ile, Lys, Phe, Thr, Val and essential AA similar to the POS control. The protease enzyme also increased AIAA for the other AA (different (\( P < 0.05 \)) from both the NEG and POS control), but did not return digestibility to that observed for POS control. In conclusion, protease supplementation increased AIAA digestibility of FFES in growing male broilers chickens. Further, the reduction in pancreas weight parallelled the improvement in AIAA digestibility for protease indicating a potential amelioration of the negative effects of TI from FFES.

Key Words: broiler, protease, trypsin inhibitor

Poult. Sci. 95(E-Suppl. 1)
254 β-Mannans of soybean meal: Their enzymatic hydrolysis and the effect of β-mannanase on growth performance and immune status of broiler chickens. Anna Rogiewicz*1, Jakub Naczmanski1, Mohammad Alizadeh1, Rob Patterson2, and Bogdan A. Slominski3. 1University of Manitoba, Winnipeg, MB, Canada, 2Canadian Bio-Systems, Calgary, AB, Canada.

The β-galactomannan content of SBM determined in this study was very low, and when assessed using the determined mannose values and the galactose to mannose ratio of 1:1.8, averaged 1.08%. Its water-soluble fraction averaged only 0.10% and accounted for 9% of the total β-galactomannan content. As opposed to the high amounts of β-mannans present in guar or copra meals, this small amount is not likely to contribute to any increased intestinal viscosity in poultry fed corn/SBM-based diets. In subsequent in vitro experiments, SBM and its water-soluble fraction were incubated with several β-mannanase preparations currently recommended to the feed industry to determine their affinity toward SBM β-galactomannan. A degree of β-galactomannan depolymerization, as evidenced by mannose disappearance, ranged from 4.3 to 20.3% for SBM, and from 13.8 to 31.7% for its water-soluble fraction. The objective of the in vivo trial was to validate a concept that SBM β-galactomannans may be involved in triggering the innate immune response by the animal when it detects a pathogen associated molecular pattern analog responsible for inducing a metabolically costly stimulation of the immune system, which would be minimized by β-mannanase supplementation. Broiler chickens were assigned to 5 dietary treatments, each consisting of 10 pens of 5 birds each, and were fed energy-deficient corn-SBM diets containing 2,900 and 3,000 kcal/kg in the starter (0–10 d of age), and grower (11–21 d of age) phases. Four commonly used β-mannanase preparations were evaluated. There was no effect (P > 0.05) of enzyme supplementation on growth performance, the relative weight of immune organs (spleen and bursa of Fabricius), and the level of immunoglobulins IgA, IgG, and IgM in serum and intestine. Further research on any potential energy-sparing effect or suppression of the pathogenic bacteria proliferation by β-mannanase supplementation is needed.

Key Words: soybean meal, β-galactomannan, β-mannanase, broiler

255 Performance of broilers fed a corn-soybean meal-based diet supplemented with a non-starch polysaccharide and phytase enzyme combination. Augustine Owusu-Asiedu*, Aikaterini E. Konstanti1, Leon J. Broom1, Emma Graystone1, and Marta I. Gracía2. 1Anpario PLC, Worksop, United Kingdom, 2Inmasde Agroalimentaria, S.L, Naples, Madrid, Spain.

The current study evaluated the effect of a commercial multi-enzyme blend containing a specific combination of xylanase, β-glucanase and phytase (Optimize; OP) on the performance, health status and mortality of broiler chickens fed a corn-soybean meal-based diet with reduced nutrient specifications. Ross 308 day-old broiler chickens (1,080) were randomly allotted to 3 treatments with 20 replicates pens/treatment and 18 birds/pen. The dietary treatments were (1) a positive control basal diet containing corn, soybean meal, full fat soybean, wheat and rye, and formulated to meet or exceed nutrient requirements of Ross 308 broilers; PCD; (2) negative control diet formulated to a lower nutrient specification using the recommended nutrient contribution by the enzyme (ME, Ca, digestible P and mean digestible AA reduced by 116 kcal/kg, 0.10, 0.12 and 0.03%, respectively; NCD); and (3) NCD + supplemented with 1 kg/MT of OP (OPD). The diets were fed in 2 phases from d 1 to 21 and d 22 to 35. Body weight, feed intake (FI), body weight gain (BWG) and feed efficiency were determined. Data were analyzed as completely randomized design by GLM of SPSS and means separated using Tukey’s test. Overall gain to feed ratio was not affected (P > 0.05) by treatment. Except for numerical differences, there were no statistical differences (P > 0.05) between PCD and OPD in all parameters measured. Overall BWG and FI increased (P < 0.05) in birds fed PCD and OPD compared with NCD. Mortality was numerically (P = 0.15) lower in OPD fed broilers compared with NCD and PCD diets. Mortality was 2.88, 2.78 and 0.66% for PCD, NCD and OPD diets, respectively. In conclusion, the current study showed broiler performance was completely restored to required standard with equal European Production Efficiency Factor (359, 350 and 364 for PCD, NCD and OPD diets, respectively), when the commercial multi-enzyme combination was added to diet with reduced nutrient specification. Thus, reformulated broiler diets with nutrient sparing of Optimize is a feasible and safe solution, which allows for reduce feed cost and maintain acceptable performance standard.

Key Words: enzyme, broiler, performance, feed cost

256 Effects of enriched xylanase and arabinofuranosidase activities on laying hens’ performance when fed wheat-based diets that differ in nutritional density. Maxime Traineau1, Pierre Cozannet1, Estelle Devillard1, Robert B. Shirley2, Roberto Montanini Neto3, Christophe Alleno4, and Aurélie Peyrat*1, 1Adisseo, Commentry, France, 2Adisseo, Atlanta, GA, 3Adisseo, Antony, France, 4Zootest, Ploufragan, France.

A new carbohydrase (Rovabio Advance P) was developed to contain a higher expression and activity of xylanase and arabinofuranosidase, in addition to several other hemicellulase enzymes. This experiment was designed to evaluate the production performance and egg quality of Rovabio Advance P in wheat-fed layers. In total, 1920 hens were allocated to 6 treatments as follows: a positive control (PC) diet that was not supplemented with Rovabio Advance P. Concerning NC1 and NC2, however, had no effect on egg quality (fracture force, Haugh Units and static stiffness) or final body weight (BW). Addition of Rovabio Advance P to the NC1 and NC2 diets significantly improved egg weight (P = 0.001) and impaired feed intake (FI) (P < 0.001) and feed conversion ratio (FCR) compared with the PC (P < 0.001). The nutritional reduction in NC1 and NC2, however, had no effect on egg quality (fracture force, Haugh Units and static stiffness) or final body weight (BW). Addition of Rovabio Advance P to the NC1 and NC2 diets significantly improved egg weight (P < 0.001), egg mass (P = 0.03), FCR (P = 0.03) and final BW (P = 0.009). Addition of Rovabio Advance P to NC1 and NC2 resulted in similar laying performance when compared with results of the PC diet that was not supplemented with Rovabio Advance P. Concerning egg quality, enzyme addition enhanced the static stiffness (P = 0.02) and Haugh units (P = 0.02) compared with non-supplemented diets. These data confirm that laying performance, egg quality and overall nutrient utilization are enhanced when diets are supplemented with a carbohydrase complex that contains xylanase and arabinofuranosidase.

Key Words: carbohydrase, diet reformulation, laying hen, layer performance, egg quality.
Evaluation of the efficacy of xylanase and arabinofuranosidase enrichment of a multi-enzyme complex on metabolizable energy value of corn-soybean meal- and wheat-soybean meal-based diets. Pierre Cozannet1, Maxime Traineau1, Estelle Devilard1, Roberto Montanini Neto2, Robert B. Shirley2, and Aurélie Preynat1, 1Adisseo S.A.S., Commentry, France, 2Adisseo S.A.S., Antony, France.

Plant cell wall degrading enzymes (enz) are key technologies in animal feed industries. The present study describes the effect of an endo-xylanase (Xyl; GH11) and an arabinofuranosidase (Abf; GH54) on the digestibility of different raw materials as estimated by an in vitro method. The effects of an enrichment of a multi-enz complex with these 2 enzymatic activities were also determined by an in vivo digestibility tests. In in vitro trial, the effect of Xyl and Abf alone or combined was measured on dry matter digestibility (dig DM) of wheat, corn and corn distiller. The highest effect of Abf was observed on corn and corn distillers (respectively, 5.7 and 14.8% improvement), which are characterized by high level of substitution of xylose backbone with arabinose. Xyl improved wheat dig DM by 3.8% ($P < 0.001$) and corn distillers dig DM by 13.3%. Combination enz further improved these values to 8.9 and 15.9% ($P < 0.001$). In vivo digestibility trials with broilers (12–22 d) were conducted by using corn-soybean meal or wheat-soybean meal-based diets supplemented with either multi-enz (Rovabio Excel) or Xyl and Abf enriched preparation (Rovabio Advance) at their commercial doses. The apparent metabolizable energy (AME) were measured.

Key Words: arabinofuranosidase, energy, enzyme, xylanase

Does phytate origin affect phytase response differently? Roger Davin1,2, Colwayne Morris1, Fenglan Yan2, Megharaja K. Manangi2, David R. Ledoux1, and Mercedes Vázquez-Añón2, 1University of Missouri, Columbia, MO, 2Novus International Inc., Saint Charles, MO.

The objective of the current study was to evaluate the response to phytase, in broilers fed the same amount of phytate P (PP) from SBM and RB, on apparent ileal P digestibility (AIPD) and bone ash % (BAP). A total of 576 Ross 308 male broiler chicks were fed a common corn-SBM-based diet from d 1 to d 15. From d 15 to 23, birds were fed 12 semi-purified diets containing 0.25% PP from either a SBM diet (0.44% total P) or a RB diet (0.35% total P), with limestone used to maintain a 1.45:1 Ca:P ratio in both diets. Phytase (Cibenza Phytaverse, Novus International, Inc., St Charles, MO) was added to SBM and RB diets at 0, 250, 500, 750, 1000 and 2000 FTU/kg in a completely randomized 2 × 6 factorial design with 8 replicate cages (6 birds/replicate). Digesta from the posterior two-thirds of the ileum and right tibias were collected on d 23. Excreta were collected daily from d 20 to 23. Data were analyzed by 2-way ANOVA to evaluate the effect of ingredient, phytase and their interaction, and by orthogonal polynomial contrasts to test the linear and quadratic effects of phytase in SBM and RB diets. Results indicated no interaction of ingredient × phytase for AIPD ($P > 0.05$). AIPD was affected by phytase ($P < 0.01$) but not by ingredient ($P = 0.48$). Phytase main effect indicated AIPD values of 43.4, 64.9, 69.6, 73.7, 72.9 and 82.7% for 0, 250, 500, 750, 1,000 and 2,000 FTU/kg of diet, respectively. Phytase effect was quadratic for both ingredients ($P < 0.01$). A significant ($P < 0.01$) ingredient × phytase interaction was found for BAP. Supplementation phytase to the SBM diet did not affect BAP ($P > 0.05$), while phytase significantly improved BAP at 250 FTU/kg and beyond for the RB diet. Phytase effect on BAP was quadratic for RB ($P < 0.01$). In summary, phytase supplementation of SBM and RB diets with similar PP content resulted in similar AIPD but different BAP response which could be attributed to differences in Ca content used to maintain Ca:P ratio.

Key Words: soybean meal, rice bran, phytase, P digestibility