at a commercial feed mill and were of similar nutritional composition. Feed form variations were made by grinding a portion of the pellets produced for each diet phase. The HQP diets averaged 78.6% intact pellets and the GP diets averaged 1,108 micron particle size. On D42, YP1 improved ending weight (EW; P=0.022) and feed conversion ratio (FCR; P=0.022). However, no YP Carryover effect was demonstrated for any of the D42-118 performance variables (P>0.05). Feeding HQP produced toms that were 0.29 kg/bird heavier (P=0.001) with 9 points lower FCR (P=0.015), as compared to toms fed GP. Regression analyses predicted that if toms fed GP finished at the same D118 EW as those fed HQP, then FCR advantages of HQP would be 12 points (R^2=0.9587). These data show that an investment in producing HQP may be economical due to returns on turkey performance.

**Key Words:** yeast product, brooder period, feed form, pellet quality, turkey performance

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**T103 PROPIONIC ACID INCLUSION WITH PRESTARTER FOR POULTS FROM YOUNG BREEDERS**  
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Supplemental organic acids benefit first wk production, particularly hatchlings from small eggs. Present experimentation employed commercial source toms from 35 wk old breeders while using a corn-soybean meal crumbed basal starter that included fish and corn gluten meals. A separate 3% addition of starch to the crumbled basal was progressively replaced with 1, 2 and 3% propionic acid (PA) and offered for the first 7 D to comprise 4 treatments of similar nutritional value (28.5% CP, 2900 kcal ME/kg). After 7D, the basal feed having only starch continued until 21D. Each treatment represented 6 replicates of 10 poults in raised wire pens. All PA additions improved live performance similarly beyond the starch basal after 2D (L, P<.05) which was less apparent 2-7D (L, P<.07). Total 0-7D mortality progressively decreased from 5.8% for the basal to 1.7% with 3% PA (L, P<.05). Half of each pen’s birds provided body measurements at 7D. Blood glucose increased from 120 to 258 mg/Dl as PA increased while liver glycogen followed in parallel from 37 to 47 mg/100g with 1% PA providing the most dramatic responses (Q, P<.001). No treatment differences in contents pH with either crop (ca. 5.0) or ceca (ca. 6.5) were apparent. During the subsequent 14 days when all poults received the starch basal feed, birds that had not been given PA 0-7 days compensated in gain and F/G such that all treatments were similar at 21D; however, benefit of previous PA to mortality continued. Total 0-21D mortality progressively diminished from 15.5 to 1.7% as dietary PA that had been received 0-7D deceased from 0 to 3% (L, P<.01). PA is a gluconeogenic organic acid that provides survival advantages to the post-hatch bird.

**Key Words:** propionic acid, poult, prestarter, blood glucose, liver glycogen

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**Environment & Management III / Metabolism & Nutrition V**

**T104 In-vitro antimicrobial susceptibility of Clostridium perfringens from broiler origin**  
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Clostridial enteritis is a common disease affecting the intestinal health of many US commercial broiler flocks. Several antibiotic feed additives have been used to control this costly disease condition. Field isolates of Clostridium perfringens were collected between 2011 and 2012 in several broiler production complexes located in the Southern United States. These isolates were tested for their ability to produce visible growth in the presence of antibiotics on a series of agar plates containing dilutions of the antimicrobial agent (agar dilution). Updated information regarding Minimum Inhibitory Concentrations (MICs) against virginiamycin and other commonly used antibiotic feed additives will be presented.

**Key Words:** Enteritis, Necrotic, Clostridium, MICs

**T105 Factors to consider in choosing poultry house lighting**  
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Energy conservation is as important as ever. Growers pay energy bills out of their earnings. The more they pay for power the less net return on the flock. Efforts to install motors, fans and lights, the components that use the most electricity in poultry houses, are being considered by growers. However, it is not as simple as replacing an old 60 watt incandescent bulb with a newer energy efficient bulb. Factors such as light intensity at floor level, uniform light distribution, life of the bulb and ease of maintaining it should be considered. The current field study evaluated incandescent, compact fluorescent (CFL), cold cathode and LED light bulbs in poultry houses. Light intensity was measured at floor level at the beginning of the study, 6 and 12 months into the study. Bulbs were cleaned prior to taking the light intensity measurements. The average light intensity was measured in a grid at 1, 10 and 20 ft off the side wall and every 5 ft down the length of the house for a total of 20 ft. Dimming curves for the bulbs were obtained and bulb losses in each house were recorded at the end of each flock. Data loggers were installed to monitor the house total power and the power utilized by the lighting system.

Dimming the light intensity below 5 lux resulted in higher CFL bulb losses. When the house dimmer was marked to show the grower how to limit dimming, bulb losses were reduced from 50% to less than 4%. The dimming curve of incandescent bulbs was the most linear, followed by cold cathode, LED and CFL. All bulbs exhibited a loss of light intensity that ranged from 25% to 50% depending on the type of bulb. The average light intensity at floor level was 6.8, 10.9, 10.4 and 20.3 for LED, CCFL, LED and CFL respectively. On a second farm Light intensity measurements were affected by bulb spacing and height from the floor and reflection off of the ceiling bedding material and walls. These data suggest that not all bulbs can be used at the current spacing of incandescent bulbs. Poultry producers should evaluate the intensity of the bulb at floor level prior to investing in bulbs for all houses on the farm.

**Key Words:** Lighting, Energy conservation, light bulb, Light intensity

**T106 Effect of repeated application of litter amendment**  
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Ammonia (NH₃) production by poultry litter is a recurring management concern for producers. Excessive NH₃ exposure has negative impacts on eye and respiratory health, as well as production efficiency. Application of litter amendments is a common management practice to reduce NH₃ concentration inside poultry houses during brooding. However, singular applications prior to chick placement typically provide other treatments. The current study was designed to supply NH₃ data on the effectiveness of repeated applications of a toilet paper litter amendment to reduce NH₃ concentrations in raised wire cages. To evaluate the potential of repeated litter amendment applications, NH₃ data were collected in hampers fitted with the toilet paper litter amendment once every 2 weeks for 20 weeks. The results showed that repeated applications of the litter amendment significantly reduced NH₃ concentrations in a manner that did not appear to be cumulative.
NH₃ abatement for a limited time. The goal of this research was to determine the effects of repeated applications of an acid-based litter amendment during a growout cycle on equilibrium litter NH₃ concentration and live performance of broilers in a common airspace.

Three trials were conducted with approximately 14 d between flocks to mimic commercial conditions. Each trial consisted of four replicate pens of five treatments. Each pen contained 42 broilers and was equipped with a tube feeder and nipple drinkers. Treatments included negative control (no amendment), singular application one day prior to chick placement (-1 d), two applications (-1 and 28 d), late application (-1, 28, and 43 d), and bi-weekly application (-1, 14, 28, and 43 d). Litter amendment was applied at two-week intervals up to 43 d of a 56 d growout at the manufacturer’s recommended application rate (100 lb/1000 ft²).

Results indicated that bi-weekly application was the most effective in reducing litter NH₃ concentrations, followed by late application. Equilibrium litter NH₃ concentrations were reduced by 56.6% and 21.8% at 42 and 57 days, respectively, for bi-weekly application. Live production parameters were not affected by repeated applications of litter amendment.

Key Words: ammonia, ventilation

T107 Evaluation of a cellulose-based industrial wastewater by-product as broiler bedding material Brian Kiepper*, Casey Ritz, Brian Fairchild Department of Poultry Science, University of Georgia, Athens, GA

The increased cost and decreased availability of pine shavings, the traditional poultry bedding material, has facilitated the need to identify alternative bedding materials for poultry growers. The objective of this study was to evaluate different pine shaving and cellulose by-product mixtures based on bulk density, litter moisture and pH, and footpad quality over 6 weeks. The experimental design consisted of 25 pens (3.7 m² each) containing 55 Cobb broilers (0.07 m²/bird) for a total of 1375 birds. The 5 treatments consisted of bedding at 8 cm depth consisting of 0% (Control, 100% pine shavings), 25%, 50%, 75% and 100% cellulose by-product with 5 repetitions. The first phase of the experiment included bulk density at Day 0, and litter moisture and pH, and footpad dermatitis (FPD) scores taken at Day 0 and 7. Results from phase one of the study showed that the Day 0 mean bulk density (g/m³) of the 100% (84) and 75% (80) treatment pens were significantly higher than the 50% (71), 25% (59) and Control (53) treatment pens. At Day 7, the mean litter pH (S.U.) of the 100% (7.93) treatment was not significantly different from the 75% (7.33) treatment, but was significantly greater than the 50% (7.00), 25% (6.47) and Control (6.09) treatments. At Day 7, the mean litter moisture (%) of the Control (23.9) and 25% (23.9) treatments were not significantly different from the 50% (15.0) and 100% (14.8) treatments. A Day 7, the mean percentage (%) of birds with no footpad downgrades in the 100% (99) and 75% (95) treatments were not significantly different from the 50% (87) treatment, but were significantly greater than the 25% (76) and Control (66) treatments. An evaluation of litter moisture versus FPD scores produced a correlation coefficient of 0.73, indicating a strong cause-and-effect relationship between increasing litter moisture and incidence of FPD. Based on phase one results, the cellulose by-product is at least comparable if not superior to pine shavings as a broiler bedding material based on litter moisture and subsequent incidence of FPD.

Key Words: broiler, litter moisture, litter pH, footpads, bulk density

T108 Effect of corn gluten feed and/or DDGS on broiler breeder performance John Brake*, Mireille Arguelles-Ramos, Charles Stark Department of Poultry Science, North Carolina State University, Raleigh, NC

An experiment was conducted to evaluate the inclusion of corn gluten (CG; 21% CP) feed and/or distillers dried grain with solubles (DDGS; 27% CP) in feed during rearing and laying on broiler breeder performance. Ross 344 males and Ross 708 females were reared sex-separate in a black-out house from which they were moved to a curtain-sided slat-litter laying house at 21 wk of age, mixed, and photostimulated. Breeders were fed sex-separate from 21 to 64 wk of age. The corn-soy based starter diets contained either 0 or 2% CG feed and/or 0 or 2% DDGS in a 2 x 2 arrangement. The same dietary design continued with the grower and layer diets except the inclusion levels were either 0 or 4%. The diets were designed to be isocaloric and isonitrogenous. The breeders were managed in all aspects in a similar manner except for differences between the 4 dietary combinations. From 21 wk of age there were 4 replicate pens of 68 females and 8 males for each of the four dietary combinations with all birds receiving the same daily feed allocation at all times, irrespective of dietary treatment. Group BW was determined on a regular basis as a response variable rather than for determination of feed increments. Egg production and mortality were determined daily while percentage fertility and hatchability were evaluated on a weekly basis from sets of 60 eggs per replicate pen. Hens fed the CG and CG+DDGS diets exhibited increased egg production relative to the Control and DDGS diets. Female mortality was reduced by the DDGS and CG+DDGS diets probably due to reduced feather coat during hot weather. Male mortality was similar among the treatments but a numerical increase was observed with respect to the Control males. Fertility, hatchability of fertile eggs, and BW were not affected by diet.

Key Words: Broiler breeders, corn gluten feed, DDGS, egg production, hatchability
T110 Effects of Tylan®, dietary nutrient content and dried distillers grains with solubles on egg production and body composition of first cycle-laying hens. Neva Nachtrieb*, Michael Persia Department of Animal Science, Iowa State University, Ames, IA

A 16 wk experiment was conducted using 720 first cycle Hy-line W36 laying hens to evaluate performance and body composition responses to Tylan®, dietary nutrient content, and dried distillers grains with solubles (DDGS) inclusion. The experiment was a 2x2x2 factorial including 0 and 0.75lbs/ton of Tylan®, control and reduced nutrient diet (energy -66 kcal/kg, Lys, Met, TSAA, The, Iso and Val), and two concentrations of DDGS (15 and 30%). The eights experimental units (EU) consisted of 3 consecutive cages of 3 birds (68 in²/bird), resulting in 72 total hens per treatment. Dietary treatments were fed from 30 to 46 weeks of age. Egg production was collected daily, feed intake was measured weekly, and hen body weight and egg mass was determined at 4,8,12, and 16 wk. Body composition was determined by DXA on one hen per EU at 8 and 16 wk. Data were analyzed by ANOVA with Students T test used to separate means if significance was detected. Over the duration of the experiment, little difference was noted in hen housed -hen day egg production or feed intake. Hens fed diets supplemented with Tylan® had improved feed efficiency (g egg /kg of feed) at 4 and 8 wk (P<0.05), and near significant improvement of feed efficiency at 12 wk although this increase was lost at 16 wk. The reduced nutrient diet resulted in increased feed efficiency over the 4, 8, and 12 wk collection periods (P<0.01), but these differences were again lost by wk 16. DDGS inclusion rate did not affect the majority of the parameters measured. There were no differences in body weight or mortality over the experiment. At 8 wk, hens supplemented with Tylan® had a near significant effect on fat mass, increasing energy storage over non-supplemented diets. These data taken in context with increased feed efficiency over this period seem to indicate that Tylan® supplementation could reduce maintenance energy needs allowing for increased performance or storage energy availability. Therefore Tylan® increased feed efficiency over the majority of the experiment and a possible explanation for this increased efficiency could be a shift of nutrients (energy) from maintenance requirements to productive or storage use.

Key Words: Egg production, Tylan, DDGS, Body composition

T111 Effect of fiber removal from ground corn, distillers dried grains with solubles and soybean meal using the Elusieve process on broiler performance and processing yield Radhakrishnan Srinivasan†, Brett Lumpkins†, Elizabeth Kim‡, Lorraine Fuller†, Joe Jordan† Department of Agricultural and Biological Engineering, Mississippi State University, Mississippi State, MS †Southern Poultry Research, Inc., Athens, GA ‡USDA-ARS South Central Poultry Laboratory, Mississippi State, MS ‡Poultry Science Department, University of Georgia, Athens, GA ‡Office of Entrepreneurship and Technology Transfer, Mississippi State University, Mississippi State, MS

The Elusieve process, a combination of sieving and elutriation (air classification), has been found to be effective in fiber separation from ground corn, distillers dried grains with solubles (DDGS) and soybean meal (SBM). The objective of this study was to determine the effect of removing fiber from ground corn, DDGS and SBM on broiler live performance during the 42 d experimental period and assess the economic impact. A total of six dietary treatments were evaluated in which three treatments incorporated an additional non-starch polysaccharide (NSP) enzyme corresponding to the following three treatments: regular diet, direct substituted enhanced diet and an iso-caloric, iso-nitrogenous enhanced diet. The study consisted of 48 pens with 45 male broiler chicks per pen. Elusieve processing increased stanch content of corn by 7.8%, and increased protein content of DDGS and SBM by 2.3 and 0.9%, respectively. Enhanced diets resulted in birds with 4.6 to 5.0% higher body weight gain, higher breast weight by 7.1 to 11.3% and feed conversion improvement by 4 to 6 points (2.4 to 3.2%) compared to regular diet. There was no effect of NSP enzyme on performance and feed consumption. Interaction effect (between NSP enzyme and dietary type) was observed only in two performance indicators of a total of 12 indicators. The increase in profit due to implementation of Elusieve process in a 1,000 ton/d feed mill is estimated to be $0.5 to 2.5 million/yr, which is 0.8 to 4.3 $ per bird produced. The payback period is estimated to be 0.9 to 4.7 yr.

Key Words: Milling, Fiber removal, Elusieve, Broiler, Nutrition

T112 Metabolizable Energy of Low-Oil DDGS Nick Dale Department of Poultry Science, University of Georgia, Athens, GA

Increasing amounts of oil are being removed from DDGS. Levels of residual oil in what until recently was considered “low-oil” DDGS (7-8%) have at times been reduced to 5% or even less. To properly consider the role of “low-oil” and the new “very low-oil” DDGS in poultry feeds, their metabolizable energies must be defined. Attempts at this laboratory and elsewhere to develop a prediction equation to estimate ME of DDGS on the basis of differences in oil content have been only marginally successful, as other variations such as corn cultivar, agronomic conditions, ethanol manufacturing facility, fiber content, etc., may affect caloric value.

To avoid such possible variations, 2 samples of normal (10-11% oil) DDGS were assayed for ME. In addition, differing amounts of oil were removed from these same samples by ether extraction, and ME again assayed. Removal of half the oil in DDGS (from approximately 10% to 5%) reduced ME by 16.5%. In addition, ME as a percent of gross energy was reduced from 61.2% in original DDGS to 54.1% in the “very low-oil” samples. This presumably reflects a greater concentration of the less well digested fractions, such as fiber, in the low-oil samples.

Key Words: DDGS, low-oil DDGS, metabolizable energy

T113 Effects of guar meal, guar gum and saponin rich guar meal extract on productive performance of broiler chicks Sherif Hassan*, ABDUL AZIZ Alaqail King Faisal University, Al Ahsa, Saudi Arabia

Two hundred forty one-d-old broiler chicks were randomly distributed among four treatments with four replicates of 15 chicks per replicate. Chicks were assigned to one of the following treatments: 1) control basal starter diet, 2) the basal starter diet reformulated with 5.0% guar meal (GM), 3) the basal starter diet with 0.90% guar gum (GG), 4) the basal starter diet with 0.250% saponin-rich guar meal extract (GS). Weekly feed intake, body weight, body weight gain, feed conversion ratio and mortality rate were recorded from 0-21 d of age. Feed intake was only significantly lower for chicks fed 0.90% GG than chicks fed 5.0% GM at 1-7 and 8-14 d of age,feed conversion ratio (1-7d) for chicks fed 0.90% GG and 0.250% GS was significantly higher than other treatments. Feed conversion ratio (8-14d) for chicks fed 0.250% GS was significantly higher than chicks fed 0.250% GS was significantly higher than chicks fed 0.90% GG. Feed conversion ratio (15-21d) of chicks fed 0.250% GS was significantly higher than the control. The overall feed conversion ratio from 1-21 d was significantly higher for chicks fed 0.250% GS and 5.0% GM than chicks fed 0.90% GG and the control. Body weight (1-21 d) was significantly lower for chicks fed 0.250% GS than the control treatment. Body weight gain (15-21 d) was significantly lower in chicks fed either 5.0% GM or 0.250% GS than the control. Total body weight gains from 1-21 d was significantly lower for chicks fed 0.250% GS than the control. Results obtained indicate
that there are more negative effects associated with adding 0.250% GS than 0.90% GG suggesting saponins may play a prominent role in the growth inhibition effects of feeding GM to broiler chicks. Therefore, saponin may likely be the primary anti-nutritive factor in GM.

Key Words: Broiler chicks, Guar gum, Guar meal, Growth, Saponin

T114 Effects of Adding Guar Meal on Productive Performance of Laying Hens Sherif Hassan*, Yousef Al-Yousef  King Faisal University, Al Ahsa, Saudi Arabia

A completely randomized design experiment was conducted to evaluate the effect of feeding different levels (0, 2.5, 5.0, 10.0, 20.0%) of guar meal (GM) in laying hen diets over a 8-wk trial period. A total of 180 Hiss laying hens (25wk old) of similar body weight were randomly distributed among 5 treatments with 6 replicates with 6 hens each. Body weight, body weight gain, egg produced per hen, feed consumption, feed conversion ratio, egg weight, egg mass per hen, and Haugh units, yolk color, and egg specific gravity were measured. Body weight and body weight gain for hens fed 10 and 20% GM were significantly lower than hens fed 0, 2.5, or 5% GM. Hens fed 10% GM supported a significantly higher egg number and percentage of egg produced per hen than the control. Egg number and percentage of egg produced per hen were significantly lower for hens fed 20% GM than hens fed 0, 2.5, 5% or 10% GM. Hens fed 20% GM consumed significantly lower feed than those fed 0, 2.5, 5% or 10% GM. A significant feed conversion ratio increase was existed for the 20% GM group compared to the remaining treatments. Egg weight decreased significantly for hens fed 20% GM compared to the other treatments. Egg mass for hens fed 5 and 10% GM was significantly higher than the control. However, hens fed 20% GM showed significantly the lowest total egg mass per hen. Egg yolk of hens received 5% GM were similar to the hens fed 10% GM, whereas hens fed 5% and 10% GM produced eggs with higher yellowness values than the control group. Egg specific gravity increased significantly for hens fed 20% GM compared to the other treatments. Mortality rate was significantly higher for the control group than hens fed 2.5 and 10% GM. Results showed that GM can be fed to laying hens at a level up to 10% without adverse effects on laying hen performance.

Key Words: Egg, Production, Performance, Guar meal, Laying Hens

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T115 In vivo efficacy of a Buttiauxella 6-phytase versus a novel Citrobacter 6-phytase in young broilers Cees Kwakernaak1*, Jan Dirk Van der Klis1, Peter Plumstead2 1Schothorst Feed Research, Lelystad, Netherlands 2Danisco Animal Nutrition, Marlborough, UK

Phytases are supplemented to poultry diets to hydrolyze phytate, improve nutrient digestibilities of which P is most important, and thereby decrease P excretion and feed cost. Phytase can be added to diets based on a standardized FTU determined in-vitro by the AOAC method. It has been shown that the in vivo efficacy can differ between 6-phytases. A 6-phytase derived from Buttiauxella spp. and expressed in Trichoderma (BT) has been recently developed. The objective was to test if this phytase has a different efficacy in vivo than a 6-phytase derived from synthetic genes mimicking Citrobacter braakii and expressed in Aspergillus (CA). Nine experimental diets were fed as pellets to Ross 308 male broilers housed in 6 replicate cages, 16 birds per cage from 5-21 days of age. A low P diet (negative control, NC) with 2900 kcal/kg AMEn (broiler), 210 g/kg CP, 4.4 g/kg P, 1.8 g/kg ret. P, 2.5 g/kg phy­tate-P, and 6.5 g/kg Ca, was used. The phytase products and diets were analyzed for in vitro phytase activity according to the AOAC method by LUFa, Oldenburg, Germany. Both phytases were added at 250, 500, 750 and 1000 FTU/kg on top of the NC diet. Feed and water were freely available. Performance was measured and at the end of the experiment tibiae were collected to determine ash content (of 4 birds per replicate). Results were analyzed by ANOVA. Statistical analyses of the phytase supplemented diets showed significant (P<0.001) differences between the phytases on FI, BWG, FCR and tibia-ash content. For FCR and tibia-ash content this phytase effect interacted (P<0.05) with dose level. BT phytase resulted on average in significantly 7% higher BWG and 5% higher FI compared to the CA phytase. For tibia-ash the difference between the phytases was significantly present at each dose level (8% higher for BT), while for FCR this was present at 500 and 1000 FTU/kg (3-5% lower for BT). Exponential curve fitting showed that 309, 287, 283 FTU of the BT was equal to 500 FTU CA phytase based on BWG, FCR and tibia-ash, respectively. It is concluded that based on a standard­ized in vitro activity (AOAC) the in vivo efficacy between recently developed 6-phytases can be highly different.

Key Words: Broilers, Phytase, Tibia-ash, Buttiauxella, 6-phytase

T116 Modelling effects of Buttiauxella phytase on energy and amino acid utilisation in broilers. Peter Plumstead’, Nickki Sriperam, David Swann Dupont Industrial Biosciences - Danisco Animal Nutrition, Marlborough, UK

A new 6-phytase derived from Buttiauxella spp. has previously been shown to be highly efficacious at improving phytate-phosphorus digestibility in broilers. As effects of phytase on amino acid (AA) and apparent metabolizable energy (AME) were previously shown to be correlated with the degree of phytate hydrolysis, it was of interest to quantify effects of Buttiauxella phytase (BP) on AA and AME. Seven different ileal and 7 total tract digestibility trials and were conducted. Trial methodology was to rear day-old broiler chicks in battery cages on a single starter feed to between 5 and 12 d of age following which birds received different test diets to 21-d of age that were deficient in Ca and P and supplemented with graded doses of BP. Test diets in the 7 ileal digestibility trials were corn/soy-based, while the 7 AME studies included basal diets with corn/soy (5 trials) or wheat/soy (2 trials). Ileal AA digestibility was determined at 21-d by collecting digesta from the anterior ileum from all birds in a pen. Energy digestibility was determined on pooled feces from a 3-day collection per cage from 17-20d of age. All observations from the 7 AA digestibility or 7 AME trials were combined and analysed as two separate datasets. Non-linear mixed models were used to describe the response in AA digestibility or AME to increasing analysed doses of BP and also evaluated effects of phytate and cereals source as additional factors. AA digestibility of all 18 AA measured increased (P<0.001) with added BP dose and was depend­ent on dietary phytate level. BP significantly increased AME in both corn- and wheat-based diets with the response in AME to added phytase reaching a plateau between 1000 and 2000 FTU/kg feed. In conclusion, BP significantly increased AME and AA digestibility in multiple studies in a dose-dependent manner with increasing phytase dose. The continued improvement in AA and AME at phytase doses above conventional levels of 500 FTU/kg should be considered in feed formulation to further increase nutrient digestibility and reduce feed cost.

Key Words: Phytase, Buttiauxella, Amino acid digestibility, AME, Broiler