P425 Studies on egg production, egg quality, tissue mineral profile and immunity during post peak phase of layers fed with HMTBa chelated organic trace minerals. D. N. Desai*[1], B. G. Gangurde[1], A. S. Ranade[1], P. E. Avari[1], M. Manangi[2], M. Vazquez-Anon[2], and D. Joardar[2], *[1]Department of Poultry Science, Bombay Veterinary College, Mumbai, Maharashtra, India, [2]Novus International Inc., St. Charles, MO.*

Two trials were conducted to study the effect of chelated organic trace minerals such as Mintrex Zn [$Zn(HMTBa)_2$], Mintrex Mn [$Mn(HMTBa)_2$] and Mintrex Cu [$Cu(HMTBa)_2$] and MAAC Fe on production performance and egg quality during post peak phase of layers for 16 weeks. The first trial was conducted on 300 layers of BV 300 strain of 39 weeks of age. The birds were randomly divided into 3 equal groups A, B and C of 100 birds, having 20 replicates of 5 birds each. The second trial was conducted on 8788 layers of BV-300 strain of 40 weeks of age under field conditions. The birds were randomly divided into 3 groups having 4 replicates of about 732 birds each. In both the trials, group A received control diet containing Zn, Mn, Cu and Fe in inorganic form at the levels of 60, 60, 9 and 60 ppm, respectively, as per Indian standards. Groups B and C received treatment diets containing Zn, Mn, Cu and Fe in chelated form at 50% and 25% of the levels used in control group, respectively. The levels of Se and I were kept same in all the groups. For both the trials, production performance, egg quality, economics, ND titers and tissue mineral levels were studied. Results from both the trials showed no differences ($P \geq 0.05$) among treatments for the measured variables such as egg production, feed consumption, FCR, mortality, egg quality, tissue mineral levels and NCD titers. However, percentage of broken eggs was significantly ($P \leq 0.05$) reduced for groups B and C compared with control. The % broken eggs for groups A, B and C were 0.310, 0.125 0.136 for Trial-1 and 0.079, 0.035 and 0.038 for Trial-2, respectively. In summary, results from the current trials indicated a significant reduction in broken eggs with no change in production performance and egg shell quality when chelated trace minerals were used in layers up to 25% reduced levels as compared with the levels of inorganic trace minerals that are currently being used in Indian poultry industry.

Key Words: layer nutrition, chelated trace minerals

P426 FGF-23 neutralization through vaccination reduced phosphate requirements of chickens. E. A. Bobeck,* K. Burgess, T. Jarmes, M. L. Piccione, and M. E. Cook, *University of Wisconsin-Madison, Madison.*

Strategies that improve the efficiency of dietary phosphate retention in animal production systems reduce costs and potentially reduce phosphate pollution. Fibroblast growth factor 23 (FGF-23), a hormone responsible for excretion of excess dietary phosphate and an indirect regulator of intestinal phosphate absorption, has questionable value in modern animal agriculture systems where phosphate inputs are tightly controlled by a nutritionist. FGF-23 was neutralized using anti-FGF-23 peptide vaccines and the response of chicks to a phosphate deficient diet was determined. Single Comb White Laying hens were injected intramuscularly with one of 2 FGF-23 peptide conjugates (AFLPGMNP or QTIYSALMI, 0.3mg of conjugate/hen/injection) conjugated to bovine gamma globulin or control vaccine vehicle at d 0 and 7. Once egg yolk anti-peptide antibody titers reached peak levels (approximately 21 d), hens were artificially inseminated and chicks carrying the passive antibodies were hatched. Within each injection treatment (each FGF-23 peptide and control) chicks were divided into 2 groups and placed on either a low (0.13% available phosphate) or normal phosphate (0.39% available phosphate) diet for 2 weeks. Chicks with control antibody had a 43% and 21% reduction in plasma phosphate and bone ash, respectively, when fed a phosphate deficient diet and compared with chicks fed a normal phosphate diet ($P < 0.05$). Similar results were observed with antibody to peptide QTIYSALMI. However, chicks with circulating anti-FGF-23- AFLPGMNP antibodies fed the phosphate deficient diet had plasma phosphate and bone ash that did not differ from chicks fed the normal phosphate diet ($P > 0.05$). This study demonstrated that neutralization of FGF-23 reduced the phosphate requirements of growing chicks and may represent a novel method to reduce phosphate inputs into animal production systems.

Key Words: FGF-23, phosphate pollution, vaccine, phosphate requirement, FGF-23 antibody

P427 Differential modulation of serum macro mineral profile of broilers during different stages of exposure to aflatoxin B_1. A. W. Yunus[1,2] and J. Böhm*[2], *[1]Animal Nutrition Program, Animal Sciences Institute, National Agricultural Research Center, Park Road Islamabad, Pakistan, [2]Institute of Animal Nutrition, University of Veterinary Medicine Vienna, Vienna, Austria.*

Various mycotoxins are known to affect the absorption and metabolism of minerals. In case of aflatoxin B_1 (AFB_1), the available evidence on the mycotoxin-induced modulation of the level of a specific element in the serum of chickens is often conflicting. Present trial was therefore conducted to study the effects of level and length of AFB_1 exposure on the levels of selected macro minerals in the serum of chickens. Twenty one male broiler chicks at 7 d of age were reared under a control diet, a low AFB_1 diet (0.07 mg AFB_1/kg), or a high AFB_1 diet (0.75 mg AFB_1/kg) for a period of 5 wk. Birds were euthanized at 16 (n = 7), 30 (n = 7), and 42 (n = 3) d of age for collection of blood samples. Total amounts of Ca, P, Mg, Na, K, and Zn in serum were determined using an atomic absorption spectrometer (model 4100, Bodenseewerk Perkin-Elmer GmbH, Überlingen, Germany). The serum levels of Ca, and Zn remained unaffected by the dietary treatments throughout the 5 wk exposure time. During the initial stages i.e., at 16 d of age, serum K was found to be lower ($P < 0.01$) under both the low and high AFB_1 diets compared with the control. Serum P level at this stage was also lower ($P < 0.05$) under the high AFB_1 diet compared with low AFB_1 diet. No effects of the dietary treatments on the studied elements in the serum were found at 30 d of age. Also, no significant effects of the dietary treatments could be noted for the serum levels of Ca, P, K, and Zn at 42 d of age. However, the high AFB_1 diet at 42 d of age resulted in higher levels of serum Mg ($P < 0.01$) compared with the control, while higher ($P < 0.01$) levels of serum Na compared with both the low AFB_1 diet and control. These data indicate that the modulation of serum levels of macro minerals during AFB_1 challenge is dependent upon both the level and length of exposure.

Key Words: aflatoxin, broiler, magnesium, phosphorus, sodium

P428 Total dietary replacement of sodium selenite by selenium yeast (Sel-Plex) improves carcass yield characteristics of male broilers. F. M. Goncalves*[1,2], V. L. Santos[1], J. K. Nunes[1], L. Novelini[1], M. A. Anciuti[1], F. Rutz[1], and P. R. Ferket[2], *[1]Federal University, Pelotas, RS, Brazil, [2]North Carolina State University, Raleigh.*

Meat yield and meat quality are economically important traits of broiler production that may be influenced by the source of dietary selenium supplementation: sodium selenite is a pro oxidant feed additive but organic selenium from yeast (Sel-Plex, Alltech Inc., Nicholasville, KY) has more antioxidant properties that may influence meat quality. The objective of this study was to evaluate carcass traits, yield and meat quality of broilers chickens supplemented with organic selenium (selenium yeast) in total replacement to sodium selenite in the diets. A total of 704 1 d-old male Cobb chicks were randomly allotted among 32 pens of 22 chicks to accommodate 16 replicate pens per treatment. Pre-starter, starter, grower, and finisher basal diets were formulated based on corn and soybean meal and then supplemented with either sodium selenite ($NaSeO_2$) or Sel-Plex to provide 0.3 mg Se/kg complete feed. Growth performance through to 42 d market weight was determined. At 42 d, 64 birds per treatment were slaughtered and carcass traits, yields and breast meat drip loss over 7 d refrigerated storage and color (Minolta Chroma Meter CR-300) were evaluated. Dietary Se source did not affect growth performance throughout the experiment. There were no Se source effects on most carcass yield traits except for the yield of back and breast: In comparison to $NaSeO_2$, Sel-Plex reduced the inedible portions of back (22.9% vs 22.2%, $P < 0.02$) and increased breast meat yield (31.3% vs 32.1%, $P < 0.05$). There were no Se source effects on breast meat drip loss or color. This experiment demonstrates that total replacement of sodium selenite by selenium yeast in broilers diets improves the economic value of carcass yield by increasing the yield of breast meat and reducing the inedible portions.

Key Words: sodium selenite, selenium yeast, broilers, carcass meat yield, performance

P429 Effects of dietary supplementing organic minerals and antioxidant on the performance of broiler chicks fed oxidized oil. T. Ao,* J. L. Pierce, K. A. Dawson, A. J. Pescatore, A. H. Cantor, and M. J. Ford, *Alltech-University of Kentucky Nutritional Research Alliance, Lexington.*

Endogenous antioxidants such as vitamin E and glutathione are known very important factors to diminish the deleterious effect due to feeding oxidized fats. EconomasE is a proprietary blend of ingredients that maximizes antioxidant status of the animal and reduces the requirement of vitamin E. Trace minerals such as Se, Zn, Cu and Mn are involved in anti-oxidation because they are essential component of many anti-oxidant enzymes. A study was conducted to investigate the effects of supplementing EconomasE and organic minerals (Bioplex, Alltech Inc.) in broiler diets on the performance of broiler chicks fed oxidized oil. Dietary treatments consisted of a 2 × 2 factorial structure with 2 kinds of soybean oil (oxidized or normal) and 2 feeding strategies (with or without EconomasE plus organic minerals). EconomasE replaced 80% vitamin E and 100% Se in control diet. The supplemental level of organic minerals including Zn, Mn, Cu and Fe was equivalent to 25% that of inorganic source in control diet. A total of 1056 chicks were raised in 12 replicate floor pens of 22 chicks per pen. Chicks were randomly assigned to each of 4 dietary treatments. Body weight gain and feed consumption was monitored weekly and corrected for mortality. Breast meat samples were taken at the end of the 5 week trial for the analysis of minerals and vitamin E. Replacing inorganic mineral and vitamin E with organic mineral and EconomasE increased weight gain ($P < 0.05$). No negative effect of oxidized oil on the growth performance was observed in this trial. The breast muscle from chicks fed EconomasE plus organic mineral had higher ($P < 0.01$) Se content than control group. No dietary effect on breast muscle VE and other trace mineral (Zn, Cu, Mn) content was detected. The growth performance data from this trial showed the beneficial effect of adding EconomasE plus organic minerals in broiler diet with or without oxidized oil.

Key Words: broiler chick, oxidized oil, performance, organic minerals, antioxidant

P430 Embryo bone development of Cobb 500 breeder hens fed diets supplemented with organic and inorganic sources of zinc, manganese and copper. A. Favero*[1], S. L. Vieira[1], R. Angel[2], D. Taschetto[1], T. L. Ward[3], and M. A. Rebollo[3], *[1]Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, [2]University of Maryland, College Park, [3]Zinpro Corporation, Eden Prairie, MN.*

The objective of this study was to investigate the effects of maternal dietary Zn, Mn and Cu source and level on egg composition and embryo bone development. The treatments were fed to broiler breeder hens from 22 to 68 wk of age (in ppm of Zn, Mn and Cu, respectively): 100, 100 and 10 from sulfate sources (Control); a mixture of 60, 60, and 3 from sulfate plus 40, 40, and 7 from the metal-AA complex (Iso) combination; and the Control treatment plus 40, 40 and 7 from the metal-AA complex (On Top). Each treatment had 10 replications of 20 females and 2 males. Eggs were incubated from eggs produced at 30, 40, 50 and 60 wk of breeder age and 5 embryos/replicate were collected at 10, 14 and 18 d of incubation. Bone length, midshaft width and mineralization ((calcified tissue/whole bone)*100) were measured for tibiae and femurs stained with Alcian Blue and Alizarin Red S. At hatch the right tibia of 5 chicks/replicate were sampled to evaluate histological tibia morphometry. Feeding Iso treatment compared with the Control diet increased the Zn content of the yolk and albumen blend ($P < 0.05$), however, the same effect was not observed for Mn and Cu ($P > 0.05$). At 14-d, the embryos from the Iso and On Top treatments had greater tibia mineralization (1.6% and 1%, respectively; $P < 0.07$). The 18-d-embryos from hens fed Iso and On Top treatments had 2% thicker tibiae compared with embryos from hens fed the Control, regardless of hen age ($P < 0.05$). Tibia and femur mineralization in 18-d-embryos was greater from hens fed the On Top treatment ($P < 0.05$). At hatch the diaphysis midshaft width increased for chicks from hens fed the Iso and On Top treatments compared with the Control diet ($P < 0.05$). The addition of the amino acid-complexed source of Zn, Mn and Cu increased embryonic and post hatch bone development.

Key Words: broiler breeder, mineral, egg, embryo, bones

P431 Zinc's impact on intestinal barrier function & Zn trafficking during coccidial vaccine challenge. C. Troche*[1], S. D. Eicher[2], and T. J. Applegate[1], *[1]Purdue University, West Lafayette, IN, [2]USDA-ARS, Livestock Behavior Research Unit, West Lafayette, IN.*

To evaluate the effects of Zn supplementation on intestinal barrier function and Zn trafficking, 3 dietary regimens were formulated: a basal corn/

SBM diet formulated with a Zn-free vitamin/mineral premix (Basal), and 2 Zn regimens formulated to provide 90 mg/kg total dietary Zn from either $ZnSO_4$, or a 1:1 blend of $ZnSO_4$ and a Zn-amino acid complex (AvailaZn100; Blend). Additional concentrations of 45 and 70 mg/kg were created by blending the 90 mg/kg Zn and basal regimens. An oral gavage of a coccidial vaccine was administered weekly at 10 times the recommended dosage (10XCV) to half of the birds (6 replicate cages per diet and challenge status; 6 chicks/cage). Ussing chambers were used to study the effect of dietary regimen and 10XCV on the jejunal secretory response, measured by short circuit current (ΔISC). Response to carbachol (a drug which induces Cl^- secretion, mimicking the anaphylactic response and increasing ISC) was 50 fold higher with 10XCV. This pattern of increased ΔISC with 10XCV was reversed with the Zn Blend regimen having a ΔISC response which was equivalent to tissues from unchallenged birds ($P = 0.03$). Zinc regimens, particularly the Zn Blend, improved the anaphylactic response of 10XCV sensitized tissues. As measured through flow cytometry, exposure to 10XCV depressed intracellular free Zn (IFZ) by 27% and increased phagocytic capacity by 5% ($P \leq 0.0001$). Zinc trafficking was measured through mRNA expression of Zn efflux (ZnT5, 7) and influx (ZIP9, 13) transporters in cecal tonsil mucosa. The ratio of ZIP:ZnT cecal expression increased 13-fold with 10XCV, shifting expression toward cytosolic Zn influx ($P \leq 0.0001$). Decreased IFZ, coupled with Zn influx into the cytosol, suggests that with 10XCV, the cell shuttles Zn to cytosolic proteins. Supplemental Zn Blend prevented carbachol-induced Cl^- secretion in 10XCV birds, suggesting that Zn regimens lessen the intestinal anaphylactic response of birds exposed to coccidia. Coccidial vaccine exposure significantly affected phagocytic response and intracellular Zn trafficking within cecal tonsils.

Key Words: zinc, coccidia

P432 Reproductive performance of Cobb 500 breeder hens fed diets supplemented with organic and inorganic sources of zinc, manganese and copper. A. Favero*[1], S. L. Vieira[1], R. Angel[2], R. F. A. Cruz[1], T. L. Ward[3], and M. A. Rebollo[3], *[1]Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, [2]University of Maryland, College Park, [3]Zinpro Corporation, Eden Prairie, MN.*

Nutrients transferred from broiler breeders to the egg are essential for the adequate embryo development. Interest on the use of organic minerals for poultry has been increasing; however, studies with broiler breeders and use of organic minerals are scarce. The objective of this work was to investigate the reproductive responses of broiler breeder hens fed diets supplemented with organic and inorganic sources of Zn, Mn and Cu. The inorganic source was sulfate whereas the organic source was a commercial metal-amino acid (metal-AA) complex. The treatments were fed to Cobb 500 broiler breeder hens (in ppm of Zn, Mn and Cu, respectively): 100, 100 and 10 from sulfate (Control); a mixture of 60, 60, and 3 from sulfate plus 40, 40, and 7 from the metal-AA complex (Iso); and the Control treatment plus 40, 40 and 7 from the metal-AA complex (On Top). Treatments were fed from 22 to 68 wk of age. Each treatment had 10 replications of 20 females and 2 males. Egg shell percentage and thickness were measured using 5 settable eggs from a single day, per replication, at 35, 45, 55, 65 wk of age. A maximum of 90 eggs per replicate pen (n = 30 traits) were set for incubation every 3 wks from 45 to 68 wk of breeder age. Feeding the Iso treatment compared with sulfate sources alone resulted in improvements on eggshell weight and thickness ($P < 0.05$), hatchability of fertile eggs ($P < 0.07$) and decreased early embryo mortality ($P < 0.01$). Feeding the On Top treatment compared with sulfates alone resulted in thicker and heavier eggshells ($P < 0.05$), increased fertile egg hatchability ($P < 0.07$), and more chicks per hen-housed ($P < 0.07$). Broiler breeder requirements of Zn, Mn and Cu and the impact of micro mineral form may be different for egg production vs embryo development and hatchability.

Key Words: broiler breeder, organic minerals, eggshell, fertile eggs, chicks

P433 Effect of organic chromium supplementation and energy levels on digestive enzyme activities in laying hens. P. D. G. Pacheco[1], A. C. Stradiotti*[1], E. V. Siloto[1], P. V. A. Alvarenga[1], T. C. Putarov[1], D. R. S. Sartori[2], J. R. Sartori[1], M. L. M. Vicentini-Paulino[2], A. Piccinin[2], and D. F. Pinheiro[2], *[1]São Paulo State University, School of Veterinary Medicine and Animal Science, Botucatu Campus, Botucatu, SP, Brazil, [2]São Paulo State University, Institute of Bioscience, Botucatu Campus, Botucatu, SP, Brazil.*

Chromium is an essential element in animal nutrition and is important to carbohydrate, fat and protein metabolism due to the potentiation of insulin action. However, little is known about the effects of organic chromium supplementation on the activity of digestive enzymes in laying hens. Thus, the aim of this study was to determine the effects of organic chromium supplementation and dietary energy level on activity of intestinal enzymes (sucrase and maltase), gastrointestinal tract size and body weight of laying hens. A total of 192, 61-week-age Bovans laying hens were housed in battery cages in a controlled environment. The experiment was conducted in a completely randomized design with 4 × 2 factorial arrangement of treatments replicated 6 times with 4 hens per repetition. The treatments consisted of 2 energy levels (2780 and 2900 kcal) and 4 levels of organic chromium supplementation (0; 0.2; 0.4 and 0.8 ppm). At the end of the experiment one hen per repetition was weighed and sacrificed by cervical dislocation, totalizing 6 hens per treatment. The abdominal cavity was then opened and the gastrointestinal organs removed, cleaned with saline solution and weighed. The small intestine immediately distal to the pancreas, free of residual food, was removed and frozen in liquid nitrogen, for further analysis of the intestinal enzymes activity (sucrase and maltase). Data were performed by ANOVA and the means were compared by Tukey test ($P < 0.05$) using the GLM procedure of SAS (2003). Digestive enzymes activity, body weight and gastrointestinal tract size were not altered by dietary treatments ($P > 0.05$). In conclusion, organic chromium supplementation associated with dietary energy level does not alter the morphophysiology gastrointestinal tract of laying hens

Key Words: digestive enzymes, gastrointestinal tract, organic chromium

P434 Effects of organic and inorganic minerals on the productive performance of broiler breeders. D. Pedro[1], A. P. Rosa[1], C. B. Santos*[1], J. Forgiarini[1], T. Branco[1], and G. J. Neto[2], *[1]Federal University of Santa Maria, Santa Maria, RS, Brazil, [2]Yessinergy Agroindustrial Ltda, Campinas, SP, Brazil.*

One experiment was conducted with the objective to evaluate organic and inorganic minerals to broiler breeders diets on their hatchery parameters. In total, 330 females and 30 males COBB 500 broiler breeders were used over 51 to 61 weeks of age. The experimental design was entirely randomized, with 3 treatments and 5 groups of 22 breeders and

2 males each. The treatments were: (PI) = inorganic mineral mix, (PO) = organic mineral mix and (70% PI + 30% PO) = 70% inorganic mix with 30% organic mix. The diets were based on corn and soybean meal. The parameters evaluated were the hatching rate, hatching of fertile eggs, fertility, embryo mortality, chick's weight and percentage of chicks of high quality. To evaluate these parameters the eggs were collected daily. They were classified and marked with the number of the corresponding box. Those eggs that were considered suitable for incubation were stored for a maximum period of 7 d in an air-conditioned room with temperature and humidity control. Incubation was carried out in a multi-stage incubator and on d 18, the eggs were transferred to a brooder. On d 21 the chicks were classified into first quality and second quality chicks. The eggs that did not hatch then underwent embryo diagnostics to evaluate fertility and the phase of embryonic mortality. After the data were obtained a variation analysis was calculated. Broiler breeders fed with 70% PI+ 30% PO had better fertility ($P = 0.0127$) and hatchability ($P = 0.0117$) than birds fed with organic mix. The hatchability of fertile eggs, number of contaminated eggs, embryonic mortality and average weight of chicks were not affected by different treatments. In conclusion the association of organic and inorganic minerals improved the fertility and hatchability of broiler breeders in this trial.

Key Words: minerals organic, broiler breeder, incubation, fertility, hatchability

P435 Supplementation of organic and inorganic minerals in the diet of broiler breeders and their effects on egg quality. D. Pedro[1], A. P. Rosa[1], C. B. Santos*[1], B. Bevilaqua[1], D. R. Klein[1], and J. G. Neto[2], *[1]Federal University of Santa Maria, Santa Maria, RS, Brazil, [2]Yessinergy Agroindustrial Ltda, Campinas, SP, Brazil.*

Minerals are essential nutrients for optimizing the performance of birds. Traditionally, it is supplemented with inorganic salts, that it has lower bioavailability than organic minerals, leading to a growing interest in increase absorption and bioavailable. Therefore, one experiment was conducted with the objective to evaluate organic and inorganic minerals to broiler breeders diets on their performance. In total, 330 females and 30 males COBB 500 broiler breeders were used over 51 to 61 weeks of age. The experimental design was entirely randomized, with 3 treatments and 5 groups of 22 breeders and 2 males each. The treatments were: (PI) = inorganic mineral mix, (PO) = organic mineral mix and (70% PI + 30% PO) = 70% inorganic mix with 30% organic mix.The birds were housed together in their respective treatment groups according to body weight and the uniformity. The diets were based on corn and soybean meal. The parameters evaluated were laying rate, egg weight, specific gravity, yolk color and percentage of albumen, yolk and shell. Six daily collects were performed to evaluate the laying rate during the experimental period. Specific gravity was determined through the immersion of the eggs in saline solutions with densities of 1.065; 1.070; 1.075; 1.080; 1.085; 1.090 and 1.095 g/cm^3. The weighting of the eggs, yolks and albumen were carried out using a precision weighing scale (0.001g). The coloration of the yolks was determined using the color fan from DSM Nutritional Products. After the data were obtained a variation analysis was calculated. The use of organic minerals in the diets of broiler breeders did not affect the productive performance of birds and quality of eggs. In conclusion the association of organic minerals and inorganic did not affect all productive parameter evaluated in this trial.

Key Words: organic minerals, broiler breeders, eggs, laying rate, performance

P436 Relative bioavailability of phosphorus of agricultural-grade and dicalcium phosphates for Japanese quails. J. H. V. Da Silva,* G. M. Dantas, P. E. N.. Givisiez, D. V. G. Vieira, P. B. De Lacerda, and J. J. Filho, *Universidade Federal da Paraiba, Bananeiras, Paraíba, Brazil.*

The relative bioavailability of phosphorus (RBP) of 3 agricultural-grade phosphates [single superphosphate (SSP), triple superphosphate (TSP) and monoammonium phosphate MAP)] was determined for female Japanese quails using dicalcium phosphate (DIP) as a standard (100% of P bioavailability) and 2 statistical models. Seven hundred and 50 Japanese quails were randomly distributed into 10 treatments and 5 replicates with 15 birds per replicate from one to 21 d of age. The control diet contained 0.39% of total phosphorus (TP) from corn-soybean meal, 25% crude protein; 2,900 kcal AME_n, and 0.85% Calcium. Test diets had similar levels, except for total phosphorus. Phosphates were added to the control diet to produce the test diets, providing 0.46, 0.53 and 0.60% TP from DIP, 0.45 and 0.53% TP from TSP and 0.46 and 0.55% TP from SSP and MAP. Slope ratio using multiple linear regressions and exponential models were used to determine RBP for average daily gain (ADG), phosphorus in the tibia (PT) and plasma phosphorus (Pp) regressed on TP considering each P source. Mean relative bioavailability of phosphorus of each phosphorus source was calculated as the average of the 3 evaluated parameters. From multiple linear regression analysis, mean RBP for SSP was 84.64% (63.2% AWG, 99.9% PT, and 90.8% Pp), for TSP was 91.26% (78.4% AWG, 93.9% PT, and 101.4% Pp) and for MAP was 104.52% (99.4% AWG, 111.0% PT, and 103.1% Pp), whereas from exponential model mean RBP for SSP was 82.43% (60.1% AWG, 96.0% PT, and 91.2% Pp), for TSP was 92.04% (78.1% ADG, 96.4% PT, and 101.6% Pp) and for MAP was 101.27% (99.8% ADG, 100.7% PT, and 103.3% Pp). The bioavailability of phosphorus present in the corn and soybean meal mixture was 26% by multiple linear regression. This study suggests that agricultural-grade phosphates can replace DIP in quail diets, particularly MAP, and that the exponential model can be used to estimate phosphorus bioavailability.

Key Words: bioavailability, phosphorus sources, quail