Chick embryo development is associated with an accumulation of polyunsaturated fatty acids in lipid tissues making them susceptible to lipid peroxidation. It has been accepted that canthaxanthin has high antioxidant capacity. Research findings have repeatedly indicated that feeding 25(OH)D3 (25-hydroxycholecalciferol), to poultry breeders, broilers and layers increased performance and health. Therefore, one experiment was conducted with the objective to evaluate a product called Rovimix MaxiChick (association of 6 ppm of canthaxanthin and 69 µg/kg feed of 25(OH)D3) to broiler breeders diets on their performance and hatchery parameters. It was used 264 females and 24 males COBB 500 broiler breeders with 25 to 52 weeks of age. The diets were based on corn and soybean meal. The treatments were: control diet and control diet with Rovimix MaxiChick. The parameters evaluated were body weight, laying rate, egg weight, specific gravity, percentage of albumen, yolk and shell, yolk color. Other parameters evaluated were the hatching rate, hatching of fertile eggs, fertility, embryo mortality, chick’s weight and percentage of chicks of low quality. To evaluate the laying rate were performed 6 daily collections during the experimental period. Eggs collect a day of week were used for all others analysis. Non-hatched eggs were submitted to embryo diagnostics. The addition of MaxiChick in diets of broiler breeders not affected the productive performance of birds and quality of eggs. Broiler breeders fed with MaxiChick had highest deposition of carotenoids in the yolk, also increase the hatchability (P < 0.0075) from 87.15 to 89.67%, hatchability of fertile eggs (P < 0.0237) from 91.63 ± 92.60% and reduce the percentage of early embryo mortality (first 48 h of incubation) (P < 0.0178) from 1.42 to 1.04% during the total period evaluated. The number of contaminated eggs, average weight of chicks and the percentage of low chicks and fertility were not affected by the addition of products. In conclusion MaxiChick improve most of the reproductive parameter evaluated in this trial.

Key Words: carotenoid, carophyll, HyD, vitamin D

Protein and energy in broiler breeder nutrition can alter offspring carcass fat and protein. The current research was conducted to determine the effect of different ME and CP levels in broiler breeder diets during rearing and laying on broiler carcass yield. A 3 × 2 × 2 × 2 factorial arrangement of treatments was used. Ross 708 21-d-old broiler breeder pullets were fed 3 ME levels: high, standard, and low (2,950, HEl; 2,800, SER; and 2,650, LER, kcal/kg, respectively), combined with high (16%, HPr) or low (14%, LPr) CP levels. At 23 wk of age, 384 breeders were individually caged and fed laying diets from 25 wk with high (2,900 kcal/kg, HEi), or low ME (2,800 kcal/kg, LEi) combined with high or low CP (15.5%, HPl; or 14.5%, LPl, respectively). Hens were inseminated at 34 wk of age; 1,885 eggs were collected and pedigree hatched. A total of 1,400 eggs hatched and 881 chicks were placed sex separately according to their maternal laying phase diet and fed ad libitum. At 39 d, 300 broilers were processed and breast muscles (Pectoralis major and P. minor), legs and wings were weighed. ANOVA was performed using the MIXED procedure of SAS. Differences were reported when P < 0.05. The LEl x HPr interaction had higher P. major yield than SER x LPr (16.3 vs. 15.7%) and both of these treatments had lower carcass yield than HEl x HPr (63.8 vs. 64.9%, respectively), whereas the other treatments did not differ. Males from the HPl treatment had higher carcass yield (64.2 vs. 63.4%, respectively) and heavier breast P. major yield (15.9 vs. 15.3%, respectively) compared to those from LPI treatment. Within LEl, LPI breeders produced females with higher P. major yield (16.8%) than HPI breeders (15.9%). In the LEl treatment, males from LPI breeders had reduced yields: 15% compared to 15.7% P. major in HPI; and 63% carcass compared to 64.5% in HPI. Male and female broiler yields phase to reach maximum gross margin, according to market prices and conditions: current prices for feed and broiler (Normal), feed cost 10% above (A), broiler price 10% below (B), and A+B. Feed intake (FI), feed conversion (FC) and feed price (FP) were calculated according to the average diet energy level. The equations were used to calculate revenues, cost and gross margin, as follow: Revenues = [initial broiler weight + (FI x FC)] x (broiler price); Costs = (FI x feed cost)/0.70; Gross margin = Revenues - Costs. According to Costs equation, feed consumption was considered as 70% of production cost. FI (y = −1.6503x + 10927, R² = 0.76) and FC (y = −5.3467(10−4)x + 3.4775, R² = 0.94) showed a linear trend at 49 d, while FP (y = 3.8557(10−2)x² − 2.1532(10−3)x + 3.2979; R² = 0.99) showed a quadratic trend. The nutritional levels that resulted in maximum gross margin in all market situations were below the recommendations (T4) and nearer T2. Profitability per broiler prediction (y = −2.7712(10−6)x² + 1.6043(10−2)x − 23.0958; R² = 0.99) showed a quadratic trend, what confirm the fact that the response of birds to diet nutritional density is a diminishing returns phenomenon and should be evaluated economically to estimate an economic optimum level rather than a biological maximum. So, computational modeling is presented as a tool to make decisions and to solve the complex problem of nutrient requirement estimation for poultry under different market conditions.

Key Words: avian, feeding programs, nutrition

Mathematical models to optimize profit and define nutritional strategies for broiler chickens. D. E. Faria*1, R. B. Araujo2, C. G. Lima1, W. F. Velloso Junior1, K. M. R. Souza1, A. Scher1, D. A. Alves1, A. Bridi1, and J. O. B. Sorbara 2, 1Universidade de São Paulo (FZEA/USP), Pirassununga, SP, Brazil, 2Novos do Brasil, Indaiatuba, SP, Brazil, 3Universidade Anhanguera, Descalvado, SP, Brazil.

This study was carried out to optimize economic outcome and define the best feed nutritional levels, based on AMEn, by using mathematical tools. 1080 d old males Cobb-500® were randomly distributed in 6 treatments with 6 replicates of 30 birds each. Diets were formulated to contain different nutritional density in each feed phase, based on metabolizable energy (AMEn), varying in steps of 100 kcal/kg from conventional treatment (T4 = nutritional levels near of Rostagno et al. (2005) requirements), reaching −300 kcal/kg (T1) and +200 kcal/kg (T6). Microsoft Excel was used to elaborate a program and, through Solver optimization tool, determine the best AMEn level in each feed
depended on the maternal diet. High protein in maternal laying phase diets increased P. major yield of male progeny.

Key Words: breeder, energy, protein, broiler, carcass

381 Effect of feeding low-density soils to Hy-Line W-36 laying hens on long-term production performance. S. A. dePersio*1, K. A. Bland1, K. W. Koelkebeck1, C. M. Parsons2, P. L. Utterback1, C. W. Utterback1, N. O’Sullivan2, K. Bregendahl2, and J. Arango3. 1University of Illinois, Urbana, IL, 2Hy-Line International, Dallas Center, IA.

An experiment was conducted with 480 Hy-Line W-36 laying hens to determine whether feeding diets that varied in nutrient density would affect long-term egg production performance. At 18 wk of age, laying hens were weighed and randomly allocated to 6 replicate groups of 16 hens each (2 adjacent cages containing 8 hens per cage, 60.9 x 58.4 cm) in a randomized complete block design. Placement within house and initial bodyweight were used as blocking criteria. The hens were fed 5 treatment diets formulated to contain 85 (Trt 1), 90 (Trt 2), 95 (Trt 3), 100 (Trt 4), and 105 (Trt 5) % of the energy and nutrient recommendations stated in the 2009 Hy-Line W-36 management guide. Production performance was measured for 52 wk from 18 to 70 wk of age. Over the course of the trial, a significant linear response to increasing nutrient density was seen for average hen-day egg production (18–70 wks of age), with Trts 2 through 5 being 81.87, 81.28, 85.98, and 84.62%, respectively. From 18 to 70 wks of age, an increase in nutrient density showed a significant linear response in decreased feed efficiency [g egg/g feed], with Trts 2 through 5 being 0.47, 0.48, 0.49, and 0.50, respectively. From 18 to 70 wks of age, a significant linear response to increasing nutrient density was found for egg weight, with Trts 2 through 5 being 58.38, 59.15, 59.10, and 60.00, respectively. These results indicate that feeding Hy-Line W-36 hens diets formulated to contain lower nutrient density specifications (85% of control) than recommended may compromise production performance. Furthermore, increasing nutrient density in the diet of a laying hen will increase egg production, egg weight, and decrease feed efficiency. However, these benefits do not take effect in early production and seem to be most effective in later stages of the production cycle; perhaps ac priming the birds for better production.

Key Words: laying hens, low density diets, egg production

382 Evaluation of different levels of trypsin inhibitor and particle size of expeller-extracted SBM on broiler performance. W. J. Pacheco*, C. R. Stark, P. R. Ferket, and J. Brake, North Carolina State University, Raleigh.

Soybean meal is the major protein source in poultry and swine diets. Expeller soybean meal (ESBM) is what remains after the oil has been mechanically removed from whole soybeans. ESBM contains more fat, less protein than solvent-extracted SBM, but it contains higher trypsin inhibitor levels, which limits its inclusion in diets of young chicks. Tolerance to dietary trypsin inhibitor may be enhanced by increasing particle size of ESBM in the diet. This hypothesis was tested in a 16 d broiler growth performance trial evaluating 12 dietary treatments consisting of a factorial arrangement of 2 ESBM particle sizes (coarse 1,300 µm and fine 530 µm) and 6 ESBM trypsin inhibitor (TI) levels (6, 9, 12, 15, 18, 21 TIU/mg). The coarse and fine ESBM were produced by grinding the soy cake with different roll gap widths on a roller mill. A total of 672 male 1-d old broiler chicks were randomly assigned among 8 replicates per treatment and 7 birds per cage. The birds were fed a starter diet in crumble form. The pancreas, gizzard, and liver were excised and weighed at 16 d of age. The ESBM was analyzed for moisture, crude protein, crude fiber and crude fat, which were used to estimate the ME. The estimated ME content of ESBM was 3.2 kcal/g. BW and feed conversion were determined at 7, 14, and 16 d of age and feed conversion (FCR) was adjusted for weights of mortality. There was a quadratic effect on BW (659, 659, 673, 669, 652, and 645 g, P < 0.01) due to the level of TI; the highest BW was obtained when birds were fed 12 and 15 TIU/mg. Birds fed coarse ESBM were heavier at 16 d (666 versus 653 g, P < 0.01). There was no difference on FCR due to particle size and TI level at 16 d. The weight of the pancreas relative to BW increased linearly as the TI level increased (P < 0.001). The weight of the gizzard relative to BW was not affected by ESBM particle size. The results of this experiment indicated that birds performed better when fed coarse ESBM with 12 and 15 TIU/mg, which could indicate poor protein digestion at high TI levels and damage to amino acids due to overcooking of the ESBM at low TI levels.

Key Words: trypsin inhibitor, expeller, particle size, gizzard, pancreas

383 Evaluation of the CYP1A1 and CYP2H1 gene expression in liver tissue of broilers fed with different concentrations of dietary aflatoxin. R. Kakani*, J. Fowler, S. Kallur, A. Haq, M. J. Bailey, and C. A. Bailey, Department of Poultry Science, Texas A&M University System, College Station.

Cytochrome P450 (CYP, CYP450) genes are involved in the biotransformation of aflatoxin B1 (AFB1) into the highly toxic metabolite known as aflatoxin-8,9-epoxide (AFBO) in chicken hepatic tissue. The current study aims at evaluating the expression of 2 such CYP genes involved in biotransformation of AFB1, namely CYP1A1 and CYP2H1, in broiler birds receiving different concentrations of dietary aflatoxin. A total of 60 d old broiler birds (Ross x Cobb) were used to test lowest levels of aflatoxin at which the 2 CYP genes (CYP1A1 and CYP2H1) would get expressed. All birds were randomly allocated to 6 dietary treatments with 2 replications per treatment and fed broiler starter feed with no aflatoxin for the first 3 d. Basal broiler starter diet was prepared using aflatoxin contaminated yellow dent corn at a dietary aflatoxin concentration of 0, 300, 500, 1000, 2000 and 4000 ppb in the final feed and being fed for a period of 13 d. Birds were sacrificed on d 17 and liver samples were collected by flash-freezing them in liquid nitrogen. RNA samples were extracted from 3 liver samples per treatment selected randomly. cDNA was prepared from the RNA (High Capacity cDNA Reverse Transcription Kit, AB system). Primers (reverse and forward) specific to each CYP gene were used for conducting PCR (PCR Super mix, Invitrogen) and the products were run on a 2% gel. Evidences in the literature reported that significant differences in the growth response were seen in birds when the dietary aflatoxin concentration was more than 1000 ppb. All our preliminary data indicates that CYP1A1 and CYP2H1 genes are transcribed in all the treatment groups indicating that the birds are sensitive to AFB1 at concentrations as low as 300 ppb of aflatoxin.

Key Words: aflatoxin, broilers, liver, gene expression

384 Evaluation of roller mill ground corn inclusion on broiler performance and digestive tract development. Y. Xu*, C. R. Stark, and J. Brake, NC State University, Raleigh.
Previous research has shown that the addition of coarse ground grain improved broiler performance and increased gizzard weight. A 14-d cage study was conducted to evaluate the effect of percentage coarse ground corn on broiler performance. A total of 672 d-old male broiler chicks were used in a factorially arranged randomized complete block design with 2 feed forms (mash and crumble) and 6 coarse corn levels (0, 10, 20, 30, 40, and 50%) with 8 replicate pens per treatment and 7 birds per pen. A portion of the corn and all soybean meal was ground with a hammermill (3.4 mm screen) while the coarse corn was ground with a roller mill. The average particle size of the final diets was 422, 431, 471, 509, 542, and 560 µm when 0, 10, 20, 30, 40, and 50% coarse corn was added to the diets, respectively. Feed consumption and BW were determined at 7 and 14 d of age and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of all dead birds. The 14 d BW of the birds fed the crumbles as compared with mash was greater (661 versus 534 g). The addition of coarse corn to the mash diets decreased BW but did not change BW in the crumble diets, thus creating an interaction. Birds fed crumbles had improved AdjFCR compared with mash (1.29 versus 1.37). The addition of coarse particles in the mash diet resulted in poorer AdjFCR but showed no effect in the crumble diet. Fecal nitrogen (N) and gizzard weight relative to BW was calculated at 14 d. The birds fed mash feed had larger gizzards (2.3 versus 1.8%) and the addition of coarse corn resulted in a linear increase in gizzard weight. Fecal N was lower in the mash compared with the crumble diets (3.14 versus 3.23%). However, fecal N increased in the mash diet but tended to decrease in the crumble diets as the overall particle size of the diet increased. The results of the study confirmed that young broilers perform better when fed diets in crumble form and coarse particles increase gizzard weight.

**Key Words:** roller mill, particle size, broiler, pellets, gizzard

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**386 Choice feeding under heat stress conditions in broilers from 15 to 35 days of age.** A. Helmbrecht1, T. G. Madsen2, S. Srinongkote3, and A. Lemme1, 1Evonik Degussa, Health & Nutrition, Hanau, Germany, 2Evonik Degussa, Health & Nutrition, Singapore, 3Bangkok Animal Research Centre, Bangkok, Thailand.

Breeder companies recommend nutrient compositions for each broiler strain and phase to optimize performance. However, due to the heat stress in hot and humid climates, it is often difficult to meet these recommendations. Additionally, there are questions whether broilers would prefer a higher or a lower concentration of amino acids (AA) in an isonenergetic diet as a means to mitigate the impact of heat stress. To test this, two isonenergetic diets were calculated to meet the requirements of birds from 14 to 35 days of age except for AA, which were formulated to meet 90% or 110% of Evonik’s recommendations (2010). 360 male Arbor Acres Plus broiler chicks were randomly allocated to 2 treatments fed one of the experimental diets exclusively and in a 3rd treatment birds were given the choice between both diets, with 12 replicates and 10 birds/pen. The experiment was conducted in Thailand during the hot and humid months of April and May. A commercial starter diet adequate in all nutrients was fed from day of hatch to d 13. Birds were raised on floor pens equipped with 2 feeders and 2 nipple water drinkers each. Feed and water were provided ad libitum. Humidity during the trial was between 42.5 and 58.5%, ambient temperatures varied between 29.5°C and 30.5°C during day and 26.0°C and 30.5°C during night, representing a clear heat stress situation for the broiler chickens. Although diets were calculated iso-energetic with table values, an additional determination of apparent metabolizable energy corrected for nitrogen (AMEn) showed significant differences between both diets (3309 vs. 3122 kcal/kg; P < 0.05), which probably resulted from an adaption of metabolism to heat stress. Under the tested heat stress conditions broilers given a choice between a lower or a higher AA density significantly prefer the lower one (feed intake 1467 vs. 1243 g; P < 0.05). Body weight improved significantly with lower AA compared to higher AA density (1552 vs. 1489 g; P < 0.05). However, the diet with higher AA density allowed for a significantly higher breast meat deposition (348 vs. 339 g; P < 0.05).

**Key Words:** broiler, heat stress, amino acids, choice feeding

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**387 Performance of female broilers fed different feeding programs.** D. E. Faria1, M. Pavesi1, D. E. Faria Filho2, C. G. Lima1, W. F. Velloso Junior1, V. S. Nakagi1, and B. L. U. Schmidt1, 1Evindaria Federal de São Paulo (FZEA/USP), Pirassununga, SP, Brazil, 2Universidade de Minas Gerais, Montes Claros, MG, Brazil.

This study was conducted to evaluate the performance characteristics of female broilers fed different feeding programs at 35, 42, and 49 d of age. 1080 d old females Cobb-500® were randomly distributed in 6 treatments with 6 replicates of 30 birds each. Diets were formulated to contain different nutritional density in each feed phase, based on.
Resolving pellet quality issues and improving turkey poult performance with the manufacture of commercial turkey diet formulations. K. G. S. Lilly*, L. K. Shires, B. N. Swiger, A. M. Evans, K. J. Shipe, and J. S. Moritz, West Virginia University, Morgantown.

High throughput and high fat inclusion in commercial turkey diets decreases pellet quality. This necessitates feed manufacturers to address these factors to realize the potential of feeding high quality pellets. In previous research at West Virginia University, a lignosulphonate binder was added to a commercial turkey diet that was pelleted using 3% mixer-added fat (MAF) at our pilot feed mill. This manufacturing technique improved manufacturing variables and the digestibility of several amino acids when fed to cecotomized roosters. The objective of this study was to explore similar manufacturing effects in a commercial feed mill and to examine these effects on turkey poult performance. Four dietary treatments were arranged in a 2x2 factorial design having variations in amino acid density (AAD) (normal or high) and manufacturing technique (3% MAF and binder or 1% MAF and sand). Total fat additions were similar and adjusted via post-pellet. Crambled diets were assigned to one of 16 pens arranged in a randomized complete block design that contained 105 10-d-old male pouls. Diets were fed from 10 to 38d with poult weight and feed intake recorded weekly. On d 39, pouls were weighed individually and on d 40, 25pouls/pen were randomly selected for breast extraction. Descriptive data from the mill indicated that diets manufactured utilizing 3% MAF and binder inclusion created comparable feed quality to those using 1% MAF and sand. A significant AAD x Technique interaction was established on d 39, demonstrating the highest average poult weight for birds fed High AAD, manufactured using 3% MAF + Binder. Significant differences were also recorded for the main effect AAD, demonstrating that pouls fed High AAD diets had higher d 40 average live poult weight (of 25 pouls randomly chosen for extraction), pectoralis major weight, and total breast weight. Our previous research that found improved amino acid digestibility when using the same binder and 3% MAF may explain the performance differences observed in the current study for 1–39 d male turkey pouls.

Key Words: pellet quality, turkey diets, mixer-added fat, pellet binders, poult performance

Effects of feed manufacture techniques that vary feed exposure to pellet die heat and pressure on pellet quality and subsequent broiler lysine utilization. K. J. Shipe*, A. M. Evans, K. G. S. Lilly, L. K. Shires, B. N. Swiger, and J. S. Moritz, West Virginia University, Morgantown.

The objective of this study was to identify feed manufacture techniques that alter lysine availability as indicated by feeding broilers in the finishing phase. Feed production rate, pellet die specification, and level of mixer-added fat (MAF) influence feed exposure to pellet die heat and pressure that may alter chemical structures of ingredients. Lysine has been indicated as a nutrient with potential to be structurally altered, especially in the presence of heat and reducing sugars, as in Maillard reactions, that decreases nutrient availability. A practical diet containing 7.5% bakery by-product meal and 0.13% lysine HCL was formulated to 90% lysine recommendations of Cobb-Vantress to best demonstrate lysine availability differences when manufactured and fed. This diet was utilized in a 2x2x2 factorial design that evaluated the effects of production rate (0.5 or 0.8 tonne/hr), die thickness (38.1 or 44.5 mm), and MAF level (0.5 or 3%) on feed manufacture, broiler performance, and processing yield. Two additional treatments: unprocessed mash and double pelleted (exposed twice to 0.5 tonne/hr production using a 44.5 mm die after 0.5% MAF) were also manufactured and fed. All diets, excluding mash, were steamed conditioned at 82°C and reground before feeding. Pellet mill electrical energy usage, pellet quality, and bulk density were increased with 0.5 tonne/hr production rate, 44.5 mm pellet die, and 0.5% MAF techniques (P = 0.0001) that created greater feed exposure to pellet die heat and pressure. Regardless of these effects, upon feeding, no differences in performance or processing yield were observed among treatments in the factorial structure (P > 0.05). Contrasts demonstrated that mash fed birds had decreased FCR compared with double pelleted fed birds, with birds fed diets from the factorial treatments being intermediate (P < 0.05). These data suggest that pelleting in general had deleterious effects on nutrient availability that could not be identified by varying feed exposure in the die. It was unclear whether or not lysine or other nutrients were affected.

Key Words: lysine, feed manufacture, pellet quality

Broiler breeder composition restriction. 1: Do attempts to shift body composition using dietary protein and energy affect early production traits? A. Pishnamazi*, E. T. Mba, T. G. V. Moraes, R. A. Renema, and M. J. Zuidhof, University of Alberta, Edmonton, AB, Canada.

The effectiveness of a composition restriction program to limit muscle deposition and support early egg production traits was assessed between photostimulation (23 wk) and 33 wk of age in 432, Ross 708 breeder hens. A 3 × 2 × 2 × 2 factorial arrangement of treatments was used. A total of 1,186 pullets were housed in floor pens and from 21 d were fed 3 ME levels: high, standard, and low (2,950, HElr; 2,800, SEr; and 2,650, Lr, kcal/kg, respectively), combined with high (16%, HPV) or low (14%, LPV) CP levels. At 23 wk, 432 pullets were caged and from 25 wk fed breeder diets with high (2,900 kcal/kg, HEI), or low ME (2,800 kcal/kg, LEI) with high or low CP (15%, HPI; or 14.5%, LP1, respectively). Feed allocation changed every week based on BW compared with breeder targets. Individual BW, sexual maturation, and egg production and weights were recorded. At 27, 30 and 33 wk of age, 144 hens dissected and breast muscle, liver, abdominal fatpad, ovary and oviduct were weighed. Analysis of variance was performed using the MIXED procedure of SAS (P < 0.05). The LEI birds matured earlier than HEI pullets (186 vs. 188 d). Initial egg wt. of LEr birds was heavier than HEr pullets (51.2 vs. 49.4g). Pullets fed HEr=HPV=LEI reached consistent 52 g egg wt. 9 d earlier than
those on LEr×LP×HEl. Overall, feeding a HE rearing or breeder diet led to higher relative fatpad wt. (2.05 vs. 1.88% and 1.99 vs. 1.83%, respectively). Birds on LEI×HIPl had more breast muscle than those on LEI×LPi (24.3 vs. 22.4% of BW). Overall, the LEI×LPi hens had heavier ovary wt., yellow follicle wt., and number of large yellow follicles than HEI×LPi birds (58.9 vs. 49.8 g; 51.2 vs. 42.3 g; and 6.1 vs. 5.2, respectively). Feed intake was lower for HEI pullets that LEI birds (131.3 vs. 136.2 g/d) due to birds equalizing energy intake (HEI = 380.7, LEI = 381.4 kcal/d). Crude protein intake was higher in LEI than HEI birds (20.4 vs. 19.7 g/d). Feed changed carcass fatness and muscling, and ovary development did not do well with lower protein intake. Nutrient needs change with age and need to be considered over the life of the bird.

Key Words: broiler breeder, CP, ME, ovary, breast muscle