M202 Response of market turkey toms to dietary protein and threonine levels in diets containing corn distillers dried grains. S. L. Noll* and J. Brannon, *University of Minnesota*, *St. Paul*.

The response of market turkey toms to diet threonine level was examined during 8 to 19 wks of age. Diets were formulated to contain 90, 94, 100, and 106% NRC digestible thr from intact protein. In addition, supplemental thr was used to reach 100 or 106% NRC thr. Diets were composed primarily of corn, soybean meal, poultry by-product meal (PBM, 10%) and corn distillers dried grains with solubles (DDGS, 20%). Large White male turkey poults (Nicholas strain) were randomly assigned to pens (10/pen) at 8 wks of age. The treatments were (T): 1. Corn soy control, 100% NRC thr; 2. PBM-DDGS 106% NRC thr; 3. As T2, plus 6% NRC thr; 4. As T2, 100% NRC thr; 5. As T4, plus 6% NRC thr; 6. As T4, plus 12% NRC thr; 7. As T2, 94% NRC thr; 8. As T7 plus 6% NRC thr; 9. As T7 plus 12% NRC thr; 10. As T2, 90% NRC thr; 11. As T10 plus 10% NRC thr. All diets were supplemented as needed with lys and met to meet the specific NRC recommendations for these amino acids. The ratio of calcium: inorganic phosphorus was maintained at 2:1. Each diet was fed to 8 replicate pens. The experimental design was a completely randomized block design. Dietary treatment affected body weight at all ages (P<.0001). BW at 19 wks of age was similar for T 1, 2, 3 and 4. Decreasing diet NRC thr to 94 and 90% significantly decreased BW while supplementation with thr improved body weight but not to the level of the control at 100% NRC. Increased average daily gain response to supplemental thr (6% NRC thr) was observed for 100, 94, and 90% NRC thr treatment groups during 8-11 and 11-14 wks of age; and, only in the 90% NRC thr treatment during 14-17 and 17-19 wks of age. Improved feed efficiency in response to supplemental thr (6% NRC thr) was observed for the 94% NRC treatment during 8-11 wks; and, for the 90% NRC thr group during 8-11 and 17-19 wks of age. In diets containing a large amount of alternative protein (10% PBM and 20% DDGS), a gain response to supplemental thr was observed when diet thr from intact protein was less than 106% NRC during 8-11 wks, less than 100 % NRC during 11-14 wks, and less than 94% NRC during 14-19 wks of age.

Key Words: Turkey, Distillers Grains with Solubles, Threonine

M203 Influence of feed form and fiber inclusion in the diet on performance of broilers from one to twenty one days of age. E. Jiménez-Moreno[1], J. M. González-Alvarado[1,2], A. P. Bonilla[1], R. Lázaro[1], and G. G. Mateos*[1], [1]*Universidad Politécnica de Madrid*, *Spain*, [2]*Universidad Autónoma de Tlaxcala*, *México*.

We studied the effects of feed form and the inclusion of fiber in the diet on productive performance of broilers from 1 to 21 d of age. There were twelve treatments arranged factorially with two feed forms (mash and pelleted) and six diets consisting in the combination of three insoluble fiber sources (OH; oat hulls, RH; rice hulls, and SFH; sunflower hulls) and two levels of fiber source inclusion (2.5 vs. 5%). In addition, a control diet without additional fiber was formulated and offered either in mash or pellet form. The diameter of the pellets was 2–mm. The control diet was based on rice, soy protein concentrate, fish meal, and fat, and had 3,200 kcal AME_n/kg, 1.4% total lysine, and 1.6% crude fiber. The fiber source was included in the experimental diets at expenses (wt/wt) of the whole diet. Each treatment was replicated six times (a cage with 12 chicks). Body weight (BW) and feed consumption (ADFI) were recorded per replicate at 0, 4, 8, 14, and 21 d of age. No interactions between main effects were observed. For the entire experiment, broilers fed pellets had better BW gain, higher ADFI, and lower feed conversion ratio (FCR) than broilers fed mash ($P \leq 0.001$). Fiber inclusion tended to improve BW gain ($P \leq 0.1$) and improved FCR ($P \leq 0.05$) but no differences were observed between diets containing 2.5 or 5% fiber source for any trait studied. From 0 to 4 d of age, broilers fed SFH had better FCR than broilers fed OH or RH (0.844 vs. 0.870 and 0.876; $P \leq 0.05$) but the effect disappeared with age. We conclude that pelleting improves productive performance of broilers from 1 to 21 d of age. Also, the inclusion of fiber source at levels of up to 5% (from 1.61% crude fiber in the control diet to 4.24% crude fiber in the 5% RH containing diet) improves productive performance in chicks fed low–fiber diets. Therefore, chicks might have a requirement for a minimum amount of fiber in the diet.

Key Words: Pellet, Fiber Sources, Broiler Performance

M204 Nutritional value of corn distiller dried grains with solubles (DDGs): Influence of solubles addition. S. L. Noll*[1], J. Brannon[1], and C. Parsons[2], [1]*University of Minnesota*, *St. Paul*, [2]*University of Illinois*, *Champaign*.

Batches of corn distiller dried grains were produced with varying levels of solubles (syrup) added back to the wet grains (mash) in cooperation with a Minnesota ethanol plant. The batches produced contained syrup added at approximately 0, 30, 60, and 100% of the maximum possible addition of syrup to mash. Actual rates of syrup addition were 0, 12, 25, and 42 gal/minute. The different combinations of mash and syrup were dried at the plant with a lag of 60 minutes in between the changes for the different rates of syrup addition. Samples of each lot of material were taken and were chemically analyzed. Digestible amino acid content was determined with cecectomized roosters. True metabolizable energy (TMEn) was determined in intact young growing turkeys. Regression analyses and correlation coefficients (Pearson) were conducted to determine the extent of the relationship between the level of solubles added and the resulting nutrient content. Particle size was greatly affected with larger and more variable particle size with the highest level of solubles addition. The larger particles ("syrup balls") were readily apparent in the 100% batch and are of concern for product quality for poultry feeds. Content of fat and ash increased with solubles addition. Fat content increased from 8% in the dried grains to 10.5% (as fed basis) where 100% of the solubles were added back. The TMEn content also increased with solubles addition from 2712 kcal/kg for the dried grains to 3743 kcal/kg where 100% of the solubles were added back. Mineral content, especially for magnesium, sodium, phosphorus, potassium, chloride, and sulfur increased as the level of solubles addition increased. Protein and amino acid content showed very little change in the various products. True amino acid digestibility coefficients of the essential amino acids tended to be negatively correlated with solubles addition. The results indicate that solubles addition has the largest effect on particle size, color, and; content of fat and minerals.

Key Words: Distillers Grains, Solubles, Energy

M205 Metabolizable energy value of crude glycerin for laying hens. K. Bregendahl*[1], P. Lammers[1], B. Kerr[2], M. Honeyman[1], K. Stalder[1], T. Weber[1], W. Dozier, III[3], K. Dion[1], M. Neal[1], and S. Mottet[1], [1]*Iowa State University*, *Ames*, [2]*USDA/ARS*, *Ames, IA*, [3]*USDA/ARS*, *Mississippi State, MS*.

An experiment with laying hens was conducted to determine the AMEn value of crude glycerin, a coproduct of biodiesel production. Crude glycerin (86.95% glycerol, 9.22% water, 0.03% methanol, 1.26% Na, 3625 kcal/kg gross energy) was obtained from AG Processing Inc., Sergeant Bluff, IA. A total of 48 40-wk-old laying hens (Hy-Line W-36) were placed in metabolic cages (2 hens/cage) in a light-controlled (16:8 L:D) room and given free access to the experimental diets. A basal diet (19% CP; 2922 kcal/kg AMEn) was formulated using corn, soybean meal, and meat and bone meal with 15% glucose and 1% Celite (to increase the content of acid-insoluble ash used as an indigestible marker). The 4 treatment diets were created by substituting 0, 5, 10, or 15% crude glycerin for glucose (3640 kcal/kg AMEn). After 7 d of dietary adaptation, excreta was collected twice daily for 3 d, freeze-dried, and analyzed for contents of DM, Kjeldahl N, acid-insoluble ash, and gross energy. Egg production was recorded daily, and eggs collected on Day 7 and 8 of the experiment were weighed for calculation of egg mass (egg production × egg weight). Feed consumption was measured over the entire 13-d-long experiment. Egg-production data were analyzed using ANOVA with 4 treatments and 6 replications in a completely randomized experimental design. The AMEn value of the crude glycerin was estimated as the slope of the linear relationship between the inclusion rate of dietary crude glycerin and the glucose-corrected AMEn value of the experimental diets. There were no treatment effects ($P > 0.05$) on the hens' egg-production rate (93.0%), egg weight (56.1 g), egg mass (52.2 g/d), or feed consumption (104 g/d). Linear regression analysis ($P < 0.001$, $r^2 = 0.92$, $n = 24$) showed that the AMEn value of the crude glycerin used in this study was 3805 ± 238 kcal/kg (mean ± SE; as-is basis) for laying hens. The results of this study show that the energy in crude glycerin is utilized with high efficiency by laying hens.

Key Words: Crude Glycerin, Metabolizable Energy, Laying Hens

M206 Nutrient digestibility of high protein corn distillers dried grains with solubles, dehydrated corn germ and bran. A. Batal*, *University of Georgia*, *Athens*.

Sectors of the ethanol industry are starting to use a new bio-refining production technology which separates the corn into three fractions: fiber, germ and endosperm, prior to ethanol production. These fractions are then converted into new co-products, high protein distillers dried grains with solubles (HP-DDGS), dehydrated corn germ meal, and bran cake. Studies were conducted to determine the nutritional parameters of these new co-products. A chick experiment was conducted to determine the phosphorus (P) bioavailability based on tibia ash. In addition, conventional and cecectomzied precision-fed rooster assays were conducted to determine TME_n and amino acid digestibility. For the chick assay, a P-deficient corn-soybean meal diet containing 0.13% non-phytate P was supplemented with 0, 0.05, 0.10, and 0.15% from KH_2PO_4 or 7 and 14% DDGS, HP-DDGS, and corn germ. Cobb 500 chicks were fed the experimental diets to 18 d of age and bioavailability of P was estimated using the slope-ratio method where tibia ash was repressed on P intake. The total P content and P bioavailability of the DDGS, HP-DDGS, and corn germ were 0.77 and 60, 0.35 and 47, and 1.18 and 31%, respectively. The average protein, fiber, and fat % for DDGS was 27, 7, and 10, for HP-DDGS 44, 7, and 3, for corn germ 15.5, 4.5, and 17, and for bran 11.6, 4.5, 7.8. The average TME_n was 2,829, 2,700, 2,965, and 2,912 kcal/kg (as-fed basis) for the DDGS, HP-DDGS, corn germ, and bran, respectively. Bran had a higher TME_n value than expected, which is likely due to the high fat content. Total concentration and percent availability, of lysine for the DDGS, HP-DDGS, corn germ, and bran was 0.79 (81), 1.03 (72), 0.83 (80) and 0.43% (68%), respectively. The total lysine as a % of CP was 3% for the conventional DDGS and only 2% for the HP-DDGS, however these products had a similar TME_n. New bio-refining techniques result in co-products that have unique nutritional qualities compared to conventional DDGS. Thus, confirmatory analyses should be conducted prior to utilizing these new co-products of ethanol production.

Key Words: Distillers Dried Grains with Solubles, Corn Germ, Amino Acid Digestibility

M207 Effects of sorghum variety on growth and subsequent egg production in layers reared in West Africa. S. Issa*[1,2], J. D. Hancock[1], M. R. Tuinstra[1], I. Kapran[2], and S. Kaka[2], [1]*Kansas State University*, *Manhattan*, [2]*National Institute for Agricultural Research in Niger*, *Niamey, Niger*.

A total of 450 1-d-old layer chicks (Harco line with an initial body weight of 29 g) were used in an 18-month experiment to determine the effects of sorghum variety on growth and egg production. There were 50 chicks/pen and three pens/treatment with feed and water consumed on an ad-libitum basis. The control diet was corn based with fishmeal and peanut cake used as the primary protein supplements. The control was formulated to exceed recommendations for all nutrient concentrations as suggested in the 1994 NRC for poultry. Sorghum was used to replace the corn on a wt/wt basis so that treatments were: 1) corn (imported from Nigeria)-based control; 2) a locally adapted landrace variety of sorghum (Mota Galmi) with red seed, purple plant, and 0.3 mg catechin equivalents/100 mg of grain DM; and 3) an agronomically improved variety of sorghum (IRAT 204) with white seed, tan plant, and no detectable tannins. For d 0 to 126, there were no differences ($P > 0.12$) in average daily gain (ADG) and gain to feed ratio (G:F) among birds fed the corn and sorghum treatments. However, the numerical advantage in ADG for birds fed the agronomically improved sorghum resulted in a 79 g advantage ($P < 0.001$) in body weight at the beginning of the laying period compared to birds fed the locally adapted sorghum. For the laying period, birds fed the sorghum grains took fewer days to come into production ($P < 0.007$), ate more feed ($P < 0.02$), and produced more eggs ($P < 0.001$) than birds fed the corn-based diet. There were no differences in average egg weight and egg:feed ratio among birds fed corn and the sorghums. Means for corn, locally adapted sorghum, and improved sorghum were 1,855, 1,840, and 1,919 g body weight at 126 days, 141, 135, and 133 d to reach 20% production, and 47, 56, and 55% production for the entire laying period. In conclusion, sorghum grain was equal (if not superior) to corn as a feedstuff in diets for layers reared in West Africa.

Key Words: Sorghum, Corn, Layer

M208 Dietary inclusion of a dairy processing plant by-product on performance and processing yields of broilers. H. L. Santiago*, L. J. Pérez, J. A. Orama, and A. A. Rodríguez, *University of Puerto Rico*, *Mayagüez, Puerto Rico*.

Dairy processing wastes resulting from the manufacture of Latin white cheese have nutrient profiles similar to grains used in poultry diets and can become potential feed sources at reasonable prices. The objective of this study was to evaluate the dietary inclusion of a dairy industry by-product (DIBP) on growth performance and processing yields of broilers. The dried DIBP incorporated into diets had a 50.6% crude protein and 1.9 % fat content. A total of 540 d-old chicks were randomized in three treatments with six replicate pens of 30 birds each. Treatments consisted of diets containing 0 (control), 3, and 6% DIBP. Feed and birds were weighed weekly up to 42 d of age to determine body weight (BW), feed intake (FI), and feed conversion (FC). At market age (43 d), a total of 180 birds were processed to evaluate carcass composition and to determine processing yields. The dietary inclusion of DIBP had no effect on growth performance of broilers. At all ages, broilers fed a 3 and 6% of DIBP had similar BW, FI, and FC than that of controls. Although, no significant differences among dietary treatments were observed for FC, birds fed diets containing 6% DIBP tended to have better FC when compared to birds fed control and 3% DIBP diets. Mortality and the percentage of culled birds were similar for all dietary treatments. No differences among treatments were observed in yields of carcass, abdominal fat, mayor cuts, and breast meat. Fat pad yield declined from 1.14 to 0.97 % as the percentage of DIBP inclusion in the diet increased. The results of this study indicate that the DIBP evaluated could be a valuable feed ingredient to supply part of the dietary protein and metabolizable energy requirements of broilers. The results showed that DIBP could be used in broiler diets up to 6% without compromising growth performance, health, and processing yields.

Key Words: Broilers, Growth, Dairy By-Product

M209 The researches for the functional components in fish meal for broiler chickens. K. Nakagawa*[1], T. Akazawa[2], M. Tamura[2], and H. Sato[1], [1]*Ajinomoto Co., Inc.*, *Tokyo, Japan*, [2]*Itochu Feed Mills Co., Ltd.*, *Tochigi, Japan*.

In our previous studies, we found that the broiler chickens grew faster when birds were fed a diet containing fish meal than when fed all-vegetable diet or a diet containing chicken meal. However, there was no effect of sole supplementation of the specific components in fish meal (ex. fish oil, creatine, glycine or taurine). Two broiler trials were conducted to identify what components in fish meal have key roles for growth. In the initial trial, 240 male Cobb broiler chicks of 0-d-old were allocated to one of four treatments with six replicates of 10 birds each. The experimental diets were all-vegetable diet (VEG as control, a diet containing 5% fish meal (FM), 5% soluble fraction (SF) or 5% insoluble fraction (IF) of fish meal, respectively. Both SF and IF were prepared by separating the slurry of fish meal into the solid and liquid parts, drying up the solid as IF, and freeze-drying the liquid as SF. Chicks were fed each experimental diet for two weeks, with individual body weight and feed intake per replicate measured on day 7 and 14. On day 14, body weight ($P<0.01$) and feed intake ($P<0.01$) were significantly improved by feeding FM, SF and IF comparing with feeding VEG. In the subsequent trial, we focused on the effect of the soluble fraction and conducted an experiment with the similar procedures with the initial one. The experimental diets were VEG, a diet containing 4% SF, 1.7% low MW fraction of SF (LMW) or 2.3% high MW fraction of SF (HMW). The inclusion of LMW and HMW in the diets was determined based on their proportion (weight %) in the whole SF. LMW and HMW were prepared from SF by using a membrane filter for 1,000 MW. On day 14, body weight ($P<0.01$), feed intake ($P<0.01$) and feed conversion ratio ($P<0.10$) were significantly improved by feeding SF and HMW comparing with feeding VEG, and not improved by feeding LMW. These results suggest that several components in fish meal have beneficial functions, and they are included in the insoluble fraction and the soluble fraction of high MW.

Key Words: Fish Meal, Fraction, Broiler Chicken

M210 Evaluation of NutriDense® corn compared to conventional corn fed to laying hens. P. Utterback*[1], E. Kim[1], C. Jacobs[1], C. Utterback[1], C. Parsons[1], J. Snow[2], and J. Weigel[2], [1]*University of Illinois*, *Urbana*, [2]*BASF Plant Science*, *Research Triangle Park, NC*.

A 12-week experiment was conducted using 360 Hy-Line W-36 hens (24 wk of age) to compare NutriDense® (ND) corn, supplied by BASF Plant Science, to conventional (CONV) corn when used in laying hen diets. Treatment 1 utilized conventional corn formulated to meet NRC (1994) requirements for layers, and the diet was formulated to contain 17% crude protein and 2900 kcal of MEn. Treatment 2 also used conventional corn, but the diet was formulated to contain lower nutrient levels to reduce feed costs. The Treatment 2 diet was formulated to contain 15% crude protein and 2800 kcal of MEn. Treatments 3 & 4 were the same as 1 & 2, respectively, but with ND corn added in place of CONV corn. The final treatment was a least-cost formulated diet containing the same nutrient levels as Treatment 1 but using ND corn instead of CONV corn. The latter treatment was included to compare the economic value of ND corn compared to the CONV corn. Diets were fed for 12 weeks, and data were summarized at two-week intervals. There were no differences among any of the treatments at any time period for body weight, hen-day egg production, egg weight, egg mass, egg specific gravity, or mortality. Feed consumption showed statistical differences among treatments ($P< 0.05$) at Week 6, 10, 12, and cumulatively, with feed intake being highest for Treatment 2 and lowest for Treatment 3. There were also significant differences in feed efficiency (egg mass divided by feed intake) among treatments at Weeks 8, 10, 12, and cumulatively due to Treatment 2 being significantly ($P<0.05$) lower than all other treatments. The results of this study indicate that the egg production performance of laying hens fed ND corn is equal to or superior to that of hens fed CONV corn and that feeding ND corn may reduce feed costs.

Key Words: Laying Hens, NutriDense® Corn, Conventional Corn

M211 Comparison of broiler performance and carcass parameters when fed diets containing combined trait insect-protected and glyphosate-tolerant corn (MON 89034 × NK603), control, or conventional reference corn. M. L. Taylor*[1], G. F. Hartnell[1], D. M. Lucas[1], M. A. Nemeth[1], and S. W. Davis[2], [1]*Monsanto Company*, *Creve Coeur, MO*, [2]*Colorado Quality Research*, *Wellington, CO*.

A 42-d floor pen study was conducted to compare broiler (Ross × Ross 308) performance and carcass measurements when fed diets containing lepidopteran protected corn combined with glyphosate tolerant corn (MON 89034 × NK603) with those of broiler fed diets containing corn grain from the conventional control and 6 conventional corn hybrids. MON 89034 produces the Cry1A.105 and Cry2Ab2 insecticidal

proteins that protect corn plants from feeding damage caused by European corn borer (Ostrinia nubilalis) and other lepidopteran insect pests. The combination of the Cry2Ab2 and Cry1A.105 insecticidal proteins in a single plant provides outstanding insect control and offers an effective insect-resistance management tool. NK603 produces the 5-enolpyruvylshikimate-3-phosphate synthase protein from Agrobacterium sp. strain CP4 (CP4 EPSPS), which confers tolerance to glyphosate, the active ingredient in Roundup$|reg; agricultural herbicides. MON 89034 × NK603 was produced by traditional breeding of plants that express the individual traits. Broilers were fed starter diets (approximately 57% wt/wt corn grain) from d 0 to d 21 and grower/finisher diets (approximately 59% wt/wt corn grain) from d 21 to d 42. The study utilized a randomized complete block design with 8 dietary treatments assigned randomly within 5 blocks of 16 pens each (8 male and 8 female) with 10 birds per pen. There were 10 pens per treatment group (5 male and 5 female). Weight at d 0 and d 42, feed intake, and feed conversion, and all measured carcass and meat quality parameters were not different (P > 0.05) for birds fed MON 89034 × NK603 and control corn diets. In addition, comparisons of the MON 89034 × NK603 diet to the population of the control and 6 reference corn diets showed no difference (P > 0.05) in any performance, carcass, or meat quality parameter measured. In conclusion, the diets containing MON 89034 × NK603 were nutritionally equivalent to diets containing the control or conventional reference corn grain when fed to broilers.

Key Words: Broiler Performance, Carcass Yield, Genetically Modified Corn

M212 Comparison of broiler performance and carcass parameters when fed diets containing soybean meal produced from glyphosate-tolerant (MON 89788), control or conventional reference soybeans. M. L. Taylor*[1], G. F. Hartnell[1], D. M. Lucas[1], M. A. Nemeth[1], and S. W. Davis[2], [1]*Monsanto Company*, *Creve Coeur, MO*, [2]*Colorado Quality Research*, *Wellington, CO*.

A 42-d floor pen study was conducted to compare broiler (Ross × Ross 308) performance and carcass measurements when fed diets containing meal produced from glyphosate-tolerant soybeans (MON 89788) with those of broilers fed diets containing meal produced from control soybean (A3244) that has similar genetic background to MON 89788. Soybean meal produced from 6 conventional soybean varieties were included in the study to provide comparison measurements for broilers fed meal derived from conventional soybeans. MON 89788 produces the 5-enolpyruvylshikimate-3-phosphate synthase protein from Agrobacterium sp. strain CP4 (cp4 epsps), which confers tolerance to glyphosate, the active ingredient in Roundup® agricultural herbicides. Broilers were fed starter diets (approximately 33% wt/wt dehulled soybean meal) from d 0 to d 21 and grower/finisher diets (approximately 30% wt/wt dehulled soybean meal) from d 21 to d 42. The study utilized a randomized complete block design with 8 dietary treatments assigned randomly within 5 blocks of 16 pens each (8 male and 8 female) with 10 birds per pen. There were 10 pens per treatment group (5 male and 5 female). No treatment differences (P > 0.05) were detected among dietary treatments for feed intake, weight gain, feed conversion, adjusted feed conversion, or any measured carcass and meat quality parameters. Comparison of all performance, carcass, and meat quality parameters measured showed no differences (P > 0.05) between birds fed the MON 89788 soybean meal diet and the population of birds fed the control and 6 conventional reference soybean meal diets. It is concluded that the diets containing soybean meal produced from MON 89788 were nutritionally equivalent to diets containing soybean meal produced from the control and conventional reference soybean varieties when fed to broilers.

Key Words: Broiler Performance, Carcass Yield, Genetically Modified Soybean

M213 Broiler chicken performance as affected by diets containing cashew nut meal submitted to different storage conditions. I. R. V. Lopes[1], M. F. F. Fuentes*[1], E. R. Freitas[1], J. R. Lima[2], R. B. Silva[1], R. C. Lima[1], and R. M. Bezerra[1], [1]*Universidade Federal do Ceará*, *Fortaleza, CE, Brazil*, [2]*Embrapa Agroindústria Tropical*, *Fortaleza, CE, Brazil*.

Cashew nut meal (CNM) is an abundant sub product from the cashew nut processing industry in Northeast Brazil and it contains about 47.8% ether extract and 22% crude protein. This experiment was conducted to evaluate the performance of broiler chickens fed diets containing CNM which had been stored with or without addition of butylated hydroxytoluene (BHT) as an antioxidant additive. A 400kg batch of freshly produced CNM was divided into five portions. One portion was stored without BHT and the others were added of 500 ppm BHT at 0, 7, 14 and 21 days of storage. Total storage time was 35 days. Weekly samplings of CNM were taken for peroxide index (PI) determination. At the end of the storing period five isoproteic and isocaloric diets were formulated as to contain 15% CNM from each of the five different storage conditions described above. A feeding trial was then carried out with 480 day old chicks males Ross x Ross. Birds were randomly distributed among the five treatments with eight repetitions of twelve birds each. The variables studied were weight gain, feed intake and feed conversion. PI values in stored CNM, with or without BHT, increased with storage time. However, diets containing CNM with or without BHT and stored for 35 days did not affect (P≥0.05) the variables studied. CNM stored for 35 days without BHT can be used in broiler diets with no effect on bird performance.

Key Words: Weight Gain, Feed Conversion, Peroxide Index

M214 Broiler performance and carcass characteristics when fed diets containing Lysine maize (LY038 or LY038 × MON 810), control or conventional reference maize. D. M. Lucas*[1], M. L. Taylor[1], G. F. Hartnell[1], M. A. Nemeth[1], K. C. Glenn[1], and S. W. Davis[2], [1]*Monsanto Company*, *St. Louis, MO*, [2]*Colorado Quality Research*, *Wellington, CO*.

Lysine maize, LY038, was developed through the application of modern biotechnology to accumulate free lysine (Lys) in the germ portion of maize grain and provide an alternative to direct addition of supplemental Lys to poultry diets. Maize LY038 × MON 810 was produced by conventional breeding of LY038 with MON 810, which provides the maize plant protection against feeding damage from the European corn borer. A 42–d broiler feeding study (10 pens of 10 male Cobb × Cobb 500 broilers/treatment) was conducted to compare the feeding value of grain from LY038 or LY038 × MON 810 to that of a conventional control (similar genetic background to the test maize) and 5 conventional maize hybrids. LY038 and LY038 × MON 810 diets, and control and conventional reference maize diets supplemented with L–Lys HCl were formulated to a Lys level below that required for

optimal bird performance; whereas, all other essential amino acids were present at levels, relative to Lys, above those required for optimal bird performance [1.05% and 0.90% total Lys (as-fed) for d 0 to 21 and d 21 to 42, respectively]. Total Lys level in control and reference maize based diets without supplemental L–Lys HCl were formulated to be 0.079% lower than supplemented diets. Weight gain, feed efficiency, and carcass yield and composition of broilers fed diets containing LY038 or LY038 × MON 810 were not different ($P \geq 0.05$) from that of broilers fed L–Lys HCl supplemented diets and were superior ($P \leq 0.05$) to that of broilers fed conventional maize diets without supplemental L–Lys HCl. Both broiler performance and carcass data demonstrate that the bioefficacy of the incremental Lys in LY038 or LY038 × MON 810 grain was not different from that of Lys in conventional maize diets supplemented with L–Lys HCl. LY038 and LY038 × MON 810 can be considered as wholesome as and more nutritious than conventional maize due to its higher than average Lys content.

Key Words: Broiler Performance, Lysine, Maize

M215 Effects of selection for mold resistance on nutritional value of sorghum grain in broiler chicks. C. R. Monge*[1], J. D. Hancock[1], C. Feoli[1], W. L. Rooney[2], S. R. Bean[1,3], and S. Beyer[1], [1]*Kansas State University*, *Manhattan*, [2]*Texas A&M University*, *College Station*, [3]*USDA/ARS*, *Manhattan*.

A total of 264 broiler chicks (Cobb x Cobb, 14 d of age, and average initial body weight of 403 g) was used in a 7-d metabolism experiment to determine the effects of selection for mold resistance on nutrient utilization. A reference diet with 50% cornstarch was formulated to meet or exceed all nutrient concentrations recommended in the 1994 NRC for poultry. Sorghum grain was then substituted for cornstarch in the reference diet. Treatments were sorghums selected from a plant-breeding program that were susceptible and resistant to mold and weathering. These sorghums were grown at four locations in Texas (Corpus Christi, Beeville, College Station, and Halfway) and one location in Kansas (Manhattan). The chicks were adjusted to treatment for 4 d followed by 3 d collection of excreta. The excreta were dried, ground, and analyzed for DM, N, and GE with Cr2O3 used as an indigestible marker. Analysis of variance suggested there were no interactions ($P > 0.66$) among location and sorghum type for average daily gain (ADG), gain to feed ratio (G:F), and retention of DM and GE. Also, there were no effects of location or sorghum type on ADG and G:F ($P > 0.37$). However, there were trends ($P < 0.06$) for location effects on retention of DM and N and these trends were in agreement with the greater retention of GE ($P < 0.02$) for chicks fed sorghums produced in Beeville vs the other locations. There was a trend ($P < 0.06$) for greater retention of DM among chicks fed the susceptible vs the resistant sorghum, but retention of N and GE were not affected by sorghum type ($P > 0.3$). Means for the susceptible and resistant sorghums were 44 and 46 g/d for ADG, 707 and 710 g/kg for G:F, 72 and 70% for retention of DM, 47 and 49% for retention of N, and 77 and 76% for retention of GE, respectively. In conclusion, selection for mold resistance had minimal and inconsistent effects on the nutritional value of sorghum grain for broiler chicks.

Key Words: Sorghum, Mold Resistance, Poultry

M216 Influence of fish meal processing on performance of broilers from 1 to 28 days of age. A. P. Bonilla, A. de Coca-Sinova, E. Jiménez-Moreno, R. Lázaro, and G. G. Mateos*, *Universidad Politécnica de Madrid*, *Spain*.

Bacterial contamination and particularly Salmonella spp. contamination limits the use of fish meal (FM) in prestarter diets for broilers. In consequence, FM processing plants apply severe heat conditions (100° C for 120 min) during rendering to reduce bacterial load. However, an increase in time and temperature conditions during processing might reduce amino acid availability and FM quality. We studied the effect of processing FM under different time and temperature conditions on productive performance of broiler from 1 to 28 d of age. There were six dietary treatments that differed in the type of FM used to replace 5% of the crude protein of the diet. There were a control diet (SFM) that included 8.0% standard FM (100° C for 120 min) and a positive control diet (FMLT) that included 7.1% of spray dried FM (70° C). The remaining four diets included the same original fresh FM that the control SFM diet but in which the FM was processed according to a factorial combination of temperature (80 vs. 90° C) and time (50 vs. 90 min). Each treatment was replicated eight times (10 chicks caged together). The experimental design was completely at random and data were analysed by a protected t–test. In addition two extra non–orthogonal contrasts were included; 1) FMLT vs. SFM and 2) main effects of temperature (80 vs. 90° C) and time (50 vs. 90 min) applied during processing and their interaction. The best BWG and FCR were obtained for broilers fed FMLT or FM processed at 80° C during 50 min but the differences with respect to broilers fed SFM were not significant. The temperature applied during processing had little effect on broiler productivity ($P > 0.10$) but an increase in processing time from 50 to 90 min tended ($P \leq 0.10$) to reduce BWG (52.16 vs. 50.57 g/d) and to impair FCR (1.44 vs. 1.47). We conclude that an aggressive thermal process with an increase in time from 50 to 90 min to reduce microorganism load and Salmonella spp. counts in feed might reduce the quality of fish meal in diets for broilers.

Key Words: Fish Meal, Heat Processing, Broiler Performance

M217 Improved phosphorus utilization in broilers fed phosphorus deficient diets early in life. R. Angel*[1] and C. M. Ashwell[2], [1]*University of Maryland*, *College Park*, [2]*North Carolina State University*, *Raleigh*.

Land application of poultry litter, that is comparatively high in P due to poor utilization of phytin P (PP) by poultry, is of increasing concern in areas of intensive poultry production in the United States. Several strategies have been developed to address this issue, but with variable effectiveness and often increasing production costs, therefore alternative strategies must be explored. To determine the effects of early P nutrition on performance and P utilization male Ross 308 chicks were fed either a control (C) (1.11% Ca and 0.50% PP) or a low (L) (0.59% Ca and 0.25% PP) diet from hatch to 4 d of age (90hr). All birds were then fed a C diet (NRC Ca and P) until d 22. From d 22 to 38 birds were either maintained on a C diet (0.7% Ca and 0.3% P) or an L diet (0.4% Ca and 0.12% P). The three treatments (Trt), C-C-C, C-C-L, and L-C-L met all other NRC (1994) nutrient recommendations. Data were collected for each phase including weight gain, feed conversion, bone ash, and specific nutrient retention. All diets and ileal contents were analyzed for dry matter, P, Ca, PP, and acid insoluble ash. Diet non-PP was determined by subtracting analyzed PP from analyzed P. Apparent ileal absorption of P and Ca, and disappearance of PP were

calculated using an indigestible marker. Broilers fed the L diet to 90 hr were better able to handle a deficiency in P in the grower/finisher phase (22 to 38 d of age) than those fed a C diet in the first 90 hr. Not only were the broilers fed the L diet early heavier (P<0.05) at 38 d of age (2275.6 vs 2235.4 g for the L-C-L and the C-C-L Trt, respectively), but they had better feed efficiency (1.76 vs 1.89 in the L-C-L and C-C-L Trt, respectively), had higher tibia ash and higher P retention (56.54 vs 45.39% for the L-C-L and C-C-L Trt, respectively) than those fed the C diet in the first 90 hr of life. This clearly establishes that "imprinting" or permanent modifications are occurring post-hatch that are long term and allow for improved P utilization when P deficient diets are fed in the grower/finisher phases.

Key Words: Phosphorus, Conditioning, Imprinting

M218 Calcium and available phosphorus levels at 2:1 ratio for growing broiler chickens. S. Bunzen, H. S. Rostagno*, L. F. T. Albino, L. R. Nery, and C. R. Silva, *Viçosa Federal University*, *Viçosa, MG, Brazil*.

The reduction of phosphorus (P) levels in broiler chickens diets will certainly help to decrease costs and P excretion with reduced effect on the environment. There are many interrelationships between calcium (Ca) and P suggesting that nutritional studies should be run evaluating Ca:available P (aP) levels at a constant ratio of 2:1. A study was carried out with the objective of determining the best %Ca:%aP level for broiler chickens from 22 to 35 days of age. A floor pen trial with 1,440 broilers (Cobb 500; 720 males and 720 females) was conducted using a completely randomized block design, in a 2 x 6 factorial arrangement (Gender x 6 %Ca:%aP levels) with eight replicates and 15 birds per experimental unit (pen). The experimental diets were based on corn (0.03% Ca / 0.08% aP) and soybean meal (0.24% Ca / 0.18% aP), supplemented with dicalcium phosphate (24.5% Ca / 18.5% aP) and limestone (38.4% Ca) to obtain 6 %Ca:%aP levels (0.40 / 0.20, 0.50 / 0.25, 0.60 / 0.30, 0.70 / 0.35, 0.80 / 0.40 and 0.90 / 0.45). Weight gain, feed consumption, feed conversion and bone (tibia) parameters (ash, Ca and P from three birds per pen) were evaluated. Feed consumption was not affected (P>0.05) by the experimental treatments. Weight gain improved linearly (P<0.05) to the dietary Ca:aP levels (gain males = 1095.26 + 102.286 aP; R2= 0.64, and gain females = 895.90 + 153.143 aP; R2=0.57) with an improvement of 36 g/male and 44 g/female (highest - lowest gain). Feed conversion of males and females broilers showed a quadratic response (P<0.05) described by the equations; Y = 1.86068 - 0.675337 aP + 0.85 aP 2 (R2 = 0.87) for males, and Y = 1.99459 - 1.44471 aP + 2.01429 aP 2 (R2 = 0.75) for females. Based on feed conversion and using a 95% confidence limit, the recommended levels are: 0.377% aP / 0.754% Ca for broiler males and 0.341% aP / 0.682% Ca for broiler females.

Key Words: Available Phosphorus, Broilers, Calcium

M219 The effects of Quantum™ phytase on broiler chick live performance and tibia ash percentage. M. E. Persia* and M. R. Bedford, *Syngenta Animal Nutrition*, *RTP, NC*.

Chick tibia ash percentage (TAP) is a sensitive measure of the phosphorus adequacy of poultry diets. Three experiments were conducted to determine the effects of two doses of Quantum™ phytase (QP) on TAP and live performance of chickens fed reduced nonphytate phosphorus (NPP) diets. Four experimental diets were utilized including a positive control diet (PC) that met or exceeded all NRC (1994) recommendations, a negative control diet (NC) similar to the PC but deficient in NPP (0.20% NPP) and the same NC diet supplemented with either 250 or 500 FTU of QP/kg (250 and 500, respectively). In all experiments, 12 blocks of either 6 or 12 Cobb x Cobb broiler chicks were assigned to each of the four treatments utilizing a randomized complete block design. Chicks were raised on experimental diets from 0 to 21 d in Petersime battery pens located in an environmentally controlled room. Weight gain and feed intake were recorded for the 21 d period. At the conclusion of the experiment, chicks were sacrificed and the right tibia was collected from four chicks per replicate group for fat-free TAP determination. Data were analyzed using ANOVA and means separated using specific pre-planned contrasts. Over all experiments, chick weight gain and feed intake was reduced 162 and 171g, respectively, when birds were fed the NC compared with PC rations. Phytase supplementation significantly increased weight gain and feed intake of the NC ration, resulting in overall increases of 95 and 128 g for weight gain and 96 and 137 for feed intake with 250 and 500 FTU/kg, respectively. Tibia ash percent was reduced by 8.3, 8.9 and 7.6% units between the NC and PC fed chickens in experiments 1, 2 and 3, respectively. Supplementation of the NC ration with 250 and 500 FTU/kg significantly increased TAP restoring 2.9, 2.3 and 2.7% units and 4.9, 4.3 and 4.8% units, respectively. These data demonstrate the consistent ability of QP to liberate P and increase weight gain, feed intake and TAP of chicks fed NPP deficient diets.

Key Words: Tibia ash, Phytase, Broiler

Nonruminant Nutrition: Weanling Pig Nutrition and Physiology

M220 Dietary nucleotides supplementation improves growth performance of early weaned pigs. D. Martinez-Puig*[1], J. Morales[2], E. Borda[1], C. Piñeiro[2], and C. Chetrit[1], [1]*Bioiberica S.A.*, *Palafolls, Barcelona, Spain*, [2]*PigChamp Pro-Europa*, *Segovia, Spain*.

In the weaning period, transition from sow's milk to the postweaning diet causes the withdrawal of milk nucleotides. Dietary nucleotide are known to be important for the maturation of the gastrointestinal tract and in the development of immune function (Carver et al., 1991). The objective of the present experiment was to study the effect of dietary supplementation of a nucleotide preparation (Nucleoforce Piglets™) on the productive performance of early weaned pigs. 192 suckling piglets of 14 days of age were distributed into two treatments according to the litter and fed with two creep feed diets, one supplemented with the nucleotide preparation (1000 ppm) and the other no supplemented. Piglets were weaned at 21 days of age and consumed the experimental diets till day 35. From day 35 until day 56 all piglets were fed with the same diet. Performance was determined on days 21, 28, 35 and 56. Mortality and faecal consistency were also assessed. During the prestarter period (21 to 35 d), the average daily gain of pigs fed the nucleotide preparation was numerically higher (76.7 g/d; P=0.12) than that of the pigs fed the control diet (53.5 g/d), although no differences were detected on the feed conversion ratio. During the starter period (35-56d), the nucleotide supplementation significantly improved