

**M40 Disinfection of eggshells using ultraviolet light and hydrogen peroxide independently and in combination.** J. Wells\*, C. Coufal, H. Parker, and C. McDaniel, *Mississippi State University, Mississippi State.*

Eggshell bacteria are decreased by ultraviolet light (UV) or hydrogen peroxide (HP) alone, however, the antimicrobial effects of these two treatments combined as well as optimum length for UV exposure are not known. Therefore, the objectives were to obtain the optimum length of UV exposure for maximum bacteria reduction and to determine if a greater bacterial reduction would occur when using a combination of UV and HP as opposed to either treatment alone. The first experiment was conducted to find the optimum length of UV exposure by exposing eggs to 4, 8, 16 and 32 min of UV. Three experiments were conducted to determine what concentration of HP in combination with UV exposure would yield maximum bacterial reduction. For experiment 2, treatments consisted of a control and UV alone, as well as 0, 1, 2 and 3% HP alone and in combination with UV. For experiment 3, treatments consisted of a control, UV alone, 3% HP alone, as well as 0, 0.5, 1, 1.5, 2, 2.5 and 3% HP in combination with UV. Experiment 4 contained 10 treatments including control, 1.5, 2 and 2.5% HP at UV exposure times of 2, 4 and 8 min for each HP concentration. After each treatment, eggs were placed in a sterile bag, and 50 ml of sterile phosphate buffered saline (pH 7.2) was added. Rinsate (0.5 mL) from diluted samples was spread plated on tryptic soy agar in duplicate and incubated for 48 h prior to bacterial enumeration. Every control eggshell contained bacteria with an average bacterial count of 4 log. Exposure to only UV for 8 min yielded optimum bacterial reduction. When administered independently, HP and UV each reduced the bacterial count by 2 log, yielding no bacteria on 16% and 30% of the plates for HP and UV, respectively. The combination of HP and UV reduced bacterial counts by a maximum of 3 log and the percentage of eggs positive for bacteria by 65%. Because bacterial contamination was further reduced by using a combination of UV and HP, hatchability and chick quality of broiler breeder eggs may be improved by these treatments.

**Key Words:** Eggshell sanitation, Bacteria, Hydrogen peroxide, Ultraviolet light

**M41 Shaking eggs during incubation: An alternative to turning.** H. R. Cutchin\*, M. J. Wineland, and K. M. Mann, *North Carolina State University, Raleigh.*

The process of turning eggs during incubation causes reduced air flow across eggs potentially leading to hot spots in the machine (Buhr, 1989). However, not turning eggs correlates strongly with decreased hatchability. This project was designed to study the effects of shaking eggs during various periods of incubation. Two customized Chickmaster setters were used, one that turns eggs (turns) and one that oscillates (osc) (shakes) through 4.5cm. Three trials are reported. In trial 1, the shaker ran at 1osc/sec for 20sec every 30min. In trial 2, the duration and frequency increased to 1osc/sec for 30sec every 10min. In trial 3, the speed was increased to 1.25osc/sec for 20sec every 20min. Each of the trials contained 6 treatments: turn control (TC), 3 (T3), and 7 (T7) as well as shake control (SC), 3 (S3) and 7 (S7). The controls remained in the setter for 18 days

**M43 Nutritional value of biochemically treated cocoa bean shell in laying hen diets.** R. A. Hamzat\*, M. D. Olumide<sup>2</sup>, E. O. Uwagboe<sup>1</sup>, and A. O. Akinsoyinu<sup>2</sup>, <sup>1</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria*, <sup>2</sup>*University of Ibadan, Oyo, Nigeria*, <sup>3</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria*, <sup>4</sup>*University of Ibadan, Oyo, Nigeria.*

Many by-products that are considered as wastes in Nigeria have great potentials as poultry feed ingredients if properly handled, processed and incorporated into rations. One of such neglected by-products is Cocoa bean shell (CBS). Nigeria is the fourth largest producer of cocoa in the world and cocoa bean shell is abundantly wasting on all cocoa processing factories in Nigeria. This trial focused on detheobrominising cocoa bean shell through application of enzyme and fermentation in order to enhance its nutritional value for layers.

Two hundred and ten (210) six-week-in-lay hens were used for this trial with thirty birds, randomly allotted to seven experimental diets containing ten birds per

of incubation. The T3 and S3 groups started in their respective setter then were switched to the other setter at d3 of incubation and the T7 and S7 groups at d7. This was performed to determine if there is a critical time period during which eggs should be turned vs. shaken. In all 3 trials, the hatch of fertile was significantly lower in the SC group than the TC group due to significantly high early (d1-3) and late (d17-20) embryonic mortality. There were significantly higher numbers of pipped chicks in SC in trial 2 and trial 3 than the other treatments. Egg temp was monitored in trial 3 using temp probes. In the shake machine the average difference in egg temp between the top and bottom of the machine was 0.2°F, which was significantly different from 0.5°F in the turn machine. In conclusion, shaking 1osc/sec for 30sec every 10min can produce an adequate hatch of fertile, though still significantly lower than turning. Shaking faster is very detrimental and shaking less frequently is not as beneficial to hatch of fertile. Turning eggs for 7 days then moving to the shaker actually improved hatch of fertile in trials 2 and 3.

**Key Words:** Shaking, Incubation, Egg temperature, Turning, Critical period

**M42 Farmers' participatory evaluation of local by-products in broiler feeds.** E. O. Uwagboe\*, F. A. Iyoha<sup>2</sup>, E. O. Aigbekaen<sup>1</sup>, S. O. Adeogun<sup>1</sup>, R. A. Hamzat<sup>1</sup>, R. A. Sanusi<sup>1</sup>, B. O. Iyamu<sup>3</sup>, C. O. Imarhiagbe<sup>3</sup>, and L. A. Akinbile<sup>4</sup>, <sup>1</sup>*Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria*, <sup>2</sup>*College of Education, Ekiadolor, Benin City, Nigeria*, <sup>3</sup>*Ministry of Agriculture and Natural Resources, Benin City, Nigeria*, <sup>4</sup>*University of Ibadan, Ibadan, Oyo State, Nigeria.*

The demand for animal protein is on the increase due to growth in population in Nigeria. For poultry industry to meet this demand research result need to be utilized for the improvement in poultry production. This study assessed farmers interest in the use of two experimental diets; kola pod husk and cassava peels. Specifically, the study was to investigate the socio economic characteristics of commercial poultry farmers, examine interest of farmers on the research result and examine the constraints militating against the use of by-products. The study was carried out in the Agricultural Development Programme poultry farm in Benin City. Thirty commercial farmers were randomly selected from the list of 300 members of Poultry Association of Nigeria Edo State to participate in the experiment and information was elicited with the use of questionnaire. The data were presented with frequency counts, percentages and charts while analysis was carried out using Chi-Square. The result revealed that the commercial farmers had mean age of 41 years with 85% having post secondary education and 60% have more than 5 years in poultry business. The Chi-Square result revealed that there is a significant relationship between level of education and interest in research results ( $X^2=14.56$ ,  $P\leq 0.05$ ). Based on responses to the constructed attitudinal statements on preferences and constraints, most (60%) of the respondents preferred kola pod husk while (40%) preferred cassava peels. In conclusion, farmers preferred the use of locally acquired by-products as a means of increasing income and reducing the heavy reliance on maize as source of energy for broiler birds.

**Key Words:** Farmers, Participatory, Evaluation, By-products, Broilers

## Nutrition II

replicate in a 3 × 3 factorial design. These diets were: A (0% CBS – control); B (5% raw CBS); C (10% raw CBS); D (5% CBS with enzyme); E (10% CBS with enzyme); F (5% fermented CBS); and G (10% fermented CBS). The layers on each diet were offered feed and water ad libitum throughout the experimental period. The results obtained indicated that there were significant differences ( $P < 0.05$ ) in feed intake, hen – day production and egg weight. Significant ( $P < 0.05$ ) differences were also recorded in internal quality characteristics (yolk weight, yolk height, yolk width, albumin weight, albumin height, yolk colour, haugh unit) and the external quality characteristics (egg length, egg width, shell width, shell thickness and shell percentage) of the eggs from the experimental layers. The enzyme treatment and fermentation technique improved the nutritive quality of cocoa bean shell in layers.

**Key Words:** Biochemical treatments, Cocoa bean shell, Laying hens, Egg quality

**M44 Evaluation of the effect of cassava peels and kola pod husk on the performance of broiler finishers.** F. A. Iyoha<sup>\*1</sup>, C. I. Aghimien<sup>1</sup>, E. O. Uwagboe<sup>2</sup>, R. A. Hamzat<sup>2</sup>, B. O. Iyamu<sup>3</sup>, C. O. Imarhiagbe<sup>3</sup>, and M. D. Olu-mide<sup>4</sup>, <sup>1</sup>College of Education, Benin City, Edo State, Nigeria, <sup>2</sup>Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria, <sup>3</sup>Ministry of Agriculture and Natural Resources, Benin City, Edo State, Nigeria, <sup>4</sup>Kolmart Farms, Ibadan, Oyo State, Nigeria.

The study was designed to compare the effect of cassava peels and kola pod husk on the performance of broiler finisher. One hundred and twenty, four-week old Hybro and Ross broilers were assigned randomly to two experimental diets of cassava peels and kola pod husk in triplicates of 15 birds each in complete randomized design. The proximate compositions of dried cassava peels; Crude protein 2.75±0.49% and ME (kcal/g) 4.66 ±0.18% and kola pod husk; Crude protein 17.60% and ME (cal/kg) 2555. The treatments were used at four levels of 0, 10, 20 and 30% replacement for maize. Data were collected daily for 4 weeks and analyzed with analysis of variance (ANOVA). The result shows that body weight gain, feed consumption and feed conversion ratio were not significantly different ( $P \leq 0.05$ ) as the two levels of the experimental diets increased. There was no significant difference ( $P \leq 0.05$ ) in the weight of feather, wing, gizzard, liver and length of intestine. It was observed that kola pod husks and cassava peels on broiler finisher performance was not significantly different and could be used efficiently in broiler finisher feeds. This will increase farmers' income as they would spend less on maize as source of energy for broiler finisher feed.

**Key Words:** Evaluation, Cassava peels, Kola pod husk, Performance, Broiler finisher

**M45 Dietary protein and energy effects on broiler live performance to 42 days.** F. I. L. Hernandez<sup>\*1</sup>, D. R. Korver<sup>2</sup>, R. A. Renema<sup>2</sup>, and M. J. Zuidhof<sup>1</sup>, <sup>1</sup>Alberta Agriculture and Food, Edmonton, AB, Canada, <sup>2</sup>University of Alberta, Edmonton, AB, Canada.

A study was carried out to investigate the effects of energy and protein levels on performance of Cobb Avian 48 broilers to 42 d. Chicks were randomly assigned to a 2 x 2 x 3 x 5 factorial arrangement of treatments, with 2 sexes; 2 levels of early nutrition (0 to 11 d); and after 11 d, 3 metabolizable energy (ME) levels and 5 dietary balanced protein (DBP) levels, balanced for 4 limiting amino acids. The three ME levels were 94, 97, and 100% of Cobb-Vantress dietary specifications for maximum growth rate and feed conversion ratio (FCR). The five DBP levels were 85, 92.5, 100, 107.5, and 115% of these same specifications. Two pre-starter nutrient densities were used, based on Cobb's starter recommendations for maximizing growth rate and FCR (HIGH), or for reduced feed cost (LOW). From 12 to 42 d of age, the pre-starter treatment was nested within pens, which housed ME x DBP x sex interactions. By 6 wk, the HIGH pre-starter increased BW (2.73 vs. 2.661 kg;  $p < 0.0001$ ). Male broilers were heavier than females ( $p < 0.005$ ) in all levels of ME and DBP. Among treatment means, BW ranged from 2.70 to 3.0 kg for males, and 2.40 to 2.50 kg for females. Females had a higher cumulative FCR than males ( $p < 0.0001$ ). In males, DBP did not affect cumulative FCR at 42 d; females fed 85% DBP had a lower cumulative FCR than those fed 100% DBP. Covariate analysis indicated that breast yield (corrected for BW) was higher at 100% through 115% DBP than at 85% (range: 494-500 g vs. 480 g, respectively;  $p < 0.0001$ ). The low ME level increased breast yield relative to the high ME level ( $p < 0.08$ ). Males had higher eviscerated BW and wing yield. In conclusion, HIGH pre-starter improved growth rate, males were more efficient than females, and high DBP levels increased breast yield.

**Key Words:** Live Performance, Yield, Broilers, Metabolizable Energy, Dietary Balanced Protein

**M46 Effect of protein and energy level in feed on posthatch chick performance.** R. Molenaar<sup>\*1</sup>, I. A. M. Reijrink<sup>1</sup>, R. Meijerhof<sup>1</sup>, J. K. W. M. Sparla<sup>2</sup>, and P. J. A. Wijtten<sup>2</sup>, <sup>1</sup>HatchTech BV, Veenendaal, the Netherlands, <sup>2</sup>Provimi BV, Rotterdam, the Netherlands.

Previous studies demonstrated that early feeding of chicks improves post hatch development, especially in combination with optimum brooding conditions.

However, optimum feed formulation for especially the first days of life are not well known. This study evaluates the effect of protein and energy level on body weight and feed intake of chicks till 4 days posthatch in a brooding system, designed to keep birds on optimum body temperature.

A total of 400 chicks originating from a broiler breeder flock of 48 weeks, were randomly assigned to 4 feed treatments, with 5 replications for each treatment. Feed treatments were: A. High digestible lysine (12.5 g/kg), high energy (2950 kcal); B. High digestible lysine (12.5 g/kg), low energy (2800 kcal) C. Low digestible lysine (10.8 g/kg), high energy (2950 kcal) D. Low digestible lysine (10.8 g/kg); low energy (2800 kcal). Body weight and feed intake were measured daily till 4 days posthatch.

Results showed that at day 4 posthatch, feed A and B resulted in significant higher body weights than feed C and D ( $P < 0.05$ ), while feed B showed a higher trend in body weight than feed A ( $P < 0.10$ ). Feed intake was not influenced by diet composition. When analyzing bodyweight gain of all birds, a general negative correlation ( $P < 0.05$ ) was found within all treatments, between bodyweight at hatch and body weight gain during the first day.

High protein levels in feed seems more beneficial for growth of posthatch chicks than high energy levels. High energy levels were achieved by including fat in the diet, which is more difficult for day old chicks to digest than protein, due to an impaired development of the intestinal tract. Regulation of feed intake by energy intake in day old chicks seem to be limited, as feed consumption was not influenced by energy level. Chicks that did not grow the first day might have hatched later and therefore were less dehydrated, indicated by the higher body weight at the start.

**Key Words:** Nutrient requirements, Protein, Energy, Early feed intake

**M47 The role of feeding regimens in regulating metabolism of sexually mature broiler breeders: hepatic lipid metabolism, plasma hormones and metabolites.** M. de Beer<sup>\*1</sup>, R. D. Ekmy<sup>2</sup>, R.W. Rosebrough<sup>3</sup>, M.P. Richards<sup>3</sup>, J. P. McMurtry<sup>3</sup>, and C. N. Coon<sup>2</sup>, <sup>1</sup>Aviagen, Huntsville, AL, <sup>2</sup>University of Arkansas, Fayetteville, <sup>3</sup>USDA-ARS, Beltsville, MD.

A trial was conducted to determine the effects of different rearing feed regimens on plasma hormone and metabolite levels and hepatic lipid metabolism on sexually mature broiler breeders. A flock of Cobb 500 birds was divided into two groups at 35 days of age and fed either everyday (ED) or skip-a-day (SKP). At 168 days of age, all birds were switched over to an ED regimen. At 185 days (26 weeks) of age, 28 ED-reared and 28 SKP-reared birds were randomly selected and sacrificed at intervals after feeding. Liver and blood samples were collected and analyzed. Glycogen, Total Liver Fat and Liver Fat % increased upon feeding regardless of treatment. The magnitude of the increase was greater for SKP birds with peaks achieved by hour 12. Similar findings were reported for birds at 16 weeks of age. Relative Liver Weight increased only in SKP birds. The overall mean gene expression of ICDH, AST, and ACC was not significantly different between treatments. Both ME and FAS were higher in SKP birds and peaked at 8 hours; indicative of continued lipogenesis and consistent with liver fat data. Corticosterone and IGF-2 levels were significantly higher ( $P < 0.05$ ) in SKP birds. Elevated corticosterone levels can be attributed to increased hunger and stress. SKP birds were also higher in Leptin, Glucagon, and T3. The increase in leptin is a reversal of what was reported during the rearing phase. In summary, different feeding regimens alter metabolic responses which carry over into sexual maturity and exhibit metabolic memory

**Key Words:** Broiler breeders, Lipogenesis, Gene expression, Metabolic hormones

**M48 Dietary lysine requirement of male broilers from 14 to 28 days of age.** W. A. Dozier III<sup>\*1</sup>, A. Corzo<sup>2</sup>, M. T. Kidd<sup>2</sup>, and P. Tillman<sup>3</sup>, <sup>1</sup>USDA-ARS Poultry Research Unit, Mississippi State, MS, <sup>2</sup>Mississippi State University, Mississippi State, <sup>3</sup>Ajinomoto Heartland LLC, Chicago, IL.

Dietary Lys requirement of broiler chickens from 14 to 28 d of age has not been well defined. This study examined growth responses of broilers provided experimental diets varying in digestible Lys concentrations from 14 to 28 d of age. Fifteen hundred and thirty-six Ross × Ross TP16 chicks were randomly

distributed into 96 floor pens at 1 d of age and were fed a common starter diet until 13 d of age. At 14 d of age, all pens were equalized with 15 birds (0.09 m<sup>2</sup>/bird) and fed the experimental diets until 28 d of age. Two diets consisting of corn, soybean meal, and peanut meal were formulated to be surfeit in limiting amino acids and contained 0.85 or 1.25% digestible Lys. Diet dilution was used with L-Lys HCl to create 9 titration diets from 0.85 to 1.25% digestible Lys in 0.05% increments (10 pens/treatment). A control diet containing surfeit Lys was used to validate the titration diets (6 pens/treatment).

Digestible Lys content of the experimental diets containing 0.85 and 1.25% were in close agreement with the calculated values based upon a cecectomized rooster assay resulting in digestible Lys of 0.84 and 1.21%, respectively. Significant ( $P \leq 0.03$ ) quadratic trends were observed for BW, BW gain, feed intake, Lys intake/BW gain, and feed conversion. Dietary treatments did not affect the incidence of mortality. Dietary digestible Lys requirements for BW, BW gain, feed intake, and feed conversion were estimated as 1.10, 1.10, 1.06, and 1.13%, respectively, based on 95% of the optimum response. These results indicate that the Lys requirement for Ross  $\times$  Ross TP16 male broilers is higher than Lys levels predicted from regression equations from Dozier et al., 2007 using mixed sexed Ross  $\times$  Ross 508 and 708 broilers.

**Key Words:** Amino acid, Broiler, Lysine

**M49 Dietary lysine requirement of female broilers from 14 to 28 days of age.** A. Corzo\*<sup>1</sup>, W. A. Dozier, III<sup>2</sup>, M. T. Kidd<sup>1</sup>, and P. Tillman<sup>3</sup>. <sup>1</sup>Mississippi State University, Mississippi State, <sup>2</sup>USDA-ARS Poultry Research Unit, Mississippi State, MS, <sup>3</sup>Ajinomoto Heartland LLC, Chicago, IL.

Dietary Lys needs of female broilers have been rarely evaluated because traditionally the needs for dietary Lys of males have served to describe an overall Lys requirement. A study was conducted evaluating increasing concentrations in dietary digestible Lys from 14 to 28 d of age. One-thousand-forty-eight female Ross  $\times$  Ross TP16 d-old female broiler chicks were randomly distributed into 96 floor pens. These chicks were fed a common starter diet in crumbled form, formulated to meet or exceed all dietary nutrient requirements. At 14 d of age, all pens were equalized in bird number (12 birds/pen; 0.09birds/m<sup>2</sup>). Two diets consisting primarily of corn, soybean meal, and peanut meal were formulated to be surfeit in limiting amino acids and contained 0.85 or 1.25% digestible Lys. Diet dilution was used with L-Lys HCl to create 9 experimental titration diets from 0.85 to 1.25% digestible Lys in 0.05% increments (10 pens/treatment). A control diet containing surfeit Lys was used to validate the titration diets (6 pens/treatment). All experimental diets were fed from 14 to 28 d of age, and offered in pellet form.

Diets were analyzed for digestible Lys content based on a precision-fed cecectomized rooster assay. Calculated and analyzed digestible Lys values of the experimental diets were in close agreement (0.84 and 1.21% digestible Lys for the diets formulated to 0.85 and 1.25%, respectively). BW gain and lysine intake displayed significant linear responses. Feed conversion exhibited a significant quadratic trend resulting in a digestible Lys requirement estimate of 1.06% based on 95% of the minimum response. Incidence of mortality was unaffected by the dietary Lys levels fed. The results from this study indicate that the Ross  $\times$  Ross TP16 female broiler requires a minimum of 1.06% digestible Lys from 14 to 28 d of age, and in agreement with results obtained in the companion study using male broilers.

**Key Words:** Amino acid, Broiler, Lysine

**M50 Determination of the effect of methionine and lysine on feed intake of growing broilers.** C. O. Imarhiagbe\*<sup>1</sup>, E. O. Uwagboe<sup>2</sup>, F. A. Iyoha<sup>3</sup>, and B. O. Iyamu<sup>1</sup>. <sup>1</sup>Ministry of Agriculture and Natural Resources, Benin City, Edo State, Nigeria, <sup>2</sup>Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria, <sup>3</sup>College of Education, Ekiadolor, Benin City, Nigeria.

In most developing countries especially in Sub-Sahara Africa, there is acute protein calorie malnutrition particularly that from animal sources. It has been observed that the average protein intake of every Nigerian falls dismally below the WHO requirement. To overcome this effect therefore, the producing animals

and their genetic potentials have to be substantially improved. Hence, a need to determine the effect of methionine and lysine in feed intake of growing broilers. This experiment was conducted on deep litter system at the livestock division of the Department of Agricultural Services of the Ministry of Agriculture and Natural Resources farm in Oko-Ogba, Benin city. The experimental design was a 3 $\times$ 3 $\times$ 2 factorial design which is three sources of feed, three levels of lysine and methionine, and two breeds of birds. A total of 120 birds were subjected to three treatments ration. The aim of the experiment was to find out the effect of three levels of lysine and methionine (0, 5 and 10%) on feed intake, daily weight gain and protein efficiency ratio in growing broilers. The experiment lasted for eight weeks and records were taken daily. The data were analyzed with analysis of variance (ANOVA). The result shows that there was no significant difference in the three levels of methionine and lysine in feed intake, daily weight gain and protein efficiency ratio in growing broilers ( $P \leq 0.05$ ). In conclusion, broilers performed well at these three levels and poultry farmers should be dissuaded from the use of excess commercial methionine and lysine which could initiate microbial growth in the intestine. This could help farmers conserve resources and prevents nutrient inhibition.

**Key Words:** Determination, Methionine, Lysine, Utilization, Broilers

**M51 Comparison of apparent and standardized amino acid digestibility of feed ingredients in cecectomized roosters, laying hens, and broilers.** S. A. Adedokun\*<sup>1</sup>, C. M. Parsons<sup>2</sup>, O. Adeola<sup>1</sup>, M. Lilburn<sup>3</sup>, and T. J. Applegate<sup>1</sup>. <sup>1</sup>Purdue University, West Lafayette, IN, <sup>2</sup>University of Illinois, Urbana, <sup>3</sup>Ohio State University, Wooster.

The aim of this study was to determine the effect of strain of bird and method of standardization on standardized amino acid digestibility (SAAD) of five plant source and one animal source feed ingredients. The SAAD were obtained by correcting apparent amino acid digestibility (AAAD) values for basal endogenous amino acid (EAA) flow obtained from feeding a N-free diet (NFD) in 21 d-old broilers and laying hens or on fasted EAA flow from cecectomized roosters. Each feed ingredient served as the only source of protein and each diet was formulated to contain 20% CP, except for the corn diet. The AAAD were not different between broilers and roosters in four of the six feed ingredients. Broilers had higher ( $P < 0.05$ ) AAAD than laying hens and roosters for the corn diet while roosters AAAD was higher ( $P < 0.05$ ) than for broilers for meat and bone meal (MBM) diet. Apparent amino acid digestibility for the three strains of bird was similar for the dark distillers dried grain with solubles (dark DDGS), canola meal and soybean meal. Lysine digestibility for the dark DDGS was very low (15%) in the cecectomized roosters. Roosters' SAAD values were higher ( $P < 0.05$ ) than broilers' in four of the six feed ingredients. There was no difference, however, between SAAD values for corn and dark DDGS for broilers and roosters. Within the cecectomized roosters, there were no differences on SAAD in light DDGS, dark DDGS, and canola meal for the three (fasted, nitrogen-free, or highly digestible protein) methods of standardization used. However, for corn, soybean meal and MBM, NFD and HDP methods resulted in higher ( $P < 0.05$ ) SAAD values for most of the amino acids than the fasted method of standardization. Results from this study showed that both the apparent and standardized amino acid digestibility values in cecectomized roosters and 21 d-old broilers in some feed ingredients were similar, yet there were differences in amino acid digestibility of other feed ingredients.

**Key Words:** Broiler, Laying hen, Rooster, Standardized amino acid digestibility

**M52 Production control I: The key to profits.** D. A. Roland\*<sup>1</sup>, M. M. Bryant<sup>1</sup>, M. Farmer<sup>2</sup>, and A. Roland<sup>3</sup>. <sup>1</sup>Auburn University, Auburn, AL, <sup>2</sup>Ridley Inc., Mankato, MN, <sup>3</sup>Roland Poultry Services, LLC, Auburn, AL.

Even though the single greatest influence on egg price and profits is egg supply, little effort has been devoted to controlling supply versus improving production efficiency. The reason is the organizational management required for effective supply management is complex. However, with enhanced industry consolidation and higher feed cost creating longer down turns and larger swings in egg

prices, the industry may be entering a new ball game. This fact, along with new tools becoming available to assist in controlling egg supply, should encourage more emphasis on supply management. In this presentation we will discuss the importance of production efficiency versus supply management and describe research effort and data required to develop the new technology (Econometric Feeding and Production Control) available to help improve both. The availability of econometric feeding and production control programs along with hen reduction and molting should allow producers much more control over supply management and profits. Although changing a century of feeding for maximum performance will be difficult and not without some learning pains, the potential gain in profits (literally billions of dollars) for even slight improvements in supply management is too much for industry to ignore.

**Key Words:** Production control, Supply management, Nutrition

**M53 Production control II: The key to profits, a software demonstration.** D. A. Roland\*<sup>1</sup>, M. M. Bryant<sup>1</sup>, M. Farmer<sup>2</sup>, and A. Roland<sup>3</sup>, <sup>1</sup>Auburn University, Auburn, AL, <sup>2</sup>Ridley Inc., Mankato, MN, <sup>3</sup>Roland Poultry Services, LLC, Auburn, AL.

The Econometric Feeding and Production Control program has five components (feed formulation, traditional feeding program, record keeping, econometric feeding and production control) integrated into a single software program. To run the program the producer enters current feed ingredient and egg prices. All diets are then re formulated with a printout showing returns (cents per dozen) for each diet. Based on the returns shown, the producer can select the diet for optimal returns and/or performance as desired. With some egg and feed prices the producer can reduce losses by feeding less protein. This can result in automatic production control (reducing egg supply with low egg prices and increasing egg supply with high egg prices). In other instances any reduction in performance will increase losses. There are no reasons producers should not feed econometrically, because it optimizes returns regardless of what other producers do and at the same time it helps control egg supply. To activate the production control features of the econometric feeding and management program egg producers will have to agree to use as a group. With the econometric feeding and management software program demonstrated, producers can know the increased cost associated with production control. That knowledge, along with the fact that small reductions in egg supply could quickly take returns from red to black, should encourage greater voluntary participation in supply management.

**Key Words:** Production control, Supply management, Nutrition

**M54 Effects of sorghum variety on growth and carcass characteristics in broiler chicks reared in West Africa.** S. Issa\*<sup>1</sup>, J. D. Hancock<sup>1</sup>, M. R. Tuinstra<sup>1</sup>, I. Kapran<sup>2</sup>, and S. Kaka<sup>2</sup>, <sup>1</sup>Kansas State University, Manhattan, <sup>2</sup>National Institute for Agricultural Research, Niamey, Niger.

A total of 840 1-d-old broiler chicks (Arbor line with an average initial body weight of 31 g) was used in a 60-d experiment to determine the effects of sorghum variety on growth and carcass characteristics. There were 40 chicks/pen and seven 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 diet was formulated to 1.3% Lys, 2.03% Met+Cys, 1.5% Ca, and 0.52% available P. 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. Average daily gain (ADG) and average daily feed intake (ADFI) were greater ( $P < 0.001$ ) for chicks fed corn vs the sorghums. However, most of this difference was caused by the low ADG and ADFI for chicks fed the improved sorghum variety vs the locally adapted sorghum variety ( $P < 0.001$ ). Gain to feed ratio (G:F) was not different ( $P > 0.28$ ) among chicks fed the treatments. Carcass weight, carcass yield, and carcass fat

were not different for corn vs the sorghums ( $P > 0.35$ ) but chicks fed the locally adapted sorghum variety had greater carcass weights and yield than those fed the improved sorghum variety ( $P < 0.02$ ). For the corn, locally adapted landrace sorghum, and agronomically improved sorghum, ADG was 37, 35, and 31 g/d, ADFI was 77, 72, and 65 g/d, G:F was 0.48, 0.49, and 0.48 g/g, carcass weight was 2,054, 2,061, and 2,018 g, and carcass yield was 76.0, 76.6, and 74.7%, respectively. In conclusion, the locally adapted landrace sorghum was superior in nutritional value to the agronomically improved sorghum and comparable in nutritional value to imported corn.

**Key Words:** Sorghum, Corn, Poultry

**M55 Performance characteristics of broiler chicks fed spent tea leaf (STL) based diets.** A. A. Mako\*<sup>1</sup>, R. A. Hamzat<sup>2</sup>, O. A. Ogunwole<sup>3</sup>, A. O. Amuda<sup>4</sup>, R. A. Salako<sup>5</sup>, A. O. Akinsoyinu<sup>3</sup>, and A. O. Olomola<sup>3</sup>, <sup>1</sup>Tai Solarin University of Education, Ijebu ode, Ogun, Nigeria, <sup>2</sup>Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria, <sup>3</sup>University of Ibadan, Oyo, Nigeria, <sup>4</sup>Oyeladun Farms Nigeria Limited, Sango Otta, Ogun, Nigeria, <sup>5</sup>Federal College of Animal Health & Production Technology, Ibadan, Nigeria.

High cost of conventional feed ingredients is a limiting factor to the growth of the poultry industry in Nigeria. Animal nutritionists are therefore investigating into some industrial wastes that are both abundantly available and have nutritional potentials for use as alternative feed ingredients. This approach will not only reduce the cost of conventional feed ingredients but also alleviate man / animal competition for these ingredients. Spent tea leaf (STL) is one of such industrial wastes constituting disposal problems on all tea processing industries in Nigeria. This study focused on the effect of feeding treated and untreated STL in the diet of broiler chicks.

Two hundred and sixty four (264) day old broiler chicks were randomly allotted to eight dietary treatments of 33 birds, replicated thrice with eleven birds each in a completely randomized design. These treatments were: C1WE (Control with enzyme); C2NE (Control with no enzyme); D3NE (Diet 3 with no enzyme); D4WE (Diet 4 with enzyme); D5NE (Diet 5 with no enzyme); D6WE (Diet 6 with enzyme); D7NE (Diet 7 with no enzyme); and D8WE (Diet 8 with enzyme). Each of these diets was fed ad-libitum to the experimental broiler chicks. The trial lasted four weeks. The parameters measured included feed intake, body weight gain, feed conversion ratio and feed cost per Kg gain. Feed intake and body weight gain were significantly ( $P < 0.05$ ) higher in the birds fed the enzyme treated diets than those fed the untreated spent tea leaf. The result revealed that 5% (raw) and 10% (enzyme treated) inclusion of spent tea leaf improved the performance of the broiler chicks.

**Key Words:** Utilization, Spent tea leaf, Performance, Broiler chicks

**M56 Evaluation of spent tea leaf as a feed ingredient for broiler finishers.** R. A. Hamzat\*<sup>1</sup>, A. A. Mako<sup>2</sup>, O. A. Ogunwole<sup>3</sup>, S. B. Amuda<sup>4</sup>, G. Saka<sup>4</sup>, M. D. Olumide<sup>3</sup>, and A. O. Akinsoyinu<sup>3</sup>, <sup>1</sup>Cocoa Research Institute of Nigeria, Ibadan, Oyo, Nigeria, <sup>2</sup>Tai Solarin University of Education, IjebuOde, Ogun, Nigeria, <sup>3</sup>University of Ibadan, Oyo, Nigeria, <sup>4</sup>Oyeladun farms Nigeria Limited, SangoOtta, Ogun, Nigeria, <sup>5</sup>Oyeladun farms Nigeria Limited, SangoOtta, Ogun, Nigeria.

Spent tea leaf (STL) is a waste of the tea processing industries in Nigeria and constitutes a serious disposal problem. Besides, the STL is being used to adulterate tea products and this act of sabotage is causing economic havoc to the tea industries in Nigeria. The use of the spent tea leaf as a feed ingredient offers a viable avenue for the utilization of the STL. This trial is designed to evaluate the STL as a feed ingredient for broiler finishers.

A total of two hundred and sixteen (216) finishing broilers were randomly distributed to eight dietary treatments with 27 birds replicated thrice with nine birds each in a completely randomized design. The treatments were: C1WE (Control with enzyme); C2NE (Control with no enzyme); D3NE (Diet 3 with no enzyme); D4WE (Diet 4 with enzyme); D5NE (Diet 5 with no enzyme);

D6WE (Diet 6 with enzyme); D7NE (Diet 7 with no enzyme); and D8WE (Diet 8 with enzyme). Each of these diets was fed *ad libitum* to the experimental broiler finishers. The trial lasted twenty eight days. The feed intake, weight gain, cost per gain (N/Kg) and carcass characteristics were the parameters evaluated. There were significant differences ( $P < 0.05$ ) in feed intake, weight gain and

carcass characteristics of broiler finishers fed the experimental diets. The result revealed that inclusion of enzyme in the spent tea leaf – based diets enhanced the performance of the finishing broilers.

**Key Words:** Evaluation, Spent tea leaf, Growth response, Finishing broilers

## SCAD I (Avian Diseases)

**M57 Efficacy of natustat and Bio-Mos for the control of Necrotic Enteritis and related *Salmonella* shedding in broiler chickens.** G. Mathis<sup>\*1</sup>, C. Hofacre<sup>2</sup>, and S. Heintzelman<sup>3</sup>, <sup>1</sup>*Southern Poultry Research, Inc., Athens, GA*, <sup>2</sup>*University of Georgia, Athens*, <sup>3</sup>*Alltech, Inc, Lexington, KY*.

The objective of the study was to determine if a Natustat starter/grower, BioMos finisher program would reduce Necrotic Enteritis and salmonella shedding. The treatments were nonmedicated, no Clostridium perfringens (CP) challenge (NM No CP), nonmedicated, CP challenge (NMCP), Natustat 2 lbs/ t (starter and grower) and BioMos 1 lb/t (finisher) CP challenge (NAT/BIO). A complete randomized block design was used with 6 replications of each treatment. Sixty male broiler chickens were placed into each pen. Prior to placement all birds were vaccinated with the coccidial vaccine, Coccivac-B. Half of the birds from each pen were tagged and dosed with *Salmonella heidelberg*. On Days 20 and 21, NMCP and NAT/BIO treatment birds were dosed with CP. On Day 22, ten birds per pen were Necrotic Enteritis lesion scored. The birds fed Natustat had significantly lower NE lesion score and NE mortality compared to NMCP birds. NMCP treatment birds had significantly poorer performance on Days 22 and 42 compared to the other treatments. NAT/BIO birds' performance, both feed conversions and weight gains, were not significantly different from the birds that were not dosed with CP (NM No CP). *Salmonella* drag swab samples on Day 14 showed that *Salmonella* was detectable in all pens, confirming the validity of the disease model. *Salmonella* drag swab samples on Day 42 showed significantly lower number of positive samples in the NAT/BIO compared to the NM No CP and NMCP pens. This study demonstrated the benefits of feeding Natustat in the starter and grower feeds and BioMos in the finisher feeds of broiler chickens exposed to Clostridium perfringens and *Salmonella*.

**Key Words:** Necrotic Enteritis, Bio-Mos, Natustat, *Salmonella*, Coccidia

**M58 Discerning genetic differences in *Salmonella* Enteritidis isolates by RAPD, a powerful molecular tool for understanding *Salmonella* epidemiology in poultry integrators.** D. Mathis<sup>\*</sup>, M. D. Lee, R. Berghaus, and J. J. Maurer, *University of Georgia, Athens*.

*Salmonella* continues to cause significant cases of foodborne illnesses in the United States. With poultry recognized as an important vehicle in past outbreaks, pressure has been placed on the poultry industry to reduce poultry and egg contamination with *Salmonella*. To be able to effectively reduce or eliminate *Salmonella* from poultry operations will require identifying its source(s), and while serotyping has been helpful, it has not been sufficient in identifying *Salmonella* to strain level. Pulsed-field gel electrophoresis (PFGE) has been a useful tool in typing most *S. enterica* serovars. However, *S. Enteritidis* (SE) is refractory to typing by PFGE, due to its clonal nature. We have been able to identify genetic differences in SE isolates using random polymorphic DNA amplification (RAPD) PCR. While we were able to discern some differences in SE isolates by RAPD, no single typing, PCR primer was sufficient to type SE by this method. However, when we collate the different RAPD DNA patterns for each typing primer into a single phylogenetic tree, we could identify sufficient genetic differences to discriminate SE isolates. From our analyses, we were able to identify geographic differences in the distribution of SE types, as well as discern source(s) of SE within a poultry integrator. This molecular approach to typing SE will prove a powerful epidemiological tool in determining the source of SE in poultry and layer operations.

**Key Words:** *Salmonella*, SE, Typing, PCR, Epidemiology

**M59 Effect of Protexin<sup>®</sup> on cecal *Salmonella typhimurium* colonization in young broiler chicks.** Y. O. Fasina<sup>\*</sup>, J. W. J. Bowers, and S. R. Mckee, *Auburn University, Auburn, AL*.

*Salmonella enterica* serovar *typhimurium* continues to be one of the most frequently isolated strains in human salmonellosis worldwide, and is commonly found in the intestine of broilers. The use of Probiotics for reducing intestinal *Salmonella* colonization has been recommended. Probiotics are live microbial feed supplements that beneficially affect the host animal by improving its intestinal microbial balance by competitively excluding pathogens. Protexin<sup>®</sup> is a commercially available probiotic designed for use in chickens. An experiment was conducted to evaluate the efficacy of Protexin<sup>®</sup> in reducing cecal *Salmonella Typhimurium* (ST) colonization in broiler chicks. Day-old ST-free chicks (126) were obtained from a commercial hatchery and randomly allocated to 3 treatments; treatment 1 (control, CN) consisted of chicks not challenged with ST; treatment 2 (CST) consisted of chicks that were challenged with ST; and treatment 3 (CPST) consisted of chicks given Protexin<sup>®</sup> ( $1.2 \times 10^8$  / bird from 1 to 7 days of age, and  $3.0 \times 10^7$  / bird from 8 to 14 days of age) and challenged with ST. On day 3 of experiment, chicks in CST and CPST were orally gavaged 1 mL of nalidixic acid-resistant ST inoculum containing  $10^6$  CFU/mL. Throughout experiment (day 1 to 14), chicks in all treatments were fed an unmedicated corn-soybean meal diet. On days 7 and 14, growth performance of chicks (weight gain, feed intake, and feed conversion (FC)) was evaluated and the ceca of chicks were also cultured to enumerate ST levels. Results showed no significant difference ( $P > 0.05$ ) in growth performance of chicks in all treatments. Microbiological enumeration of ST showed that chicks in the CN treatment remained ST-free throughout this study. Also, ST levels were similar for chicks in both CST and CPST treatments on days 7 and 14. Although ST level in the CPST treatment was numerically reduced from 4.0 log CFU on day 7 to 3.66 log CFU on day 14, the effectiveness of Protexin<sup>®</sup> in reducing intestinal ST levels in broiler chicks was not significantly apparent.

**Key Words:** Protexin<sup>®</sup>, *Salmonella*, Broiler chicks

**M60 Effect of Pectin-Protexin<sup>®</sup> synbiotic therapy on the concentration of *Salmonella typhimurium* in the ceca of broiler chicks.** Y. O. Fasina<sup>\*</sup>, J. W. J. Bowers, and S. R. Mckee, *Auburn University, Auburn, AL*.

Synbiotic therapy comprising of a probiotic and a prebiotic has been proposed for use to reduce intestinal *Salmonella* colonization in poultry. Probiotics are live microbial feed supplements that competitively exclude pathogenic bacteria from the intestine. Prebiotics are non-digestible but fermentable polysaccharides that function as substrates to promote the growth of specific probiotic bacteria. Protexin<sup>®</sup> is a commercially available probiotic designed for use in chickens, while pectins are soluble indigestible polysaccharides that are fermented by intestinal microflora. It was hypothesized that sugar beet pectin would serve as prebiotic for the beneficial bacteria in Protexin<sup>®</sup> and subsequently reduce cecal *Salmonella* levels in chicks. An experiment was conducted to determine the effect of pectin-Protexin<sup>®</sup> synbiotic therapy on cecal concentration of *Salmonella Typhimurium* (ST) in broiler chicks. Day-old ST-free chicks (320) were obtained from a commercial hatchery and randomly allocated to 4 treatments; treatment 1 (control, CN) consisted of chicks not challenged with ST; treatment 2 (CST) consisted of chicks that were challenged with ST; treatment 3 (CPST) consisted of chicks given Protexin<sup>®</sup> in feed (0.15g / kg feed) and challenged with ST; and treatment 4 (CPSTE) consisted of chicks given Protexin<sup>®</sup> (0.15g / kg feed) and sugar beet pectin (5g / kg feed) in feed, and then challenged with ST. All chicks were fed unmedicated corn-soybean meal diet. On day 4 of experiment, chicks in CST, CPST and CPSTE were orally gavaged 1 mL of nalidixic acid-resistant