milk yield or heat stress was not associated with increased fetal loss. (Research Support: USDA IFAFS grant 2001-52101-11318).

Key Words: Dairy Cattle, Fetal Loss, Pregnancy

104 Effect of a CIDR insert and flunixin meglumine administered at the time of embryo transfer on pregnancy rate and resynchronization of estrus in beef cattle. S. H. Purcell*[1], B. E. Beal[1], and K. R. Gray[2], [1]*Virginia Polytechnic Institute and State University, Blacksburg,* [2]*Cross Country Genetics North, Westmoreland, KS.*

The objectives of this study were to evaluate the effects of flunixin meglumine (FM), an inhibitor of $PGF_{2\alpha}$ synthesis, administered at the time of embryo transfer (ET) and insertion of an intravaginal progesterone-releasing device (CIDR) at the time of ET on pregnancy rates (PR) and the resynchronization of estrus. Beef cows (n = 552) and heifers (n = 160) in three locations were assigned randomly within age to one of four treatments: FM = injection of FM (500 mg i.m.; Phoenix Scientific; St. Joseph MO) 2 to 12 min prior to ET; CIDR = insertion of a CIDR (1.38 g progesterone; Pfizer; New York, NY) for 13 d immediately following ET; FM + CIDR or untreated control. Fresh or frozen embryos were randomly assigned to be transferred to recipients on d 6 to 9 of the estrous cycle. At one location, recipients (n = 493) were observed for signs of return to estrus beginning 9 d after ET. Recipients that returned to estrus were bred by AI or received an embryo 7 d after estrus. Pregnancy was diagnosed (d 28 to 60) by ultrasonography or palpation per rectum. PR were analyzed using the LOGISTIC procedure of SAS. Variation in the timing of the return to estrus was determined by an F-test for heterogeneity of variances. PR following the initial ET was not affected by CIDR administration ($P > 0.05$; 69% with CIDR, 76% without CIDR). There was a significant FM x location interaction on PR (Location 1, 89 vs 57%; Location 2, 70 vs 66%; Location 3, 74 vs 77% for FM vs no FM, respectively). The timing of the return to estrus was less variable ($P < 0.01$) for recipients fitted with a CIDR, but PR following AI (69 and 64%) or second ET (74 and 82%) did not differ ($P > 0.05$) in cows receiving or not receiving a CIDR, respectively. Effects of FM on PR varied among locations and CIDR insertion at ET reduced variation in timing of the return to estrus.

Key Words: Embryo Transfer, Flunixin Meglumine, CIDR

PSA-Environment and Management-Enteric Bacteria

105 Utilization of an experimental chlorate product in reduction of necrotic enteritis in broiler chickens. J. L McReynolds*[1], J. A. Byrd[1], R. C. Anderson[1], T. S. Edrington[1], T. L. Poole[1], R. W. Moore[2], L. F. Kubena[1], and D. J. Nisbet[1], [1]*USDA-ARS, Southern Plains Agriculture Research Center, College Station, TX,* [2]*USDA-ARS, Russell Research Center, Athens, GA.*

Clostridium perfringens (CP) is one of the etiologic agents of Necrotic Enteritis (NE). The clinical signs of this disease include depression, decreased appetite, diarrhea, and severe necrosis of the intestinal tract. Development of new technologies to combat this costly disease is needed in the commercial poultry industry. In the present investigation, in vitro and in vivo studies were conducted to determine the effects of an experimental chlorate product (ECP) on CP. In the in vitro study intestinal contents were obtained from single comb White Leghorn laying hens and diluted (1:1) with thioglycollate enrichment medium. The contents were divided into six 10 mL aliquots and assigned to the following experimental groups: a control, ECP with a 5 mM chlorate ion equivalent, or ECP with a 10 mM chlorate ion equivalent (2 replicates/group). The effects of ECP were evaluated in vitro over time. By 3 h there was a significant reduction in CP ($P \leq 0.05$) in the 5 mM ECP (3.88 Log $_{10}$), and 10 mM ECP (3.29 Log $_{10}$) when compared to the control (5.51 Log $_{10}$). In the in vivo experiment, evaluations of the ECP administered in the drinking water and in the feed (1X ECP is equivalent to a 15 mM chlorate ion concentration) showed reductions in clinical signs associated with NE. Lesion scores were reduced significantly in birds fed the ECP (1.25) when compared to the controls (2.1). The incidence of CP and mortality were also reduced significantly in birds fed the ECP. Populations of generic *E. coli* were significantly lower in all of the treatment groups compared to the controls. These results indicate that an ECP may provide the poultry industry with an additional management tool for controlling NE.

Key Words: *Clostridium perfringens*, Experimental Chlorate Product, Necrotic Enteritis

106 The use of biodegradable pellets for the control of *Salmonella* in broilers during feed withdrawal. J. A. Byrd*[1], L. H. Stanker[2], J. L. McReynolds[1], and D. J. Nisbet[1], [1]*USDA-ARS, Food & Feed Safety Research Unit, College Station, TX,* [2]*USDA-ARS, Foodborne Contaminants Research Unit, Albany, CA.*

Poultry undergo a feed withdrawal (FW) prior to transport to the processing plant. During FW, poultry tend to peck at floor litter that may be contaminated with *Salmonella* and *Campylobacter*. These pathogens could be transported to the processing plant in the upper gastrointestinal of poultry which may leak out during slaughter and cross contaminate other carcasses. One approach would be to supply a disinfectant and another source of nutrition that would not physically fill the upper gastrointestinal tract. Presently, we evaluated the use of a novel biodegradable starch extruded pellet (BP) that can be treated with bactericidal or bacteristatic compounds. The BP was provided to market-age broilers during an 8 h FW. All broilers were challenged with 10^8 *Salmonella* Typhimurium (ST) by oral gavage 6 days prior to FW. One h after the onset of FW, 454 g of BP containing either 2% lactic acid (LA), citric acid (CA), or D-limonene + CA + diosulfosuccinate (DSS) were placed on the litter in each pen. In two experiments, broiler provided BP containing LA caused a significant decrease ($P < 0.05$) in the incidence of ST in crop contents (40%) as compared to the controls (65%). Similarly, broilers provided BP containing LA (0.8 Log_{10} ST /g crop content) caused a significant decrease ($P < 0.05$) in the number of ST recovered in the crop compared to controls (1.87 Log_{10} ST/g). The material is environmentally compatible in that it will degrade in poultry grow-out houses thus providing beneficial bacteria a food source without physically filling the gastrointestinal tract. These studies suggest that incorporation of this biodegradable material in the broiler grow-out house during pre-transport feed withdrawal may reduce *Salmonella* and *Campylobacter* contamination of crops and broiler carcasses at processing.

Key Words: Salmonella, Biodegradable, Crop

107 Apparent absence of horizontal transmission of *Campylobacter* among caged broiler breeder roosters. R. J. Buhr*[1], N. A. Cox[1], J. S. Bailey[1], J. L. Wilson[2], L. J. Richardson[1,2], D. E. Cosby[1], and D. V. Bourassa[1,2], [1]*USDA-ARS Russell Research Center, Athens, GA,* [2]*University of Georgia, Athens.*

This study was undertaken to evaluate the potential for horizontal transmission of *Campylobacter* between adjacent caged broiler breeder roosters. Feces and semen from individually caged roosters at 41 wk of age were sampled for the presence of *Campylobacter* for 3 consecutive wk and determined to be negative. Three roosters were challenged with a marker strain of *Campylobacter* jejuni either orally using 1.0 mL of suspension (1.4 10^6 / mL). Three additional roosters were challenged by dropping 0.1 mL of suspension on the everted phallus immediately after semen collection. Six non-challenged roosters were placed in wire-floored cages interspersed between the challenged roosters. Roosters were meal fed daily in individual feed troughs and provided individual nipple drinkers per cage. Feces and semen samples were collected weekly from each rooster for a period of 5 wk post-challenge. The 6 non-challenged adjacently caged roosters were consistently negative for both feces and semen from 1 through 5 wk. At 6 wk roosters were necropsied and samples collected from the thymus, spleen, liver/gall bladder, and ceca, and all were negative for non-challenged roosters. Challenged roosters all produced *Campylobacter* positive feces and semen at 1 and 2 wk post-challenge. At 3 wk post challenge all fecal samples were positive for *Campylobacter*, but 2 semen samples were negative, one from each challenge route. At 4 wk post-challenge all semen samples were negative for *Campylobacter*, and only 3 fecal sample remained positive (2 for oral and 1 for phallus challenge routes). At 5 wk post challenge all semen and fecal samples were negative for *Campylobacter*. Necropsy samples from challenged roosters were negative for the thymus, spleen, and liver/gall bladder at 6 wk post-challenge. Two ceca samples were found to contain *Campylobacter*, one from each challenge route. These results indicated

that *Campylobacter* is not readily transferred horizontally between adjacently caged roosters. At 6 wk the presence of *Campylobacter* in the ceca was undetected in 4 of the 6 challenged roosters.

Key Words: *Campylobacter*, Broiler Breeder Roosters, Horizontal Transmission

108 Effects of *Aspergillus* meal prebiotic on gut development and ascites mortality. F. Solis*[1], J. M. Balog[2], G. Tellez[1], S. Higgins[1], A. Torrez[1], A. M. Donoghue[2], and N. B. Anthony[1], [1]*University of Arkansas, Fayetteville,* [2]*USDA/ARS/PP&PSR, Fayetteville, AR.*

We hypothesize that the developing gastrointestinal tract of rapidly growing broilers has a significant impact on the eventual development of ascites syndrome. Since the addition of *Aspergillus* meal (AM) prebiotic to poultry feed has been shown to improve gut development, the objective of this study was to determine if AM would reduce the negative effects of hypoxia on the gut and reduce ascites incidence. Four hundred (200 commercial and 200 susceptible) day old chicks were randomly assigned to either a control feed or a feed with 0.2 % AM added. Groups were reared at either local altitude (390 meters above sea level) or simulated high altitude (2900 meters above sea level). Mortality was checked twice daily and necropsied for ascites. Birds and feed were weighed weekly. At 6 wk the remaining birds were weighed, killed and organs were weighed. There were no significant effects due to prebiotic feeding for any of the variables evaluated. As previously shown, chickens reared at sea level were heavier (2.01 kg) than those at high altitude (1.13 kg). Also, chickens grown at high altitude showed 84.8% ascites mortality compared with 1.3% at local altitude. Of particular interest in this study was the finding that susceptible chickens had heavier relative gut wt (0.0575), when compared to the commercial birds (0.0511, $P< 0.05$). Interestingly, when measurements were made of the villi length, it became apparent that although susceptible birds have heavier relative gut wts, the duodenal villi were significantly shorter (204.4 μ at high altitude), when compared with the commercial birds (229.4 μ at high altitude). Villi height was also influenced by altitude alone, with both commercial and susceptible birds combined mean duodenal villi height at high altitude was 195.1 μ, while at sea level the mean was 227.4 μ. The results showed that hypobaric hypoxia results in a significant reduction in gut development.

Key Words: Ascites, Prebiotic, Gut Development

109 *Salmonella* and lactobacilli growth in a simulated crop model using chicken or turkey feeds. A. D. Wolfenden*[1], S. N. Henderson[1], R. L. Jarquin[1], G. M. Nava[1], L. R. Bielke[1], J. L. Vicente[1], G. I. Tellez[1], D. J. Donoghue[1], A. M. Donoghue[2], and B. M. Hargis[1], [1]*University of Arkansas, Fayetteville,* [2]*PPPSRU, ARS, USDA, Fayetteville, AR.*

The chicken crop is a well known source of *Salmonella* contamination of carcasses at processing. Very recent evidence has been presented suggesting that *Salmonella* may amplify and perhaps colonize the crops of poultry. Presently, we evaluated *Salmonella enteritidis* (SE) or Lactobacilli spp. (LAB) growth (known to produce bacteriocin-like agents inhibitory to SE growth), alone or in combination, in either chicken or turkey feeds, using a previously-published simulated crop model *in vitro*. In exp. 1, 1.25 g of either chick starter or turkey starter were added to tubes and autoclaved. Sterile saline (4.5 ml) was added to each tube. Tubes were divided into 6 groups; chick starter+SE, chick starter+SE+LAB sprayed on feed ($1.1x10^4$ cfu/g), chick starter+SE+LAB (10^6 cfu/ml), turkey feed+SE, turkey feed+SE+LABS ($2.0x10^5$ cfu/g) sprayed on feed, turkey feed+SE+LABS (10^6 cfu/ml). 0.5 ml of 10^5 SE was added to each tube in groups containing SE. Tubes were individually shaken for 2 sec. and incubated for 2.5 hr at 40C. At 1 or 2.5 hr, cfu of SE or LAB were determined by plating serially on appropriate agar. A significant ($p<.05$) increase in SE was observed in chick starter at 1(4.26 log10 cfu) and 2.5 hr(5.66 log10 cfu) regardless of LAB presence. Interestingly, very little SE amplification occurred when turkey starter was used as the substrate (<1 log10 cfu), regardless of LAB presence. Experiment II was similar in design. Again, SE was observed to amplify at either 1(4 log10 cfu) or 2.5 hr(6 log10 cfu) in chick starter, with no consistent effect of LAB addition. Very little SE amplification (< 1 log10 cfu) was observed in commercial turkey starter, and addition of LAB at these concentrations did not affect SE recovery. Potential explanations for amplification of SE in chick starter, but not turkey starter, are currently being explored and may be an important aspect related to the role of crops for contamination of chicken but not turkey carcasses.

Key Words: Crop, *Salmonella*, Lactobacilli

110 Effect of dietary administration of *Aspergillus* meal on broiler chick performance with low protein diets. A. Torres-Rodriguez*[1], C. D. Sartor[1], S. E. Higgins[1], A. D. Wolfenden[1], L. R. Bielke[1], C. M. Pixley[1], A. M. Donoghue[2], G. Tellez[1], and B. M. Hargis[1], [1]*University of Arkansas, Fayetteville,* [2]*PPPSRU, USDA-ARS, Fayetteville, AR.*

Aspergillus meal (Fermacto®, F) is a prebiotic feed additive. In two experiments we evaluated the effect of F with low protein diets on chick performance. In Experiment I, two levels of crude protein (CP), 23 and 19%, with or without F (0.2%) were evaluated. Chickens fed 19%+F were heavier ($p<0.05$) than 19% alone (243.3±5.16 vs 205.8±4.06 std.err., respectively) at 14 days of age. Chickens fed 23% were heavier than both 19% groups (311g ± 5.49 std.err.). In Experiment II, two levels of CP, 21and 19%, with and without F (0.2%), were evaluated with 100% and 90% NRC lysine, methionine and tryptophan requirements for 21% and 19% diets, respectively. Both 21% groups were heavier ($p<0.05$) than 19% groups, whereas 19%+F chickens were heavier than 19% alone (640.46 g ± 4.98, 656.91 g ± 5.39 std.err., for 19 alone, and 19%+F, respectively; $p<0.05$) at 21 days of age. Results from these trials indicate that F may offer a protein sparing effect, potentially allowing for diets with lower levels of protein and amino acids. *Aspergillus* meal might offer better results when protein and amino acid levels are lower than those recommended by NRC or applied in some commercial flocks.

Key Words: *Aspergillus* Meal, Prebiotic, Low Protein Diets

111 Evaluation of an organic acid mixture to reduce *Salmonella enteritidis* in the chicken crop. R. L. Jarquin*[1], A. D. Wolfenden[1], G. M. Nava[1], J. L. Vicente[1], C. D. Sartor[1], A. M. Donoghue[2], and B. M. Hargis[1], [1]*University of Arkansas, Fayetteville,* [2]*PPPSRU, ARS, USDA, Fayetteville, AR.*

An organic acid mixture (OAM) consisting of tannic (.024%), lactic (.042%), butyric (.048%) and acetic (.048%) acids (final concentrations) were evaluated in 4 experiments. Each experiment utilized an *in vitro* simulated crop assay which has been described. Briefly, 1.25 grams of chick starter was measured into 13 x 100 mm borosilicate tubes (n=10/replicate) and autoclaved. Sterile saline (4.5mL) was added to each tube with 0.5mL of SE inoculum (1×10^5). In EXP 1 and 2, 0.5x OAM, 1x OAM, or 2x OAM significantly reduced SE recovery by at least one log10 ($p<0.05$) during a 2 hr incubation at 37° C. However, no effect of higher or lower concentrations of the OAM were observed. Tannic acid alone (.024%) did not reduce SE recovery in these experiments. After in vitro testing, water consumption (WC) in the presence of feed or during feed withdrawal (FW) using the OAM or tannic acid alone were measured in market age broilers (4 8 weeks of age) in EXP 3 and 4. Two pens (40 birds/pen) were randomly assigned to each treatment, with treatments consisting of no treatment (control), 1x, 2x, or 3x OAM, or 0.02%, 0.1%, 0.25%, or 0.36% of tannic acid alone in the drinking water (DW). WC was measured at 8 hours. In the presence of feed, no differences in water consumption were observed between the control, 1x OAM, or tannic acid concentrations of 0.02% or 0.1%. However, WC apparently decreased when 2X or 3X OAM or 0.25% or 0.36% tannic acid were administered. During FW, water consumption was decreased (40-70%) in groups receiving either 1X, 2X, or 3X OAM. No effect of 0.02% tannic acid was observed, although 0.25% or 0.36% tannic acid decreased WC (27-52%). Ongoing studies are aimed at evaluation of the effect of DW treatments with selected OAM concentrations on Salmonella recovery from market-aged broilers.

Key Words: *Salmonella*, Crop, Organic Acids

112 Cell yield and genetic reponse in *Salmonella* Typhimurium in a continuous culture during shifts in pH. K. D. Dunkley*[1], M. M. Kundinger[1], C. S. Dunkley*[1], T. R. Callaway[2], R. C. Anderson[2], D. J. Nisbet[2], and S. C. Ricke[1], [1]*Texas A&M University, College Station,* [2]*USDA-ARS, College Station, TX.*

Salmonella Typhimurium is attracting world wide attention as it continues to cause foodborne illness to human beings. The organism is resistant to a wide range of anti-infectious agents and as a result the illness is more difficult to treat. The objective of this study was to analyze the expression of specific virulence and stress genes (*hilA* and *rpoS*) in *Salmonella* Typhimurium at various nutritional stress and pH in a continuous culture system. *Salmonella* Typhimurium cells were propagated in continuous cultures with a total volume of 0.50 liter LB minimal medium at 98% turnover rate. Two chemostats were used for adjusting dilution rates and pH levels. Dilution rates were 0.0125 h^{-1}, 0.025 h^{-1}, , 0.05 h^{-1}, , 0.1 h^{-1}, , 0.27 h^{-1}, , 0.54 h^{-1}, , 1.08 h^{-1}, and 1.44 h^{-1}, while pH levels were 6.1 through 8.0. Results indicated that cell protein increases as dilution rates (D) increase (D 0.0125 h^{-1}, =1184 g cell: 0.27 h^{-1}, =1431g cell, however, at 0.54 h^{-1}, there was a decline in the g/cell protein quantity. This suggests that when dilution rate reaches washout in the chemostat, the cell mass decreases. Changes in glucose yield (Y_{glc}) also indicated that as the pH increases so does the Y_{glc}(pH 7.29=243± 14g cell/mol glucose utilized: pH 6.15= 30±13g cell/mol glucose utilized (P>0.05)). To analyze gene expression, samples were stored in RNAprotect (Qiagen, Valencia, CA) in duplicate. Real-time PCR reactions were performed on an ABI Prism 7700 Sequence Detection System (Perkin-Elmer Applied Biosystems, Foster City, CA). Samples were analyzed using the Comparative Ct ($\Delta\Delta$Ct) method by normalizing to the endogenous control gene (*rsmC*). Both *hilA* and *rpoS* expression appeared to change in response to corresponding pH and Y_{glc} transitional changes in the continuous culture.

Key Words: *Salmonella*, Continuous Flow Culture, Virulence

113 Isolation and prevalence of *Campylobacter* in the reproductive tracts and semen of commercial turkeys. K. Cole*[1], J. S. Holliman[1], P. J. Blore[1], A. M. Donoghue[2], and D. J. Donoghue[1], [1]*Department of Poultry Science, University of Arkansas, Fayetteville,* [2]*Poultry Production and Product Safety Research Unit, ARS, USDA, Fayetteville, AR.*

Campylobacter is one of the leading causes of human gastroenteritis in the United States and epidemiological evidence has implicated raw poultry products as a significant source of human infection. *Campylobacter* frequently colonizes the avian intestine but recent research indicates that this organism can also colonize the oviduct of laying hens and broiler breeders. The present studies were undertaken to determine if *Campylobacter* is present in the reproductive systems of commercial turkeys. In the first study, the reproductive tracts of 11 hens and 17 toms were aseptically excised and the segments (female: vagina, shell gland, isthmus, magnum, and infundibulum; male: ductus deferens and testes) were swabbed with a dry cotton sterile swab. The swabs were incubated for 24 h in *Campylobacter* enrichment broth and 0.1 mL of the enriched sample solution was streaked onto *Campy*-line agar plates and incubated at 42°C for 48 h in a microaerophilic environment for detection of *Campylobacter*. Of the 11 hens sampled, *Campylobacter* was isolated from the vagina (10/11), the shell gland (7/11), the isthmus (8/11), the magnum (6/11), and the infundibulum (3/11). Of the 17 toms sampled, *Campylobacter* was isolated from the ductus deferens (8/17) and the testes (2/17). In a second study, pooled semen samples from 7 separate farms were randomly collected by abdominal massage over a period of 13 weeks. The pooled semen samples were serially diluted and 0.1 mL of each dilution was plated on *Campy*-line agar and incubated at 42°C for 48 h in a microaerophilic environment for enumeration. *Campylobacter* was isolated from 57 of the 59 pooled semen samples and levels ranged from $<10^1$ to 1.58 x 10^6 cfu/mL of semen. Naturally occurring *Campylobacter* is present in the reproductive tracts and semen of commercial turkeys and may enable vertical transmission of Campylobacter from the hen to the poult.

Key Words: Campylobacter, Turkeys, Reproductive Tract

114 Evaluation of the effect of fish meal supplementation on *Salmonella enteritidis* growth in chick starter *in vitro*. S. N. Henderson*[1], A. D. Wolfenden[1], R. L. Jarquin[1], G. M. Nava[1], J. A. Byrd[2], and B. M. Hargis[1], [1]*University of Arkansas, Fayetteville,* [2]*USDA-ARS-SPARC, College Station, TX.*

While the contents of chicken crops are well known to play an important role in contamination of carcasses at processing, recent evidence has been presented suggesting that *Salmonella* may amplify and perhaps sometimes colonize the crop *in vivo*. *Salmonella* infections have been associated with the use of animal/fish meal supplementation, probably because of the known increased contamination frequency of these feedstuffs. Presently, we evaluated the ability of *Salmonella enteritidis* (SE) to amplify in a simulated *in vitro* crop assay, using either an all vegetable chick starter diet or a similar diet supplemented with fish meal (5%). In three replicate experiments, three different chick starter formulations, two with all vegetable protein sources, and one with fish meal (5%) supplementation, were compared for ability to support *Salmonella* growth *in vitro*. Briefly, for each experiment, 1.25 g of each feed type was measured into 13 x 100 mm borosilicate tubes (n=10/replicate) and autoclaved. Sterile saline (4.5mL) was added to each tube with 0.5mL of SE innocula at initial concentrations of 6.75x10 ^{3}, 1.15x10 ^{5}, and 8x10 ^{4}colony forming units (cfu)/mL, for each experiment, respectively. The tubes were then incubated at 40°C for 1 or 2.5 hrs, and cfu/ml were determined by serial dilution and spread plate enumeration on selective medium. Each of the feed types, in each of three experiments, supported the apparent amplification of SE by $>$ 1 log10 cfu/ml during the 2.5 hr incubation. Inclusion of fish meal did not affect the ability of SE to grow in the feed substrates in any of the 3 experiments. Since inclusion of fish meal did not enhance the ability of *Salmonella* to grow in this *in vitro*crop model, these data suggest that fish meal may not be important for supporting *Salmonella* growth in the crops of chickens.

Key Words: *Salmonella*, Crop, Fish Meal

PSA-Nutrition: Amino Acids and Vitamin/Mineral Nutrition I

115 Evaluation of guar by-products in high production laying hen diets. C. Zhang*, A. L. Cartwright, J. B. Carey, and C. A. Bailey, *Department of Poultry Science, Texas A&M University, College Station.*

Guar (*Cyamopsis tetragonoloba*) is a drought-tolerant annual legume grown for its high concentration of galactomannan gum. Guar seeds are split to produce guar gum and both a high protein germ fraction and a lower protein hull fraction, which are usually recombined to create guar meal. The price of guar meal in the United States is about half that of soybean meal and therefore of potential value poultry diets. A 5 × 5 Latin square experiment was conducted to evaluate using low concentrations of guar germ or a combination of guar germ and hull (guar meal) in high production laying hen diets. A total of 125 Lohmann laying hen pullets (21-week-old) of similar body weight were assigned to 5 groups of 5 replications with 5 birds in each replication. Hens were fed either a non-guar control diet, or a diet with 2.5 and 5% guar germ, or 2.5 and 5% guar meal for 20 weeks. There was no difference (P >0.05) in hen-day egg production which averaged 96.09, 94.43, 94.34, 94.38 and 96.31%, or feed consumption which averaged 99.2, 101.2, 101.5, 103.0 and 103.0 g/day per hen, respectively. The grams feed consumed per gram egg (FCR) were 1.798, 1.856, 1.855, 1.940 and 1.834, respectively, with the 2.5% guar meal-fed group higher than the other groups. Feeding guar did not affect yolk color or shell quality (shell thickness, egg breaking force and specific gravity), but decreased Haugh units. A guar fraction × concentration interaction was detected with respect to FCR which decreased in birds fed guar meal as concentrations increased from 2.5 to 5%. The results showed that both guar germ and guar meal can be fed to high production laying hens at up to 5% without adverse effects on laying hen performance and egg quality.

Key Words: Guar, Laying Hen, Egg Production