

developed from a cross between Red Rhode Island males and Fayoumi females-RB"). At 65 wk of age 285 hens (153 from BB and 132 from RB) were housed in individual cages and fed a commercial layer ration (17% crude protein, 2800 kcal AMEn/kg, 3.7% calcium and 0.66% total phosphorus) except during the induced molting periods. Productive performance traits were recorded daily from 71 to 88 wk of age. At 0, 5, 10 and 30 days from the beginning of treatments, 10 birds were selected randomly per treatment per period and injected intramuscularly with 1 ml of 10% sheep red blood cell's (SRBC's) suspension prepared in 0.9% physiological saline to measure the antibody production titer against SRBC's and Newcastle Disease Virus. Results indicated that induce molting improve productive performance whereas, no differences were detected between molting methods. Non-molting group recorded lower

values for egg rate (48.0 vs. 59.7 vs. 60.8%;  $P < 0.0001$ ) and feed conversion ratio (4.74 vs. 2.88 vs. 2.95;  $P < 0.0001$ ) compared to Zinc and California methods, respectively. Hens molted with California method recorded higher antibody titer against SRBC's (8.04 vs. 5.96 vs. 5.21;  $P < 0.0001$ ) than hens treated with Zinc method or non-molting hens, respectively. However, the antibody titer against Newcastle Disease Virus was not affected. Hens of RB have lower productive performance but higher antibody titer against SRBC's (7.56 vs. 5.25;  $P < 0.0001$ ) than BB hens, respectively. We conclude that both molting methods have the same impact on hen's productivity and California is better than Zinc for affecting humoral immune response. In addition, RB hens have lower productive performance but higher immunity than BB hens.

**Key Words:** molting, laying hen performance, immunity

## Environment and Management II

**72 Differences in growth parameters and response to yeast components in chicks seeded with gut microflora from high and low weight broilers.** R. Van Wyhe\*<sup>1</sup>, M. Bedford<sup>2</sup>, R. Dalloul<sup>1</sup>, and A. P. McElroy<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Ab Vista, Marlborough, Wiltshire, United Kingdom.

Research has shown that gut microflora in obese and normal weight animals differs in composition. The objectives of this trial were to 1) evaluate the effect of feeding cecal droppings collected from heavy (HW) or low weight (LW) broilers on performance and 2) to determine if dietary supplementation with yeast derivatives would effect growth and gut morphology in broilers fed the cecal droppings from HW or LW populations. Cobb 500 broiler chicks were given a standard commercial diet and raised to 28 d of age. At d28, birds of top 10% and bottom 10% body weight (BW) were moved into batteries and cecal contents were collected for a period of 24 hours. Cecal droppings collected from the HW and LW populations were collected for a period of 24 hours and then fed to Cobb 500 chicks (n=1400/group; HW or LW microflora) for a period of 48 hours. After 48 hours, chicks from each microflora treatment were weighed and placed in floor pens (n=42/pen) according to 4 dietary yeast treatments. Diets were 1) control (C); 2) HCT, (C+ 0.1% HCT); 3) PO24 (C + 0.1% PO24); 4) RNA (C + 0.1% RNA) for a resulting 8 total treatments (n=8 reps/diet). BW and feed intake were measured for the feeding periods of starter (d0-10), and grower (d10-28), and cumulative (d0-28). On d10 and d28, 1 bird per pen was selected for the measurement of villus height (VH), crypt depth (CD) and villus height: crypt depth ratio (VCR) in the duodenum, jejunum and ileum. Cumulatively and during the grower period feed conversion was reduced ( $P < 0.05$ ) and BW was increased ( $P < 0.05$ ) in the control compared to HCT or PO24. There were no differences in microflora treatments or dietary and microflora interactions for performance. On d28, in the ileum, VCR of control was less ( $P < 0.05$ ) than that of the HCT diet. In the jejunum and ileum, VCR was higher ( $P < 0.05$ ) and CD was lower ( $P < 0.05$ ) in the LW group on d 28. These results suggested that in a non-challenge setting early feeding of microflora from HW or LW broilers or dietary yeast products effected intestinal morphology, and yeast derivative feeding was not beneficial for growth performance.

**Key Words:** bacteria, yeast, poultry, gut, performance

**73 Evaluation of length of finisher Maxiban® withdrawal period on broiler performance.** R. Lehman\*, C. Walk, J. Sottosanti, R. Van

Wyhe, A. Barri, C. Honaker, and A. McElroy, Virginia Polytechnic Institute and State University, Blacksburg.

Coccidiosis costs the poultry industry billions of dollars annually due to anticoccidial medications, disease-invoked losses in bird performance and mortality, and treatment. To reduce anticoccidial costs, increasing the length of the non-medicated, withdrawal period may be considered; however this raises concern regarding late-breaking coccidial infections. This experiment evaluated the effect of Maxiban® withdrawal period length on bird performance during a mild environmental coccidia exposure. Day-old Cobb 500 male broilers were placed in floor pens (43 birds/pen) on pine shavings previously seeded with 3 species of *Eimeria* and raised to day 40. Each pen received one of 5 dietary treatments (n=12 reps) including a non-medicated control diet or one of 4 diets consisting of the control supplemented with the anticoccidial Maxiban® from day 1 to day 25, 28, 31, or 34. Birds were fed non-medicated finisher diets on the day of Maxiban® removal. Performance parameters included body weight (BW), body weight gain (BWG), feed intake (FI), feed conversion (FC), and mortality, which were measured on days 18, 25, 28, 31, 34, and 40. Until day 34, birds on the control diet had lower ( $P \leq 0.05$ ) BW and BWG than the groups receiving Maxiban®, but no differences existed by day 40. Feed intake only differed between day 0 and 25 between the control and the group receiving Maxiban® to day 28 ( $P \leq 0.05$ ). At day 40, no differences in FC existed among any of the groups receiving Maxiban®, whereas birds on Maxiban® diets generally had better FC than birds on the control diet. There was no difference in mortality throughout the trial. Birds in this trial performed at or above Cobb performance standards, which indicated that the litter exposure to coccidia resulted in a mild infection. Results suggest that early withdrawal of Maxiban® caused no significant decrease in bird performance during a mild coccidia infection; however, results may vary with a more severe challenge.

**Key Words:** anticoccidial, withdrawal period, coccidiosis, performance, Maxiban®

**74 Identification and evaluation of candidate *Bacillus* probiotics (DFM) for use in commercial turkey feed.** R. E. Wolfenden\*, N. R. Pumford, M. J. Morgan, A. D. Wolfenden, G. Tellez, and B. M. Hargis, University of Arkansas, Fayetteville.

As effective probiotic *Bacillus* spores are identified, these may offer advantages of in terms of stability, cost, and feed application over current

probiotics. Presently, environmental samples were pasteurized, plated, and evaluated for anti-microbial activity using soft agar overlays containing target bacteria. Colonies which produced anti-*Salmonella* activity were selected for isolation and then evaluated for *in vitro* anti-clostridial and anti-*Campylobacter* activity using similar soft agar overlays under appropriate atmospheres. Polyvalent isolates were speciated and GRAS or non-pathogenic species were further evaluated for resistance to high temperatures, and for ability to grow to high numbers with high sporulation efficiency. In exp. 1, isolates meeting above criteria were mixed with turkey starter to achieve  $10^6$  cfu/gram of feed. Day-of-hatch turkey poults were orally gavaged with  $10^5$  cfu of *Salmonella typhimurium*, placed into groups, tagged, weighed, and fed control or spore-containing rations. At day 11, all poults were weighed, humanely killed, and cultured for isolation of *Salmonella* from the crop and ceca. Isolates PHL-NP122, -JH33, -MM65, -NP119B, and -NP117B were significantly heavier than negative controls ( $p < .05$ ). Additionally, *Salmonella* was recovered less frequently ( $p < .05$ ) from ceca and crops of poults treated with PHL-MM65 and -NP122 as compared to negative controls. Isolates PHL-MM65 and -NP122 (a *Brevibacillus laterosporus* and *Bacillus subtilis*, respectively) were further evaluated using poults raised under commercial conditions, exp. 2. After 7d, 600 poults from within the house were tagged, weighed, and placed into one of four replicate pens for each treatment group (negative control, histostat, PHL-MM65 106 spores/g feed, or -NP122  $10^6$  spores/g feed). After 14 days the poults were weighed and BWG calculated, PHL-NP122 (331g), and histostat (328 g) were heavier ( $p < .05$ ) than the negative control (292g), while PHL-MM65 (301g) was not significantly heavier ( $p < .05$ ). These data may suggest that this method of screening and evaluation could lead to commercially-useful *Bacillus*-based probiotics.

**Key Words:** *Bacillus*, probiotic, direct-fed microbial

**75 Effects of probiotic administration during coccidiosis vaccination on performance in broilers exposed to field strain *Eimeria*: Comparison to monensin administration.** A. Klein<sup>\*1</sup>, J. Lee<sup>1</sup>, M. Farnell<sup>1</sup>, L. Oden<sup>1</sup>, S. Pohl<sup>1</sup>, K. Stringfellow<sup>1</sup>, M. Mohnl<sup>2</sup>, R. Beltran<sup>2</sup>, G. Schatzmayr<sup>2</sup>, S. Fitz-Coy<sup>3</sup>, C. Broussard<sup>3</sup>, and D. Caldwell<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Biomin GmbH, Herzogenburg, Austria, <sup>3</sup>Intervet/Schering-Plough Animal Health, Summit, NJ.

The objective of this investigation was to evaluate coccidiosis vaccination, with or without probiotic administration, for effects on broiler performance in the presence of field strain *Eimeria* during a 44 day pen trial. Cobb 500 males (n=3200) were placed in 64 pens (n=50) on built up litter. The trial consisted of eight experimental groups: negative control, probiotic alone (water), probiotic alone (feed), vaccine alone, vaccine with probiotic (water), vaccine with probiotic (feed), ionophore (monensin), and ionophore with probiotic. Field strain *Eimeria* oocysts were applied to all pens through feed-based challenge on day 14. Experimental parameters consisted of body weight gain, feed conversion, and oocyst output. Body weights of broilers in the vaccine with probiotic (water) group were higher ( $P < .05$ ) at termination (d 44) than all other experimental groups and equivalent to the ionophore alone and ionophore with probiotic groups. Similarly, cumulative mortality corrected feed conversion ratio (FCR) was lower ( $P < .05$ ) in broilers from the vaccine with probiotic (water) group compared to negative controls, and not different from FCR in ionophore administered broilers. Oocyst output data for vaccinated broilers demonstrated early peak shedding (d 10-20) that diminished to essentially non-detectable levels for the remainder of grow-out. Conversely, oocyst output in non-vaccinated broilers peaked later (d 20-44) in the trial. These data suggest that co-

administration of probiotic during coccidiosis vaccination results in performance parameters that are improved when compared to vaccination alone and indistinguishable from protection conferred by feeding an ionophore in the presence of field strain *Eimeria*.

**Key Words:** coccidiosis vaccine, probiotic, *Eimeria*, broiler, performance

**76 Effects of probiotic administration during coccidiosis vaccination on lesion development in broilers exposed to field strain *Eimeria*: Comparison to monensin administration.** A. Klein<sup>\*1</sup>, J. Lee<sup>1</sup>, M. Farnell<sup>1</sup>, L. Oden<sup>1</sup>, S. Pohl<sup>1</sup>, K. Stringfellow<sup>1</sup>, M. Mohnl<sup>2</sup>, R. Beltran<sup>2</sup>, G. Schatzmayr<sup>2</sup>, S. Fitz-Coy<sup>3</sup>, C. Broussard<sup>3</sup>, and D. Caldwell<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Biomin GmbH, Herzogenburg, Austria, <sup>3</sup>Intervet/Schering-Plough Animal Health, Summit, NJ.

The objective of this trial was to evaluate live oocyst vaccination, with or without probiotic administration, for protection against clinical field strain *Eimeria* challenge. Experimental groups consisted of negative control, probiotic alone (water), probiotic alone (feed), vaccine alone, vaccine with probiotic (water), vaccine with probiotic (feed), ionophore (monensin), and ionophore with probiotic. Broilers in each experimental group (n=24) were placed in floor pens and exposed to field strain *Eimeria* oocysts through feed-based challenge on d 36. All broilers were subjected to necropsy on d 43 for assessment of gross and microscopic intestinal lesions. Broilers in vaccine, probiotic, and ionophore experimental groups were observed to have reduced ( $P < .05$ ) gross lesion scores in the mid-intestine compared to negative controls. Reduced ( $P < .05$ ) gross lesion scores in the lower intestine were also observed in vaccine alone and probiotic (water) groups. Broilers in all vaccinated and probiotic alone groups had reduced ( $P < .05$ ) microscopic mid-intestine lesion scores as compared to the ionophore alone group. Broilers receiving vaccine with probiotic, as well as probiotic alone (feed), had reduced ( $P < .05$ ) microscopic lower intestine lesion scores compared to broilers in negative control and ionophore groups. In general, broilers in the ionophore alone group were associated with higher ( $P < .05$ ) microscopic mid and lower intestine lesion scores compared to vaccine alone, probiotic alone, and vaccine with probiotic groups. These observations suggest that the administration of probiotic during coccidiosis vaccination modulates the host response and improves intestinal health in broilers during clinical field strain *Eimeria* challenge.

**Key Words:** coccidiosis vaccine, probiotic, *Eimeria*, broiler, lesion development

**77 The influence of two essential oil blends on live performance after challenged with *Eimeria* spp. and *Cl. perfringens*.** K. S. Macklin<sup>\*</sup> and J. B. Hess, Auburn University, Auburn, AL.

Two essential oil (EO) blends were evaluated in their ability to mitigate the effects of a *Clostridium perfringens* and mixed species coccidia challenge. The two EO products evaluated were ROS<sup>TM</sup> and RS 100<sup>TM</sup> (RS), they contain a proprietary blend of EO. To evaluate these products, an experiment was performed that consisted of 560 commercially obtained broiler chicks that were randomly divided among seven treatments containing 8 replicates of 10 chicks. There were four diets used, they all consisted of AU starter that had nothing added (CON), 454g/907kg of ROS (ROS), 454g/907kg of RS 100 (RS) or had Maxiban (MAX) added 72g/907kg. Each diet consisted of a challenge treatment and an unchallenged treatment, the exception being MAX which consisted only

of a challenge treatment. The challenged treatments (CON+, ROS+, RS+ and MAX+) were given a gavage at day 13 of a coccidia cocktail consisting of *E. acervulina*, *E. maxima*, *E. tenella*. Four days later the birds were administered *Cl. perfringens*. Three of the diets were not challenged; their designation was CON-, ROS- and RS-. On day 28 the trial was terminated, at that time feed and surviving birds were weighed (BW). From these numbers feed conversion (FCR) was determined. Additionally on day 28, ceca were removed and *Cl. perfringens* was enumerated.

The weights at the end of the trial show that CON- (1.24kg), RS- (1.25kg) and MAX+ (1.22kg) had significantly higher BW than the other four treatments. Among those four treatments, ROS+ (1.02kg) weighed the least. FCR was significantly better with ROS- (1.80) compared to the other seven, while CON+ (2.03) was determined to be the worst. There was no statistical difference detected with the *Cl. perfringens* counts among the treatments.

**Key Words:** essential oil, coccidiosis, *Clostridium perfringens*

**78 Immune response of broiler chickens fed different levels of arginine and vitamin E to a coccidiosis vaccine and *Eimeria* challenge.** C. Perez-Carbajal<sup>1,2</sup>, D. Caldwell<sup>1</sup>, M. Farnell<sup>1</sup>, K. Strigfellow<sup>1</sup>, G. Casco<sup>1</sup>, S. Pohl<sup>1</sup>, A. Pro-Martinez<sup>2</sup>, and C. A. Ruiz-Feria<sup>\*1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Colegio de Postgraduados, Montecillos, Mexico, Mexico.

One-d old chicks (n = 300) were vaccinated (Coccivac<sup>®</sup>-B) and divided into six groups to evaluate three levels of arginine (ARG) in the feed (1.44%, NA; 1.74%, MA; or 2.04%, HA) and two levels of vitamin E (VE, 40 or 80 IU / kg of feed, E40 and E80, respectively) in a factorial experiment. Birds were reared in floor pens and provided a corn-soybean basal diet and water *ad libitum*. At d 14, all chickens were orally challenged with a mixture of *Eimeria* field isolates (*E. acervulina*, *E. maxima*, and *E. tenella*). At d 9, 14, 22, and 28, serum samples were collected to measure antibody levels (IgG, IgA, and IgM isotypes; ELISA). *In vitro* heterophil (HOB) and monocyte (MOB) oxidative burst was measured at d 21 from cells isolated from peripheral blood. Lesion scores (LS) at the upper (UI) and middle intestine (MI) were determined at d 21 and 31. Levels of IgG were not affected at d 9, but at d 14 birds fed the E40-HA or E80-MA diet had the highest IgG levels; at d 22, birds fed the E80-MA or E80-HA diet had the highest IgG levels; whereas at d 28 birds fed the E80-MA diet had the highest IgG levels. The IgA concentration was not affected at d 9 or 28 and was not consistently affected at d 14; but at d 22 IgA levels were highest in birds fed the E40-NA feed. The IgM concentration was not affected at d 22; was lower in birds fed NA levels irrespective of VE level at d 9 and 14; but at d 28 IgM levels were higher in birds fed the E40-HA feed or the E80-MA feed. The HOB was lower in the E40 diets, but was increased when combined with the MA and HA levels, whereas birds fed the E80 diet had a high HOB irrespective of ARG level. Similarly, birds fed the E80 diet had high levels of MOB which was not further improved by ARG, whereas birds fed the E40-MA diet had the highest MOB response. The LS were not different at d 21, but at d 31 birds fed HA diet had lower LS in the UI than birds fed the MA diet, and birds fed the E80 diets had lower LS than birds fed the E40 diets. These results indicate that ARG and VE play complementary roles on the immune response against *Eimeria* infections.

**Key Words:** broilers, arginine, vitamin E, coccidiosis, immune response

**79 Prophylactic and therapeutic supplementation with caprylic acid reduces enteric *Campylobacter jejuni* concentrations in young chickens.** D. J. Donoghue<sup>\*1</sup>, F. Solis de los Santos<sup>1</sup>, I. Reyes-Herrera<sup>1</sup>, J. H. Metcalf<sup>1</sup>, K. Venkitanarayanan<sup>2</sup>, P. J. Blore<sup>1</sup>, and A. M. Donoghue<sup>3</sup>, <sup>1</sup>University of Arkansas, Poultry Science Department, Fayetteville, <sup>2</sup>University of Connecticut, Department of Animal Science, Storrs, <sup>3</sup>Poultry Production and Product Safety Research Unit, ARS, USDA, Fayetteville, AR.

*Campylobacter* is one of the most commonly reported bacterial causes of human food-borne illness and epidemiological evidence indicates poultry and poultry products as significant sources of human *Campylobacter* infection. Caprylic acid is an 8-carbon fatty acid, naturally found in bovine milk, and a food-grade compound. Although caprylic acid has been shown to be bactericidal against several microbial pathogens, *in vitro*, it has not been tested in the control of *C. jejuni* in chickens. A series of studies were conducted to evaluate if caprylic acid reduced *Campylobacter* in birds before being infected (prophylactic efficacy) or after colonization (therapeutic efficacy). For prophylactic efficacy, four replicate experiments (n=40/experiment) were conducted feeding either 0.7 or 1.4% caprylic acid and negative and positive controls in 10 d old birds. Chicks were challenged with five *C. jejuni* strains 3 d post hatch. The 0.7% dose produced the greatest reduction in *Campylobacter* (approx. 2-3 logs). To test for therapeutic efficacy, three replicate experiments (n=60/experiment) were conducted using doses of 0.35, 0.7, 1.4, 2.8% caprylic acid and negative and positive controls in 15 d old birds. Chicks were challenged with five *C. jejuni* strains 3 d post hatch. When caprylic acid was fed for 3 d prior to collection the 0.7% and 1.4 % doses exerted the greatest therapeutic efficacy by reducing *Campylobacter* approximately 3-4 logs. The use of caprylic acid, a natural and safe feed additive shows the potential to reduce this significant human pathogen in poultry.

**Key Words:** *Campylobacter*, caprylic acid, enteric colonization, chickens, pathogens

**80 Characterizing compensatory effects of silymarin on gossypol toxicity in lines of chickens divergently selected for humoral immune response.** S. R. Blevins<sup>\*1</sup>, R. M. Lewis<sup>1</sup>, D. J. Blodgett<sup>2</sup>, M. Ehrich<sup>2</sup>, and P. B. Siegel<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg.

Corn is a main constituent of U. S. poultry diets. Rising corn prices have caused the poultry industry to seek alternative feeds. Cottonseed meal (CSM) offers an alternative due to its high protein content. Although CSM could not replace corn due to its low energy content, it is a sensible substitute for soybean meal. Replacing soybean meal with CSM would offset corn costs. Feeding CSM is problematic because it contains gossypol, a hepatic toxin. If a feed additive protecting chickens from gossypol's harmful effects could be identified, CSM could be used in poultry diets. A possibility is silymarin, an extract from milk thistle seeds. Silymarin is used to treat hepatic disorders. White Leghorn male chicks from 2 lines divergently selected for humoral immune response were housed 3 to a cage. Seventy-two 4-wk old chicks from each line were used. Cages were randomly assigned 1 of 4 diets: 1000 ppm gossypol (G), 1000 ppm silymarin (S), 1000 ppm gossypol and 1000 ppm silymarin (GS), or a control (C). Blood samples were collected at the start of the experiment and weekly thereafter. Hematocrits and gamma-glutamyl transferase activity were determined. Body weight and feed intake were recorded weekly. After 4 wk, chickens were killed by cervical dislocation, and livers were collected. Liver homogenates were

assayed for quinone reductase activity. Liver slices were preserved in 10% buffered formalin for histological analysis. Lines did not differ significantly in their response to diet for any of the physiologic measures considered. Body weight and feed intake were depressed ( $P < 0.01$ ) in G and GS treated chicks. Gossypol and GS treated chicks had higher lipidosis scores ( $P < 0.01$ ) as well as increased quinone reductase activity ( $P < 0.01$ ) than C. Furthermore, gamma glutamyl-transferase activity was increased ( $P < 0.01$ ) in G and GS treated chickens compared to C and S treated chicks. At least at the amount included in these diets, silymarin did not ameliorate the toxicity of gossypol.

**Key Words:** liver toxicity, gossypol, silymarin, enzyme activity level, chicken

**81 Effects of mycotoxin contaminated diets and Mycofix<sup>®</sup> Select on Leghorn performance characteristics.** K. A. Jessen\*<sup>1</sup>, D. J. Caldwell<sup>1</sup>, J. Coppedge<sup>1</sup>, L. Oden<sup>1</sup>, S. Pohl<sup>1</sup>, A. Klein<sup>1</sup>, R. Beltran<sup>2</sup>, G. Schatzmayr<sup>2</sup>, T. Applegate<sup>3</sup>, and J. T. Lee<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>Biomim GmbH, Herzogenburg, Austria, <sup>3</sup>Purdue University, West Lafayette, IN.

The current experiment was conducted to determine the effect of mycotoxin-contaminated diets [aflatoxin (AFLA) and deoxynivalenol (DON)] and dietary inclusion of Mycofix<sup>®</sup> Select, on layer hen performance during a 10-week trial. The experimental design consisted of a 4 x 2 factorial with four toxin levels: control, low (0.5 PPM AFLA + 1.0 ppm DON), medium (1.5 PPM AFLA + 1.5 ppm DON), and high (2.0 PPM AFLA + 2.0 ppm DON) with or without the inclusion of Mycofix<sup>®</sup> Select. Three hundred and eighty-four 25-week-old laying hens were randomly assigned to one of the eight treatment groups. Birds were fed contaminated experimental diets for a six week phase of toxin administration followed by a four week recovery phase, when all birds were fed mycotoxin free diets. Twelve hens from each treatment were subjected to necropsy following each phase. Relative liver and kidney weights were increased ( $P < 0.05$ ) at the medium and high toxin levels following toxin administration. Mycofix<sup>®</sup> Select reduced ( $P < 0.05$ ) relative liver and kidney weights following the recovery period. High toxin decreased ( $P < 0.05$ ) feed consumption and egg production during the toxin period. Mycofix<sup>®</sup> Select increased ( $P < 0.05$ ) egg production during the first two weeks of the toxin phase. Medium and high levels of toxin reduced ( $P < 0.05$ ) egg weight following the toxin phase. An interaction existed between toxin and Mycofix<sup>®</sup> Select inclusion with regard to feed conversion (g of feed/g of egg). High inclusion level of toxin increased feed conversion compared to the control diet, while Mycofix<sup>®</sup> Select inclusion reduced feed conversion to a level comparable to the control. These data indicate that Mycofix<sup>®</sup> Select can reduce and/or eliminate adverse effects of mycotoxicosis in peak-performing laying hens.

**Key Words:** layer, mycotoxin, egg production, feed efficiency, aflatoxin

**82 Comparing post-molt body weight and egg weight with two protein and five energy levels.** P. L. Ruzsler\*<sup>1</sup>, C. L. Novak<sup>2</sup>, and D. M. Denbow<sup>1</sup>, <sup>1</sup>Virginia Polytechnic Institute and State University, Blacksburg, <sup>2</sup>Land O'Lakes Purina Feed, Kansas City, MO.

In a trial to determine how to control egg weight and body weight in molted hens, 180 hens were full fed a low nutrient (FFLN) molt diet and 18 hens (controls) were molted with a 4-day fasting method. This was a second molt at 132 weeks-of-age for these hens. Each treatment was replicated 6 times with 3 hens per replicate. On the 29th day of the

molt, 5 of the FFLN treatment groups were placed on a 12% CP layer diet and 5 groups were placed on a 14% CP layer diet, each with energy ranging from 2,750 to 2,882 Kcal ME/kg by increments of 26 Kcal. The control hens were fed a 15.5% CP/2,822 Kcal ME/kg layer diet. Energy had no effect on any of the measured parameters. However, the hens on the highest energy levels tested, 2882 & 2854 Kcal/kg, compared consistently different numerically from the rest. They consumed the least amount of feed, experienced the lowest levels of production and laid the heaviest eggs. There were no differences between the 14% CP group and the control group. However, the hens fed the 14% CP diets laid 7.6% more total eggs than the hens fed 12% CP (74.9% vs. 67.1%), weighted 182g more (1823g vs. 1641g), and laid heavier eggs (68.5g vs. 65.7g). During the period of egg production above 50% from 7 to 32 weeks they consumed an average of 11.6g more feed per hen per day, 119.9g vs. 108.3 g respectively. When economically comparing the feed ingredient costs for 14% CP layer diet vs. 12% CP layer diet resulting in feed costs of \$230 vs \$210/ton respectively, it shows that the 12% layer diet was better. The results using data from this study show a \$0.97 lower feed cost per hen for the 12% CP layer diet or a savings slightly more than the feed cost for producing 2 dozen eggs. This study showed that the lower level of crude protein fed resulted in a lower body weight and produced lighter eggs more economically.

**Key Words:** egg weight, body weight, energy, protein, economics

**83 The efficacy of Optiphos<sup>®</sup> in pre-molt and post-molt diets fed to Hyline W-36 laying hens from 32-117 weeks of age.** E. T. Meyer\*, P. L. Utterback, C. W. Utterback, L. Mejia, and C. M. Parsons, University of Illinois, Urbana.

Three experiments were conducted to test the effectiveness of Optiphos<sup>®</sup> phytase in corn-soybean meal diets fed to laying hens during various ages of the laying cycle. The first experiment evaluated the effect of Optiphos<sup>®</sup> on first cycle layers from 32-62 weeks of age. Six treatments were replicated four times using 14 hens. Treatments consisted of a negative control diet containing 0.105% nonphytate phosphorus (NPP), positive control (0.45% NPP), marginal NPP level (0.20%), and supplemental Optiphos<sup>®</sup> at 150, 250, or 15,000 FTU/kg added to the negative control. The second experiment evaluated the enzyme in late pre-molt diets, and also, in post-molt diets from 68-88 weeks of age. Five treatments were replicated five times with 14 hens. Pre-molt diets contained 0.38% NPP, 0.48% NPP, and 0.28% NPP supplemented with 150, 750, or 1,500 FTU/kg Optiphos<sup>®</sup>. Post-molt NPP levels were increased by 0.06% NPP in each diet. The last experiment evaluated Optiphos<sup>®</sup> near the end of the second laying cycle at 112-117 weeks of age. Five treatments were replicated five times using 14 hens. Diets contained 0.43% NPP, 0.53% NPP, and 0.33% NPP supplemented with 150, 1000, or 2000 FTU/kg Optiphos<sup>®</sup>. Measurement parameters included hen-day egg production, egg weight, egg mass, egg shell quality, feed consumption, feed efficiency, tibia ash, and concentration of P in the excreta. In the first experiment, all production parameters were greatly reduced ( $P < 0.05$ ) by the 0.105% NPP treatment, and this treatment was terminated at 40 weeks of age due to low egg production (less than 50%). None of the measured production parameters were affected by the other dietary treatments except that P in the excreta was significantly reduced for all phytase treatments when compared to the 0.45% NPP treatment. Dietary treatments had no consistent effects on any measured parameter in Experiments 2 and 3. This study indicated that Optiphos<sup>®</sup> improves P utilization and reduces P excretion in laying hens at various stages of the egg production cycle.

**Key Words:** phytase, phosphorus, egg production

**84 Evaluation of limit feeding varying levels of DDGS in nonfeed withdrawal molt programs for laying hens.** L. Mejia\*, P. L. Utterback, E. T. Meyer, D. L. Studer, C. W. Utterback, C. M. Parsons, and K. W. Koelkebeck, *University of Illinois, Urbana*.

An experiment was conducted using 672 Hy-Line W-36 hens (69 wk of age) to evaluate if limit feeding varying levels of DDGS with corn (C), wheat middlings (WM), and soybean hulls (SH) would affect postmolt performance of laying hens in a nonfeed withdrawal molt program. Treatments consisted of feeding hens a 47% C:47% SH diet (C:SH) *ad libitum* for 28 d (positive control). Hens on the other seven treatments were limit fed 65 g/hen/d for 16 d, then fed 55 g/hen/d for 12 d. Treatments 2 and 3 were fed 49% C:35% WM or SH:10% DDGS [(C:WM:10DDGS), (C:SH:10DDGS)]. Treatments 4 and 5 were given 49% C:25% WM or SH: 20% DDGS [(C:WM:20DDGS), (C:SH:20DDGS)]. Treatments 6 and 7 were fed 47% C:47% DDGS (C:DDGS) and 47% WM:47% DDGS (WM:DDGS). Hens on treatment 8 were fed a high 94% DDGS diet. At the end of the 28 d molt period, all hens were fed a 16% CP corn-soybean meal layer diet and production performance was measured for Weeks 5 to 26. Body weight (BW) loss ranged from 7% (C:DDGS and DDGS) to 25% (C:SH). Hens fed the C:WH:10DDGS and C:SH:10DDGS lost 13 and 20% BW, respectively. Also, hens fed the C:WM:20DDGS, C:SH:20DDGS and WM:DDGS diet lost 11, 14, and 13% BW, respectively. Hens fed the control diet had the lowest ( $P<0.05$ ) feed intake during the molt period. Feed consumption during the molt period (Weeks 1 to 4) was similar between the C:WM:10DDGS, C:WM:20DDGS, C:SH:20DDGS, C:DDGS, WM:DDGS, and DDGS diets. No consistent differences were observed among treatments throughout the postmolt period for egg production and egg weights. In fact, no treatments reached 0% egg production during the molt period. This study shows that feeding DDGS diets at levels of 65 g/hen/d for 16 d followed by 55 g/hen/d for 12 d during the molt period did not cause hens to totally cease production. However, long term production performance was not different than feeding a C:SH diet. These results suggest that lower levels of feeding DDGS may be needed for nonfeed withdrawal molt programs.

**Key Words:** molting, laying hens, DDGS

**85 Effects of cinnamon, garlic and yucca extracts on growth performance and serum biochemical parameters in broilers.** A. G. Chen\*, H. J. Chen, C. M. Yang, Q. H. Hong, and J. Feng, *Zhejiang University, Hangzhou, Zhejiang, China*.

The experiment was conducted with 360 one-day-old Avian commercial broilers to study the effects of dietary cinnamon extract (CE), garlic extract (GE) and yucca extract (YE) on growth performance and serum biochemical parameters in broilers. The chickens were randomly divided equally into 4 treatment groups, each group with 3 replications, and received the same basal corn-bean diets included a starter from 1d to 21d and then a grower until 42 d, added with recommended dose 250 mg/kg CE, 25 mg/kg GE and 10 mg/kg YE to relevant group, respectively. The birds were kept in a stainless steel net coop each replication with 24 h light and received feed and water *ad libitum*. At 21 d and 42 d of age, 6 chicks were respectively picked out from every group and were bled to collect serum samples and intestinal samples for laboratory analysis. The results showed that the average daily gain (ADG) of CE, GE and YE group were increased by 7.20% ( $P<0.05$ ), 3.43% ( $P>0.05$ ) and 4.89% ( $P>0.05$ ), feed gain ratio (F/G) was improved by 9.71%

( $P<0.05$ ), 3.40% ( $P>0.05$ ) and 3.40% ( $P>0.05$ ) compared with the control, respectively. At 21d of age, the content of serum urea nitrogen (SUN) and serum uric acid (SUA) and the activity of serum xanthine oxidase (SXO) in CE group were reduced by 35.17% ( $P<0.01$ ), 13.73% ( $P<0.01$ ) and 16.33% ( $P<0.05$ ) compared with the control, respectively. At 42 d of age, SUN and SUA level and SXO activity were lowered by 24.35% ( $P<0.01$ ), 15.49% ( $P<0.05$ ) and 23.09% ( $P<0.01$ ), respectively. The SXO activity in CE group was decreased by 14.86% ( $P<0.01$ ) and 15.34% ( $P<0.01$ ) compared with GE and YE group, respectively. Also, adding CE, GE and YE into broiler diets resulted in lower UN and UA level of intestinal contents. It is clear that CE significantly decreased the SXO activity and SUA levels more than GE and YE, especially in the latter period, thereby it may play a more important role in improving the growth performance of broilers.

**Key Words:** cinnamon extract, broiler, growth performance, serum urea nitrogen, serum uric acid

**86 Effect of using zeolite in the broiler diet on reducing *Salmonella* and on production performance.** M. M. Mashaly\*<sup>1,2</sup>, S. F. Al-Zenki<sup>1</sup>, A. Y. Al-Nasser<sup>1</sup>, A. E. Al-Saffar<sup>1</sup>, M. E. Al-Bahouh<sup>1</sup>, F. K. Abdullah<sup>1</sup>, and G. G. Ragheb<sup>1</sup>, <sup>1</sup>*Kuwait Institute for Scientific Research, Safat, Kuwait*, <sup>2</sup>*Pennsylvania State University, University Park*.

Broiler *Salmonella* contamination is a problem for the poultry industry and the consumers. A viable strategy is to reduce the levels of *Salmonella* at the farm level and implement good manufacturing practices at the processing plant. In the current study, zeolite was used in the broiler diet to reduce broiler *Salmonella* contamination. This is because zeolite is known to have the ability to lower ammonia emission which could result in a decrease in *Salmonella* contamination. Therefore, the objectives of the current study were to evaluate the effect of using zeolite in the broiler diet on both reducing *Salmonella* in broilers and on production performance.

One hundred and twenty broiler chicks were placed in each of 36 floor pens. The pens were divided into four groups of nine pens each and were used for one of four treatments. These treatments included the control group, and either 1, 1.5, or 2 % zeolite added in the feed. This study was repeated both in the summer and winter season. The prevalence of *Salmonella* on the chicken body and in the ceca was determined at 7, 21, and 35 days of age and at the processing plant. In addition, body weight, feed consumption was recorded at 7, 21, and 35 days-of age and feed efficiency was calculated.

In addition to reducing *Salmonella* contamination at the farm, it was found that treatments significantly ( $p<0.05$ ) reduced *Salmonella* contamination at the processing plant, both in the summer, from 33% (control) to 8% (mean for treated groups) for the carcass and from 20% to 13% for the ceca and in the winter season from 13% to 4% for the carcass and from 22% to 5% for the ceca. It was also found that in the winter season, feed efficiency was significantly ( $p<0.05$ ) better in the treated groups (1.766, mean for the treated groups) than in the control group (1.980). However, feed efficiency was similar in all four groups during the summer season. It can be concluded that using zeolite in the feed can be beneficiary in both reducing broiler *Salmonella* contamination both at the farm and at the processing plant and improving production performance at least in the winter season.

**Key Words:** broilers, zeolite, *Salmonella*, production performance