

Metabolism and Nutrition, Feed Additives II

209 Effect of diets with or without BacPack (*Bacillus subtilis* C-3102 plus yeast cell wall) on hatchery parameters in three commercial broiler breeder field trials at the same company. Ronald Nietfeld*¹, Danny M. Hooge², and John Schleifer¹, ¹Quality Technology International, Inc., Elgin, IL, ²Hooge Consulting Service, Eagle Mountain, UT.

BacPack ABF (BP ABF; a proprietary blend of Calsporin and IMW50 yeast cell wall preparation), was evaluated in broiler breeder feeds to determine effects on hatchery parameters in 3 commercial field trials. In each trial, flocks on nearby farms were given control (CON; unsupplemented) or BP ABF supplemented diets to Cobb 500 × Cobb MX breeders. Trials were started in March, April, and May 2015, respectively. Trial 1: from 25 wk; 1 CON vs. 1 BP ABF farm; 31–65 wk data; Trial 2: from 21 wk; 1 CON vs. 2 BP ABF farms; 32–62 wk data; Trial 3: from 21 wk; 1 CON vs. 1 BP ABF farm; 31–63 wk data. Paired *t*-test ($P \leq 0.05$) was used for weekly hatch of total eggs % and 3-trial meta-analysis. A 2-sample (unpaired) *t*-test ($P \leq 0.05$) was used for randomly collected hatchery data. Weekly hatch of total eggs % means significantly increased in Trials 1 and 3 for the BP ABF dietary treatment and approached significant difference ($P = 0.090$; BP ABF 2.36% higher; 86.40 vs. 84.04%) for combined trials. Hatchery results collected randomly showed significant increases in hatch of total eggs % in Trials 2 and 3 and combined trials (3.97% higher; 88.01 vs. 84.04%) for BP ABF diets. Fertility % and hatch of fertile eggs % significantly increased in Trials 2 and 3, and approached significance in Trial 1 ($P = 0.069$ and $P = 0.087$, respectively), with BP ABF diets compared with CON diets. Infertile eggs % significantly decreased in Trials 2 and 3, and approached significance ($P = 0.069$) in Trial 1, for BP ABF diets compared with CON diets. Cull eggs % significantly decreased in each trial for flocks fed BP ABF diets. Variable results were obtained by treatment with early, middle, late, and pipped dead %, transfer cracks %, and contaminated eggs %. Early cracks % were significantly lower for combined trials at 0.156% for CON diets compared with 0.278% for BP ABF diets. Broiler breeders fed BP ABF diets had improved hatchery parameters, especially hatchability of total eggs set (3.97% actual or 4.72% relative increase), compared with those fed CON diets.

Key Words: *Bacillus subtilis* C-3102, broiler breeder, fertility, hatchability, yeast cell wall

210 Efficacy of a bacillary probiotic supplementation (*Bacillus subtilis* DSM 17299) in broilers: Combined analysis of fourteen different studies. Alfred Blanch*¹, Mickaël Rouault¹, Oscar Casabuena², Carlos Millán², and Marta I. Gracia², ¹Chr. Hansen A/S, Hørsholm, Denmark, ²Imasde Agroalimentaria S.L., Pozuelo de Alarcón, Spain.

The efficacy of the probiotic feed additive, Gallipro (G; *Bacillus subtilis* DSM 17299), included in broiler diets at 8×10^5 viable spores/g was evaluated using statistical meta-analysis of data from 14 different studies conducted using healthy broilers from day-old to market weight at 42 d of age. Trials involved 14,828 male broiler chicks distributed in 532 replicates. The experimental design was applied in the starter, grower and finisher phases, from day-old to slaughter at 42 d of age. Diets were based in corn/soybean meal or wheat/corn/soybean meal. The total weight gain, feed to gain ratio and mortality at 42 d data from

each experiment were tested for homogeneity between trials before being pooled and analyzed in combination to determine whether benefits were consistent independent of trial site and conditions. Data were analyzed by linear mixed model procedure with G supplementation and type of basal diet as fix effects and trial as random effect. Over the entire experimental period (d 1 to d 42 of age), probiotic supplementation significantly improved ($P < 0.0001$) total weight gain (2.3%) and feed to gain ratio (2.3%). Mortality was considered normal (mean 3.15%) and was not affected by G supplementation. No G by type of basal diet interactions were observed for total weight gain, feed to gain ratio or mortality, which indicated that G improved performance of broilers independent of the type of basal diet. The results demonstrated that Gallipro in broiler diets, supplemented at the dose of 8×10^5 viable spores/g, can be beneficial in terms of broiler performance.

Key Words: *Bacillus subtilis*, probiotic, broilers, performance

211 *Bacillus subtilis* probiotic improved performance of corn-fed broilers with or without ionophore coccidiostats. Vincent Jacquier¹, Lamy Rhayat*¹, Pierre-André Geraert², and Estelle Devillard¹, ¹Adisseo France SAS, Commentry, France, ²Adisseo France SAS, Antony, France.

Specific direct-fed microbials have been shown to increase animal performance, most probably by improving gut health. As bacteria, they can show sensitivity to antimicrobial compounds and their use could be non-compatible with the use of ionophore coccidiostats such as monensin and salinomycin. The objective of the present study was to investigate the effect of *Bacillus subtilis* DSM 29784 on the performance of broilers fed a corn-based diet supplemented or not with coccidiostat. A total of 960 d-old male broiler chickens, Ross PM3, were randomly allocated according to a factorial design with 4 treatments (16 replicates of 15 birds per treatment) and reared until 35 d in floor pens. The experimental treatments were T1 = negative control (basal diet); T2 = T1 + *Bacillus* strain DSM 29784 at 1.10^8 cfu/kg of feed; T3 = T1 + *Bacillus* strain DSM 29784 + monensin (1.10^8 cfu/kg of feed and 100 ppm, respectively); T4 = T1 + *Bacillus* strain DSM 29784 + salinomycin (1.10^8 cfu/kg of feed and 60 ppm, respectively). Feed intake (FI) and body weight gain (BWG) were measured at 21 and 35 d and adjusted feed conversion ratio (FCR) calculated. Ileal and cecal contents were collected at 35 days to study microflora composition. At 35 d, *Bacillus subtilis* DSM 29784 treated group showed a higher BWG (+5.2%; $P < 0.05$) and a lower adjusted FRC (-4.8%; $P < 0.05$) than the control group. The addition of coccidiostats did not decrease the effect of *Bacillus subtilis* DSM 29784, no significant differences were found between T2, T3, and T4 in term of improvement of performance, when compared with the control group. Preliminary results on microbiota composition showed that *Bacillus subtilis* DSM 29784 increased beneficial bacterial population in the broiler digesta, specifically the butyrate-producing populations. These results suggest that *Bacillus subtilis* strain DSM 29784 improves broiler performance by modulating intestinal microbiota. There were no antagonistic effect when ionophores were added to the diet. In conclusion, *Bacillus subtilis* strain DSM 29784 can be added to medicated diets to improve broiler chicken performance.

Key Words: direct-fed microbial, *Bacillus subtilis*, broiler, ionophore coccidiostat

212 *Bacillus subtilis* 29784 contributes to control the effect of *Clostridium perfringens* on broiler performance. Lamya Rhayat^{*1}, Greg F. Mathis², Charles L. Hofacre³, Vincent Jacquier¹, Pierre-André Geraert¹, and Estelle Devillard¹, ¹*Adisseo France SAS, Commentry, France*, ²*Southern Poultry Research Inc., Athens, GA*, ³*University of Georgia, PDRC, Athens, GA*.

Clostridium perfringens contributes to necrotic enteritis (NE) syndrome which causes important economic losses in the broiler industry. *Bacillus subtilis* 29784 has been previously shown to inhibit several strains of *C. perfringens* in different types of *in vitro* tests. The study aimed to examine the effect of supplementing diet with *B. subtilis* 29784 on growth parameters. A battery trial from 0 to 28d of age used Cobb male broiler chicks challenged with 0 or 5,000 oocysts of *Eimeria maxima* on d14 and with 0 or 1×10⁸ cfu of *C. perfringens* per bird once daily on d19, 20, and 21. There were 8 cages of 8 birds each per treatment fed with an unmedicated US standard broiler starter diet. Six treatments were: (1) Non-infected chicks, unmedicated diets; (2) infected chicks, unmedicated diets; (3) infected chicks, bacitracin methylene disalicylate (BMD, 55 ppm); (4) infected chicks, *B. subtilis* 29784 (5.107 cfu/kg); (5) infected chicks, *B. subtilis* 29784 (1.108 cfu/kg); and (6) infected chicks, *B. subtilis* 29784 (5.108 cfu/kg). Body weight gain (BWG) and feed intake were measured on d28 in order to calculate the feed conversion ratio (FCR). The challenge strongly decreased the performance of the animals up to -24.5% on BWG and +32.8% on FCR. *B. subtilis* 29784 restored the BWG of challenged animals by +19.8% to 29.8% and their FCR by -15.5% to -17%. The level of improvement obtained with *B. subtilis* 29784 was the same for all three doses tested.

Key Words: direct-fed microbial, *Bacillus subtilis*, *Clostridium perfringens*, broiler, performance

213 *Bacillus subtilis* improves performance of broilers fed medicated or nonmedicated feed. Lamya Rhayat^{*}, Vincent Jacquier, Pierre-André Geraert, and Estelle Devillard, *Adisseo France SAS, Commentry, France*.

Bacillus-based direct-fed microbials are of particular interest to improve gut health and performance, due to their ability to modify gut microbiota, and to remain viable after pelleting. The objective of the present experiment was to investigate the effect of *Bacillus subtilis* DSM 29784 on the performance of broilers compared with or in combination with bacitracin methylene disalicylate (BMD). A total of 2400 d-old male broiler chickens, Cobb 500, were randomly allocated according to a factorial design with 4 treatments (12 replicates of 50 birds) and reared until 35 d in floor pens. The experimental treatments were T1 = negative control (basal diet, corn-based); T2 = T1 + BMD at 55 ppm; T3 = T1 + *Bacillus* strain DSM 29784 at 5.10⁸ cfu/kg of feed; T4 = T1 + *Bacillus* strain DSM 29784 + BMD (5.10⁸ cfu/kg of feed and 55 ppm, respectively). Feed intake (FI) and body weight gain (BWG) were measured

at 21 and 35 d and feed conversion ratio (FCR) calculated. At 21 d, the 3 treatments (groups T2, T3 and T4) significantly improved BWG and FCR ($P < 0.05$). There was also a numerical improvement when T4 was compared with T2 and T3. At d 35, all treatments increased BWG, significantly ($P < 0.05$) for T3 and T4 with an improvement of 7.7 and 6.8%, respectively. T2 and T3 improved significantly ($P < 0.001$) the FCR by 3.3 and 3.7%, respectively. For T4, there was also a significant ($P < 0.001$) FCR improvement of 4.1%, with a numerical ($P > 0.05$) increase compared with T2 and T3. These results showed that *Bacillus subtilis* strain DSM 29784 improves broiler performance, and the level of improvement is similar to that obtained with BMD. There were no antagonistic interaction between the 2 products and a trend for performance increase was obtained with the combination. In conclusion, *Bacillus subtilis* strain DSM 29784 can be added to non-medicated as well as medicated diets to improve broiler chicken performance.

Key Words: direct-fed microbial, *Bacillus subtilis*, broiler, antibiotic growth promoter, performance

214 Effect of feeding Mexican sunflower leaf *Tithonia diversifolia* Hemsl A. Gray on carcass quality of Guinea fowl. Anthony H. Ekeocha^{*}, *Federal University Oye-Ekiti, Oye, Ekiti, Nigeria*.

A study was conducted for 12 wk to investigate the effect of feeding Mexican sunflower leaf, *Tithonia diversifolia*, on carcass characteristics of Guinea fowl. Ninety-day-old keets were used. The keets were randomly assigned to 5 treatments (A, B, C, D, and E). Treatment A served as control whereas birds in treatments B, C, D, and E received Mexican sunflower leaf (MSL) at 1.5, 3.0, 4.5, and 6.0% respectively as graded replacement (wt/wt) for wheat bran. Feeds and water were provided ad libitum and the routine vaccination/medication followed the standard procedures. Data were analyzed using descriptive statistics and ANOVA. The results shows a significant ($P < 0.05$) decrease in all the parameters measured for carcass characteristics except for the neck weight (167.21 g) where birds on treatment B (1.5% MSL) obtained the highest neck weight and the spleen with highest weight (5.32 g) obtained in treatment C (3.0% MSL). The liver weights significantly increased ($P < 0.05$) across the dietary treatments while other organs observed did not differ significantly ($P > 0.05$) in weight across the treatments. The carcass quality shows no significant ($P > 0.05$) difference in head weight, drumstick weight and breast weight. However, live performance was affected, with birds on control diet (treatment A) significantly ($P < 0.05$) having higher weight (2,610.30 g) than birds in the other treatments. Inclusion of MSL at 1.5, 3.0, 4.5, and 6.0% has almost no effect on the carcass characteristics but the study suggests that MSL meal could be safely incorporated into guinea fowl rations at up to a 6.0% inclusion level without adverse effects. However, from the data presented here, an inclusion level of 3.0% appears to be adequate.

Key Words: Mexican Sunflower leaf, carcass, quality, Guinea fowl