202 Performance and oxidative stability effects of synthetic antioxidant in broilers fed diets containing either oxidized or non-oxidized fat. M. K. Manangi1, M. Vazquez-Anon1, T. Wineman1, M. Wehmeyer1, J. D. Richards1, S. Carter1, and C. Owens2, 1Novus International Inc., St. Charles, MO, 2University of Arkansas, Fayetteville.

A 42d study was conducted to determine the performance and oxidative stability effects of synthetic antioxidant (Santoquin M6 containing 66.6% Ethoxyquin (AOX)) in broilers fed diets containing either oxidized or non-oxidized fat. A total of 640 Ross-708 male chicks were assigned to 4 treatments with 8 pens/treatment and 20 chicks/pen. The study was carried out as a 2 × 2 factorial design with 2 sources (oxidized vs. non-oxidized) of fat and 2 levels (0 vs. 125ppm) of AOX. The treatments consisted of: non-oxidized fat with no AOX, T1; non-oxidized fat with AOX, T2; oxidized fat with no AOX, T3; oxidized fat with AOX, T4. Soybean oil was used as a source of fat. For T3 and T4 diets, soy oil was oxidized to contribute 5meq peroxide/kg in the starter and 7meq peroxide/kg in the grower and finisher diets. Thiobarbituric acid reactive substances (TBARS, a measure of lipid peroxidation) were assayed in breast meat from 4 birds per pen as a measure of meat oxidative stability. No interaction (P > 0.05) was observed for source and level on performance variables, and breast meat TBARS. Main effects (source and level) indicate that feeding oxidized fat reduced feed intake by 200g (P < 0.01) and weight gain by 140g (P < 0.01), and increased TBARS in 10d old refrigerated pre-cooked meat by 1.7µmole malondialdehyde (MDA)/kg meat (P = 0.07) and in 1d old refrigerated cooked meat by 20.4µmole MDA/kg meat (P < 0.01) compared with birds fed non-oxidized fat. Supplementing 125ppm synthetic AOX improved feed intake by 140g (P = 0.02) and weight gain by 70 g (P = 0.07), and decreased TBARS in 10d old refrigerated pre-cooked meat by 2.0µmole MDA/kg meat (P = 0.04) and in 1d old refrigerated cooked meat by 19.6µmole MDA/kg meat (P < 0.01) compared with birds fed zero synthetic AOX. Overall, the AOX effectively improved the broiler performance, and also the oxidative stability of the precooked and cooked meat compared with chicks fed no synthetic AOX.

Key Words: antioxidant, TBARS, Santoquin, breast meat

203 Differences among origins on nutritional and quality parameters of soybean meal. G. G. Mateos1, M. González2, S. Sueiro2, M. Hermida2, J. Fickler3, P. G. Rebollar1, M. P. Serrano1, and R. P. Lázaro1, 1Universidad Politécnica de Madrid, Madrid, Spain, 2Laboratorio Mouriscade, Lalín, Pontevedra, Spain, 3Evonik, Hanau, Germany.

Soybean meal (SBM) is the main protein source in livestock feeds. United States (USA), Brazil (BRA), and Argentine (ARG) are the major SBM exporter countries. The nutritive value of SBM varies because genetics, environment, farming conditions, and processing of the beans influence strongly the content and availability of major nutrients. The present research was conducted to determine the influence of origin (USA, BRA and ARG) on nutritive value and protein quality of SBM. Samples (n = 385) were collected during a 4-yr period and analyzed for major dietary components, at the same laboratory and by the same technician, following AOAC procedures (Mouriscade, Spain). Amino acids (AA) were analyzed by NIR technology (Evonik, Hanau, Germany). On DM bases, USA meals (n = 148) had more CP (53.9 vs. 51.6 vs. 52.7%; P ≤ 0.001) and less NDF (8.8 vs. 10.7 vs. 12.0%; P ≤ 0.001) than ARG (n = 126) and BRA meals (n = 110). Sucrose and stachyose content was higher, and raffinose lower, for USA than for ARG and BRA meals (8.1 vs. 7.6 vs. 6.5%; 6.4 vs. 5.6 vs. 5.3% and 1.09 vs. 1.31 vs. 1.57%, respectively; P ≤ 0.001). The USA meals had more P (0.79 vs. 0.69 vs. 0.74%; P ≤ 0.001) than the BRA with ARG being intermediate. Also, BRA meals had more Fe (201 vs. 127 and 133 mg/kg; P ≤ 0.001) but less K (2.3 vs. 2.6 and 2.5%; P ≤ 0.001) than ARG and USA. The USA meals had higher KOH solubility (87.3 vs. 82.5 and 83.6%; P ≤ 0.001), protein dispersibility index (19.9 vs. 17.1 and 15.3%; P ≤ 0.001), and trypsin inhibitor activity (3.9 vs. 3.0 and 3.0 mg/g; P ≤ 0.001) than ARG or BRA SBM. The amino acid profile (% CP) varied with the origin. Lysine (6.15 vs. 6.09 vs. 6.05%), met-cys (2.86 vs. 2.86 vs. 2.80%), thr (3.91 and 3.93 vs. 3.88%), trp (1.36 vs. 1.37 vs. 1.34%) and the content of these 5 key AA was higher (P ≤ 0.001) for USA and ARG than for BRA, respectively. It is concluded that SBM of USA origin have a higher feeding value (protein quality indicators, less fiber and more sucrose, phosphorus, CP, and indispensable AA content) than South American meals. Thus, the origin of the beans should be specified in feed tables for accurate and precise formulation of diets by the feed industry.

Key Words: soybean meal, protein quality, nutritive value

204 Effects of the main cereal and type of fat of the diet on productive performance and egg quality of brown egg-laying hens from twenty-two to fifty-four weeks of age. A. Pérez-Bonilla1, M. Frika2, C. Jabbour2, S. Mirzaie2, H. Irandoust2, J. Garcia1, and G. G. Mateos2, 1Camar Agroalimentaria S.L., Toledo, Spain, 2Universidad Politécnica de Madrid, Madrid, Spain.

The influence of the main cereal and supplemental fat of the diet on productive performance and egg quality was studied in 756 brown-egg laying hens from 22 to 54 weeks of age. The experiment was conducted as a completely randomized design with 9 treatments arranged factorially with 3 cereals (dented corn, soft wheat, and barley) and 3 types of fat [soy oil (SBO), acidulated soapsstocks (AOS), and lard]. Each treatment was replicated 4 times (21 hens per replicate). All diets were formulated to have similar nutrient content except for linoleic acid that ranged from 0.76 to 3.4% depending on the combination of cereal and fat source used (wheat and lard vs. corn and SBO). Productive performance and egg quality traits were recorded every 4-wks and BW was measured at the beginning and at the end of the experiment. For the entire experimental period egg production (92.9 vs. 92.1 vs. 91.5%), egg weight (64.5 vs. 64.1 vs. 63.6%), and egg mass (59.9 vs. 59.1 vs. 58.2) were similar for all treatments. Hens fed the wheat and lard diet showed the lowest numerical values (62.8 vs. 64.0, for the mean of the other treatments). Body weight gain was higher for hens fed corn and wheat than for hens fed barley (238 vs. 243 and 202 g; P ≤ 0.05). Mortality was not influenced by diet. Source of fat did not affect any of the performance variables studied, except for BW gain that was higher for hens fed lard than for hens fed SBO and AOS (251 vs. 221 and 210 g; P ≤ 0.05). Egg quality variables were not influenced by diet except for yolk color that was higher for hens fed corn than for hens fed wheat or barley (9.0 vs. 8.3 and 8.3; P ≤ 0.001) and for hens fed lard than for hens fed SBO or AOS (8.9 vs. 8.5 and 8.2; P ≤ 0.001). It is concluded that the 3 cereals and the 3 fat sources tested can be used indistinctly in diets for laying hens provided that a minimum amount of linoleic acid is used. The results indicate that brown egg laying hens do not need more than 1.0% linoleic acid in the diet to maximize egg size and egg production.

Key Words: cereal, fat source, linoleic acid, hen performance, egg weight

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Evaluation of feeding various sources of distillers dried grains with solubles (DDGS) in non-feed withdrawal molt programs for laying hens.

An experiment was conducted using 588 Hy-Line W-36 hens (68 wks of age) to evaluate if laying hens can be successfully molted by ad-libitum feeding various levels and sources of DDGS. The 3 sources of DDGS varied greatly in color. Treatment 1 consisted of a 47% corn (C):47% soy hulls (SH) molt diet (C:SH) fed for 28 d (positive control). Treatments 2, 3 and 4 were molt diets containing 94% DDGS from various sources fed for 28 d. Treatments 5, 6 and 7 were C: 42% SH: 20% DDGS, also fed for 28 d. At the end of the 28 d molt period, all hens were fed a 16% CP corn-soybean meal layer diet. Body weight (BW) loss during the molt period was greatest for hens fed the C:SH diet (26%). The BW loss was greater for hens fed the C:SH:DDGS diets (12%) than for the hens fed the 94% DDGS diets (2%) and the reduction in BW loss varied among DDGS sources. Feed consumption was lower for hens fed the C:SH control diet compared with hens fed the DDGS diets. Hens fed the C:SH diet had egg production near 0% during the last 3 weeks of the molt period. Hens on the other treatments did not have egg production below 8–10% during the molt period, and the reduction in egg production varied among DDGS sources. The darkest brown DDGS resulted in the greatest reduction in egg production. During the first 8 weeks of the post molting period, egg production of hens that had been fed the C:SH diet during the molt period was generally lower than that of hens fed the other molt diets. This study showed that responses varied among DDGS sources; however, none of the molt diets containing 20–94% DDGS resulted in satisfactory reductions in BW or egg production.

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


This study was carried out to investigate the effect of DDGS and yeast-derived products on growth performance, small intestinal morphology and gut development in broiler chickens from 1 to 21 d of age. In addition to DDGS, the yeast products used in the study contained different levels of potentially active components including mannan polysaccharides, β1,3 and β1,6-glucans and nucleotides. The brewer’s yeast contained 0.32% nucleotides and 18.9% cell wall polysaccharides (CWP) with the component sugars mannose and glucose accounting for 99.0%. Such amounts would reflect the composition of yeast biomass present in DDGS. Other products investigated included a yeast cell wall product containing 43.3% CWP with mannose and glucose accounting for 99% and a commercial product containing the processed baker’s yeast with 21.6% CWP and 1.13% nucleotides. The nucleotide product contained 9.3% nucleotides and very little CWP. It contained, however, 6.8% mannose derived from yeast cell walls with very little glucose, indicating the presence of free mannan but not β1,3 and β1,6-glucans. One-day-old male broiler chickens were assigned to 8 dietary treatments of 9 replicates of 5 chicks per pen from 1 to 21 d of age. The dietary treatments included: a positive control, a negative control with no antibiotics and coccidiosis (NC) and NC diets containing DDGS (10%), brewer’s yeast (0.5%), yeast cell wall (0.25%), a commercial product (0.2%) and the nucleotide product at 2 levels 0.025% and 0.05%. The addition of brewer’s yeast decreased (P < 0.05) BWG and resulted in the highest FCR compared with other treatments. Relative bursa and spleen weights were unaffected by dietary treatments. The addition of brewer’s yeast and yeast cell wall reduced crypt depth. Diet supplemented with the nucleotides had the highest villus height/crypt depth ratio (VCR), while diet supplemented with the yeast cell walls had the lowest VCR. Diets containing the nucleotide product increased the number of goblet cells in the ileum from 827 to 2016.

**Key Words:** DDGS, yeast products, gut morphology, goblet cells, broiler

Effects of ingredient composition on rate of passage in broiler chicks. S. J. Rochell*, T. J. Applegate, E. J. Kim, and W. A. Dozier, III1, 1Auburn University, Auburn, AL, 2Purdue University, West Lafayette, IN, 3USDA-ARS Poultry Research Unit, Mississippi State, MS.

This study examined the rate of passage in broiler chicks fed 4 diets varying in ingredient composition. Two hundred eighty-eight male Ross × Ross 708 chicks (12 birds per pen; 0.45 m² per bird) were randomly assigned to 24 pens (6 replicate pens per treatment) at 1 d of age. Experimental diets consisted of: 1) corn-soybean meal-based (CSM) diet containing bovine meat and bone meal (MBM) (5% inclusion), 2) CSM diet containing distillers dried grains with solubles (DDGS) (5% inclusion), 3) semi-purified (SP) diet containing MBM (40% inclusion), and 4) SP diet containing DDGS (76% inclusion). All diets were formulated to contain 20% CP and were adequate for Na, Ca, P, trace minerals, and vitamins. Birds received a common starter diet until 13 d of age and experimental treatments were provided from 14 to 18 d of age. On d 18, 4 identical diets containing titanium dioxide (0.5% inclusion) as an inert marker were provided for 2 h. All excreta were then collected every h for a 12 h period after birds were given access to the diets for 1 h. Cumulative excretion curves were determined for each pen using the Weibull model. From the total excretion curves, time of 1% titanium excretion (T1), 50% titanium excretion (T50), and mean retention time (MRT) were assessed. Faster (P ≤ 0.001) rate of passage was determined for broilers fed 2 SP diets when compared with the 2 CSM-based diets, as indicated by T1 (0.94 vs. 1.35 h), T50 (4.58 vs. 4.96 h), and MRT (5.31 vs. 5.60 h). Feeding broilers SP diets containing MBM had shorter (P ≤ 0.02) T1 and T50 than birds fed CSM diets containing MBM. Broilers fed SP diet with DDGS displayed shorter (P ≤ 0.02) T1, T50, and MRT than CSM diet formulated with DDGS. Broilers fed SP diet containing DDGS had shorter (P ≤ 0.04) T50 and MRT compared with the SP diet containing MBM. These data indicate that broilers fed SP diets had a faster rate of passage than birds provided practical diets, and ingredients in SP diets can influence rate of passage.

**Key Words:** rate of passage, ingredients, broilers

A comparison of nutrient digestibility in wheat distillers dried grains with solubles (DDGS) and 3 wheat DDGS fractions produced using a 2-step dry fractionation process for broilers. M. Oryschak*, D. Korver2, and E. Beltmanen3, 1Alberta Agriculture and Rural Development, Edmonton, AB, Canada, 2University of Alberta, Edmonton, AB, Canada.

High fiber content is believed to limit usefulness of wheat DDGS produced by Western Canadian ethanol plants as a protein feed for monogastrics. Reducing fiber content through fractionation may enhance the nutritive value of wheat DDGS for poultry. Several wheat DDGS
fractions (varying in fiber and protein content) were produced using a 2-step technique where DDGS were first separated by particle size and then by weight. Nutrient digestibility of wheat DDGS was then compared with that in 3 of the resulting wheat DDGS fractions. Ross 308 broilers (1-d old; n = 390) were distributed equally among 30 test cages and received a commercial starter diet for 14 d. On d 14 broilers were then offered ad libitum access to either a basal diet or one of 4 test diets (70% basal diet: 30% wheat DDGS or one of 3 wheat DDGS fractions), all of which included 0.5% chromic oxide as a marker. Each treatment appeared once per block for a randomized complete block design with 6 replicate cages per treatment. Excreta were collected for 24 h before all birds being sampled for ileal digesta on d 21. Excreta and digesta were pooled to produce a single specimen of each for each test cage. Diets, digesta and excreta were then analyzed for nutrient content and digestibility coefficients calculated for each. Apparent and standardized ileal digestibility coefficients for DM, CP and all AA did not differ among test ingredients. Our results suggest that the major benefit of dry fractionation of wheat DDGS is reducing the diluting effect of fiber thereby the concentration of protein. Given the range in fiber content among DDGS and the fractions tested, our data further suggest that factors other than fiber content affect nutrient digestibility of wheat DDGS for broilers.

Key Words: wheat DDGS, dry fractionation, nutrient digestibility, broiler

209 Bioassay of diverse feed ingredients for AME, TME, TMEn and their evaluation in broiler chicks. J. I. Sultan*, S. Minhas, A. Javavid, and H. Nawaz. University of Agriculture, Faisalabad, Faisalabad, Punjab, Pakistan,

One metabolic and one performance trial was simultaneously conducted. In metabolic trial, 60 6 adult White Leghorn cockerels were used to explore baseline information regarding apparent metabolizable energy (AME), true metabolizable energy (TME) and true metabolizable energy corrected for nitrogen (TMEn) for indigenous energy and protein sources and subsequently using same TMEn values on the performance of broilers. In performance trial, 480 d-old broiler chicks were divided into 3 groups and fed 3 isonitrogenous (20% CP) diets varying in energy i.e., low, (11.30 MJ/kg), medium (11.72MJ/kg) and high TMEn (12.13MJ/kg), formulated on the basis of TMEn determined in trial 1. Feed intake decreased (P < 0.01) linearly with increasing the level of TMEn. Weight gain in broilers fed medium high level of TMEn was higher (P < 0.01) than those fed low level of TMEn. Feed conversion ratio and dressing percentage were improved (P < 0.01) with increasing the dietary level of TMEn. Cost effective weight gain was attained in broilers fed medium TMEn.

Key Words: energy, protein sources, broiler chicks, AME, TME, TMEn

211 Nutrient digestibility in canola meal for broilers: Effects of oil extraction method and fractionation by air classification. M. Oryschak*1, D. Korver2, and E. Beltranena1,2, 1Alberta Agriculture and Rural Development, Edmonton, AB, Canada, 2University of Alberta, Edmonton, AB, Canada.

Fiber content of canola meal reduces AME content and may impair nutrient digestibility. Air classification may allow fiber to be removed from the meal, thereby potentially reducing antinutritional effects of fiber. Differences between expeller- and extruder-pressing of canola together with omitting the solvent extraction step may impact digestible nutrient and energy content in the resulting meal. The nutrient digestibility of a conventional, solvent-extracted canola meal (CM) was compared with that of 2 air classified CM fractions (AC1, AC2) and samples of expeller-pressed (EXP) and extruder-pressed CM (EXT). Ross 308 broilers (1-d old; n = 468) received a commercial starter diet until 14 d of age. On d 14 broilers were then offered ad libitum access to either a basal diet or one of 5 test diets (70% basal diet: 30% CM, AC1, AC2, EXP or EXT), all of which included 0.5% chromic oxide as a marker. Each treatment appeared once in each block for a randomized complete block design with 6 replicate cages per treatment. Excreta were collected for 24 h before all birds being sampled for ileal digesta on d 21. Excreta and digesta were pooled to produce a single specimen of each for each test cage. With the exception of LYS, AID and SID of AA was highest for CM. Digestibility of most AA was similar between CM and AC1. Coefficients for MET, THR, ILE, LEU, VAL and PHE were 6% lower for AC2 compared with CM. No differences in nutrient digestibility were observed between AC1 and AC2. Digestibility of most AA was between 10 to 15% higher in EXT compared with EXP. Digestibility of LYS was higher for EXT compared with CM, while coefficients for ARG, HIS, THR and TRP were similar between EXT and CM. In conclusion, air classification did not improve nutrient digestibility of conventional canola meal. Differences observed between the samples of expeller- and extruder-pressed canola meal suggest that different nutrient digestibility coefficients should be assumed for each when formulating diets for broilers.

Key Words: in vitro digestibility, AME prediction, broiler chick, wheat

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212 Nutrient digestibility of 4 varieties of triticale compared to that of Canadian Prairie Spring wheat for broilers. M. Oryschak*, D. Korver, and E. Beltman, 1Alberta Agriculture and Rural Development, Edmonton, AB, Canada, 2University of Alberta, Edmonton, AB, Canada.

Increasing pressure on global wheat supplies has negative implications for Western Canadian broiler production which uses wheat as its major energy source in diets. Triticale (x Triticosecale) is reported to have several agronomic advantages over wheat and similar nutritional value for poultry. Due to limited production in Western Canada, it is also less sought after than wheat by local ethanol producers. To compare the feeding value of triticale to that of wheat, nutrient digestibility of single samples of Bunker (BUN), Alta (ALT), Pronghorn (PRO) and Tyndal (TYN) varieties of triticale were compared with 2 random, mixed-source samples of Canadian Prairie Spring wheat (CPS1, CPS2). Ross 308 broilers (1-d old; n = 468) were distributed equally among 36 test cages and received a commercial starter diet for 14 d. On d 14 broilers were then offered ad libitum access to one of 6 test diets (8% premix, 92% test grain), all of which included 0.5% chromic oxide as a marker. Each treatment appeared once in each block for a randomized complete block design with 6 replicate cages per treatment. Excreta and digesta were pooled to produce a single specimen of each for each test cage. Diets, digesta and excreta were then analyzed for nutrient content and digestibility coefficients calculated for each. There were no differences in AA digestibility among the triticale samples, but AME was lower in BUN compared with the other triticale varieties. In contrast, digestibility of most AA and AME was higher for CPS2 compared with CPS1. Digestibility of AA was similar between all triticale varieties and CPS2. In conclusion, our data suggest that triticale has similar nutrient digestibility to Canadian Prairie Spring wheat and is a viable alternative feed grain for broilers.

Key Words: triticale, wheat, nutrient digestibility, broiler


A preliminary assessment of incorporating varying levels of Vernonia amygdalina leaf meal and a commercial symbiotic Biovet-YC on performance, serum enzymes, hematology and organ weights of broilers was undertaken in a trial lasting 6 weeks. One hundred and 50 chicks of Arbor acre strain were randomly assigned to 6 treatments comprising 25 birds per treatment and 5 birds per replicate. Diets containing Vernonia amygdalina leaf meal at 0, 2.5, 5.0, 7.5 and 10.0g/100g of feed and the sixth diet, Biovet-YC at 0.1/100g of feed were formulated. Routine antiviral vaccinations were administered on the birds but without any medication throughout the course of the trial. Feed intake and weight gain were significantly lowered by Vernonia amygdalina leaf meal inclusion in the feed. Values obtained for serum alkaline phosphatase (19.82, 21.40, 21.20, 21.05, 20.82 and 22.90 ug/L for birds on treatments 1, 2, 3, 4, 5 and 6 respectively) were significantly (P < 0.05) higher with increasing inclusion of test ingredient. The red blood cell counts and the weight of kidney were significantly (P < 0.05) higher for birds on treatment 5. Vernonia amygdalina leaf meal should be incorporated at lower levels below 2.5g/100g in broilers diet. The bioactive component of Vernonia amygdalina could be extracted, characterized and exploited for poultry production.

Key Words: Vernonia amygdalina leaf meal, serum indices, organ weight, symbiosis, haematology