

832 Effect of a targeted B-vitamin regimen on rate and efficiency of fast growing broilers from 0 to 49 days. M Coelho, W McKnight*, and B Cousins, *BASF Corporation*.

Nine thousand eight hundred, day old male Cobb X Cobb broilers were utilized in a 5x2 factorial design (10 replications/treatment) to determine the effects of five B-vitamins (riboflavin, pantothenic acid, niacin, B12 and folic acid) fortification levels (NRC, 2X, 4X, 8X and 16X NRC) and two levels of stress (low and moderate) on the performance of 0-49 day broilers. Diets were formulated to be isocaloric and isonitrogenous. The starter diet was fed in crumble form and the grower and finisher diets in pellet form. Across stress levels, broilers at 21 days had body weights of 645^e, 666^d, 693^c, 704^b and 715^a grams and corrected feed efficiency of 1.438^d, 1.410^c, 1.388^b, 1.376^{ab} and 1.371^a when supplemented with NRC, 2X, 4X, 8X and 16X NRC B-Vitamins, respectively. Carcass dry yield increased as vitamin supplementation increased (65.5^c, 66.3^{bc}, 66.7^{bc}, 67.5^{bc} and 68.5^a% for NRC, 2X, 4X, 8X and 16X NRC supplementation, respectively) and breast meat as percent of live weight also increased (16.12^d, 16.36^{cd}, 16.75^{bc}, 17.02^{ab} and 17.19^a% for NRC, 2X, 4X, 8X and 16X NRC supplementation, respectively). Fat pad as percent of live weight decreased with increased supplementation (13.08^d, 12.72^c, 12.55^{bc}, 12.31^{ab} and 12.17^a for NRC, 2X, 4X, 8X and 16X NRC supplementation, respectively). Under moderate stress, broilers fed 4X NRC had a \$0.17/bird advantage and 42X return over the NRC treatment birds. Broilers fed 16X NRC levels had a \$0.18/bird advantage and 10X (1000%) return over 2X NRC and \$0.13/bird advantage and 8X (800%) return over 4X NRC.

Key Words: Broilers, Vitamins, Performance

833 Impact of glutamine, Menhaden fish meal and spray-dried plasma on the growth performance and intestinal morphology of broilers. G.F. Yi*¹, G.L. Allee¹, J.W. Frank¹, J.D. Spencer¹, and K.J. Touchette¹, ¹*University of Missouri-Columbia*.

A 21-day trial was conducted to evaluate the effects of glutamine (GLN), Menhaden fish meal (MFM), and spray-dried plasma (SDP) on the growth performance and intestinal morphology of broilers. A total of 378 1-d-old male broilers were randomly allotted to one of nine treatments, with six replicate pens per trt and seven birds per pen. Trt 1 was a corn-soybean meal control diet. Trt 2 to 8 were 3%, 6%, or 9% MFM or 3%, 6%, or 9% SDP diets, and a 9% MFM + 3% SDP diet, respectively. Trt 9 was the control diet supplemented with 1% GLN. Body weight (BW), body weight gain (BWG), feed intake (FI) and gain:feed ratio (G:F) were used to evaluate the growth performance. At d 3, 7 and 14, villus height (VH), crypt depth (CD) and VH:CD ratio (CVR) of duodenum and jejunum were used to compare the intestinal morphology of broilers. Breast muscle weight and tibia ash was measured to evaluate the effects of MFM on breast muscle and tibia growth at d 21. From d 0 to 3, feeding 3% SDP improved the BW and BWG (P<0.05) compared to broilers on the control diet. During wk 1, feeding 3% SDP improved BW and BWG relative to all the other dietary treatments except the 6% MFM diet (P<0.05). At d 21, no significant differences were observed between BW, BWG, and FI among treatments (P>0.05). At d 3, feeding 9% MFM or 1% GLN tended to decrease CD of both the duodenum and jejunum compared to the birds fed the control diet (P<0.10). No significant differences between VCR of either duodenum or jejunum were observed at d 3, 7 or 14 after hatch (P>0.05). There were no significant differences between breast muscle weight and tibia ash among treatments at d 21 (P>0.05). These results suggest that additional research is needed to understand the role that these special ingredients may have in a prestarter diet for broilers.

Key Words: Broilers, Glutamine, Spray-dried plasma

834 Impact of glutamine, Menhaden fish meal and spray-dried plasma on the growth performance and intestinal morphology of turkey poults. G.F. Yi*¹, G.L. Allee¹, J.D. Spencer¹, J.W. Frank¹, and A.M. Gaines¹, ¹*University of Missouri-Columbia*.

A 21-day study was conducted to determine the effects of glutamine (GLN), Menhaden fish meal (MFM) and spray-dried plasma (SDP) on the growth performance and intestinal morphology of turkey poults. A total of 336 1-d male turkey poults were randomly allotted to one of

eight dietary treatments, with seven replicate pens per trt and six birds per pen. Trt 1 was a corn-soybean meal control diet. Trt 2 to 7 contained 3%, 6%, 9%, or 12% MFM, or 1.5% and 3% SDP, respectively. Trt 8 was the control diet supplemented with 1% GLN. Body weight (BW), body weight gain (BWG), feed intake (FI) and gain:feed ratio (G:F) were used to evaluate the growth performance. Villus height (VH), crypt depth (CD) and VH:CD ratio (VCR) of duodenum and jejunum were used to compare the intestinal morphology of birds at 7 and 21 days after hatch. From d 0 to 7, feeding 1% GLN improved the BW, BWG and G:F compared to birds fed the control diet (P≤0.05). Compared with the birds fed the control diet, the addition of MFM was 3% to 12% resulted in a linear increase (P<0.05) in BW, BWG, and G:F, and SDP addition from 1.5% to 3% resulted in a linear increase (P<0.05) in G:F. During wk 2, the addition of MFM resulted in a linear increase (P<0.05) in FI relative to birds on the control diet. From d 0 to 14, feeding 1% GLN improved the G:F relative to all the other dietary treatments except the 12% MFM diet (P<0.05). At d 21, there were no significant differences between BW, BWG, and FI among treatments (P>0.05). Compared with the control diet, feeding 1% GLN improved the G:F significantly (P<0.05). At d 7 or 21 after hatch, no significant differences were observed between the VH, CD, or VCR in the duodenum or jejunum among treatments (P>0.05). These results indicate that these special ingredients may have a beneficial role in prestarter diets for turkeys.

Key Words: Turkeys, Fish meal, Glutamine

835 Apparent ileal digestibility of amino acids in soybean meal, Menhaden fish meal, catfish meal and spray-dried plasma in young broilers. G.F. Yi*¹, G.L. Allee¹, H.J. Liu¹, J.W. Frank¹, and J.D. Spencer¹, ¹*University of Missouri-Columbia*.

This trial was conducted to determine the apparent ileal digestibility of amino acids (AA) in soybean meal (SBM), menhaden fish meal (MFM), catfish meal (CFM) and spray-dried plasma (SDP) in young broilers. A total of 120 21-day-old male broilers (809±20 g) were randomly allotted to one of the four dietary treatments with six replicate pens per trt and five birds per pen. All birds were fed similar diets prior to being fasted for 20 h. Birds were then refed semi-purified corn starch diets for 5 h, where SBM, MFM, CFM or SDP served as the only AA source. Chromium oxide (Cr₂O₃ at 0.1% of diet) was supplemented as the indigestible marker. After refeeding, all the birds were killed to collect ileal digesta (the ileum defined as the portion of the intestine extending from the Meckel's diverticulum to the ileo-cecal junction). The AA and Cr₂O₃ content of the experimental diets and ileal digesta were measured to calculate the apparent ileal AA digestibility. The results indicated that among those four tested AA source, SDP had the highest AA digestibility while CFM had the lowest Lys, Met+Cys, Thr, Trp, Leu, Ile, Val, Phe+Tyr, Arg, His, Gly, Ser, Asp, Glu, Pro, Ala, essential AA, non-essential AA, and total AA digestibility (P≤0.01). Compared with SBM, MFM had higher Cys+Met, Leu, Thr, Ile, Val, Gly, Pro, Ala, essential AA, and total AA digestibility (P≤0.01). This research shows that the AA digestibility of SDP for young broilers is higher than all other tested protein sources. Compared to SBM, MFM was found to have higher digestible AA for young broilers, while CFM was found to be inferior to SBM.

Key Words: Fish meal, Ileal AA digestibility, Spray-dried plasma

836 Evaluating potential value-added sorghums for the poultry industry. A Johnson*, J Fulton, J Akridge, and M Latour, *Purdue University, West Lafayette, Indiana, USA*.

Sorghum is considered in broiler feed formulations in the regions where broiler and sorghum production overlap. Nutritionists have noted sorghum's variability of crude protein and essential amino acids (CP-EAA) as problematic in poultry diets. The sorghum industry is seeking opportunities to develop specialty hybrids that meet the needs of the poultry industry and ensure a long-term customer. One possibility is to address the main concern of many nutritionists about sorghum by reducing the variation of CP-EAA. Other possibilities that could be coupled with this reduction in variation of CP-EAA include an increase in the concentration of lysine and an increase in the CP-EAA levels. The expectation is that all three enhanced sorghums would result in more efficient broiler production through less waste of feed nutrients. The

benefits these enhanced sorghums might bring to the broiler industry could also be displaced by technology. The use of Near Infrared (NIR) grain analyzers would allow the mixing of rations using the actual nutrient profile of the ingredients. This process is expected to reduce the amount of wasted nutrients. This study estimates the effects on feed expenditures for five alternative scenarios: a BASE scenario (simulation with currently available sorghums), a sorghum hybrid with a reduced variation in CP-EAA (RV), a sorghum hybrid with RV and enhanced lysine concentration, a sorghum hybrid with RV and higher levels of CP-EAA (HPRV), and the adoption of NIR technology. The impacts of the enhanced sorghum and technology scenarios are determined by comparing estimated feed expenditures to the BASE scenario. The simulation model incorporates a least-cost feed formulation, stochastic CP-EAA levels of feed ingredients, and a broiler growth model. The simulation was run for each scenario for five years. Annual prices paid by poultry producers were used. The HPRV scenario was the only one that was in the efficient set for all three of the efficiency criteria used. This indicates that a sorghum hybrid that has increased levels of CP-EAA coupled with a reduction in the variation of CP-EAA holds the most promise for the broiler industry in terms of feed expenditure efficiency.

Key Words: Poultry Nutrition, Value-Added Grain, Poultry Management

837 Effects of seed coat and plant color in sorghum on growth of broiler chicks. C. L. Jones^{*1}, J. D. Hancock¹, J. F. Pederson², C. W. Starkey¹, and D. J. Lee¹, ¹*Kansas State University, Manhattan, KS*, ²*USDA-ARS, Lincoln, NE*.

A total of 960 broiler chicks (1 d old) were used in a 14-d growth assay to determine the effects of seed coat (pericarp) and necrotic plant color on growth performance. Treatments in the experiment were sorghums with: 1) red pericarp/purple plant color; 2) red pericarp/tan plant color; 3) white pericarp/purple plant color; and 4) white pericarp/tan plant color. The 20 sorghum lines used in the experiment were 97% genetically identical except for those genes for pericarp and plant color. The sorghums were ground through a Prater Pulverizer[®] hammermill to a mean particle size of 600 microns and incorporated into diets with 1.2 % lysine, 1.1% Ca, and 0.5% available P. When the diets were fed to chicks, no differences were observed for ADG ($P > 0.36$) or ADFI ($P > 0.35$). As plant color was changed from purple to tan in the red pericarp sorghums there was little effect on gain/feed, but in the white sorghums, gain/feed tended to increase as plant color was changed from purple to tan (pericarp x plant color interaction, $P < 0.06$). In conclusion, pericarp and plant color did not affect ADG or ADFI of broiler chicks. But, there was a trend for improved gain/feed when white seed coat color was combined with tan plant color.

Item	Red/purple	Red/tan	White/purple	White/tan	SE
ADG, g	23.1	23.0	22.8	23.3	0.4
ADFI, g	32.6	32.7	32.9	32.2	0.5
Gain/feed, g/kg	709	703	693	724	9

Key Words: Sorghum, Food-quality, Chick

838 The effect of using different levels of tilapia by-product meal in broiler diets. L. E. Ponce and A. G. Gernat^{*}, *Escuela Agrícola Panamericana/Zamorano, Tegucgalpa, Honduras*.

The tilapia industry in Central America has grown significantly. Much waste is generated by the industry due to the fact that only the myomere muscles are removed (filleted) and commercialized. This portion constitutes approximately 36% of the entire fish, leaving the remaining 64% of the fish as waste lost during the various processing operations. This waste from the tilapia processing plant has the potential of being an alternative protein source in broiler rations. The objective of this study was to measure the effect of substituting different levels of tilapia by-product meal (TM) for soybean meal (SBM) in broiler diets. For the experiment 0, 10, 20, 30, 40, and 50% of the crude protein contributed by the SBM in broiler diets was substituted by crude protein from TM. The control and five levels of TM were used in a corn-soybean based diet and fed to chicks from 0-42 days. Chicks were identified and randomly allocated in a randomized complete block design. Body weight, cumulative feed consumption, feed conversion ratio, and mortality were determined on a weekly basis. At processing, carcass weights and yields were determined on a prechilled basis. Results show that the 10 and 20% TM group had significantly ($P \leq 0.05$) improved body weights from 14

to 28 d of age compared to the other treatments. No significant differences were found for the remaining 35 to 45 d body weights, cumulative feed consumptions, feed conversion ratios, mortalities, carcass weights or yields for any of the treatments. In conclusion, this particular TM can be used at levels up to 50% without negatively affecting bird performance or carcass quality.

Key Words: Tilapia, Tilapia by-product meal, Soybean meal

839 Nutritional value of wheat screenings for broiler chickens. G Audren^{*}, H Classen, and K Schwan, *University of Saskatchewan, Saskatoon, SK, Canada*.

Two trials were conducted to study the nutritional value of two wheat screening samples in broiler diets. Experiment 1 evaluated the chemical composition, energy, and amino acid digestibility of two wheat screening samples. Experiment 2 evaluated the performance of 1980 female broiler chickens, housed in straw litter pens, and fed different levels of the two wheat screening samples. In the latter study, the wheat screening samples replaced 0%, 25%, 50% and all of the wheat in diets fed to broilers. Each diet had 6 replications with 55 birds per replication. The metabolisable energy, protein content, and mean ileal amino acid digestibility were 3107 kcal/kg, 15.77%, 83.3%, and 3023 kcal/kg, 15.19%, 80.4% for the wheat screening samples 1 and 2, respectively. The samples contained 90.5% or 88.2% wheat and the major weed seed in both samples was wild buckwheat, which was 4.5% or 6.3% in samples 1 and 2, respectively. In the broiler feeding trial, no significant differences were found between the wheat diet and those containing wheat screenings with regards to growth, feed efficiency, and mortality. There were variations in the composition of wheat screening samples, however in this study, these variations did not significantly affect the performance of broiler chickens. Wheat screenings totally replaced wheat in balanced broiler diets without affecting performance.

Key Words: Broiler, Feed, Wheat Screenings

840 Use of cottonseed meal for broiler breeder pullets. N. M. Dale^{*}, J. L. Wilson, and A. J. Davis, *University of Georgia*.

The two major challenges facing producers of broiler breeder pullets are: 1) to prevent the accumulation of excess body weight, and 2) to maintain a reasonable degree of body weight uniformity in the flock. It is frequently difficult to maintain satisfactory flock uniformity while imposing the degree of feed restriction needed to maintain appropriate body weights during the rearing period especially when using soybean meal as the main dietary protein source. It is hypothesized that by using a less nutrient dense protein source, such as cottonseed meal (CSM), it may be feasible to restrict body weight gain in developing pullets without having to resort to extreme feed restriction. This should lead to improved flock uniformity. In a preliminary study, 8 replicates of 8 mixed sex Ross x Ross chicks were assigned to each of four dietary treatments: 1) a typical broiler starter diet, 2) a soy based pullet rearing diet, 3) a cottonseed meal (with added soapstock) based diet, formulated to the same nutrient specifications as #2, and 4) as #3, with soapstock-free CSM. After two weeks, body weights (relative to diet 1 were 75.1, 63.1, and 62.7%, respectively. Relative feed conversions were 131.5, 138.5, and 149.2%, respectively. These data confirm the potential of CSM in restricting growth. In a subsequent experiment, six hundred Cobb breeder pullets were reared to 2 weeks of age on a standard pullet starter diet. At this time, they were divided into two treatments of 300 pullets each and reared on pullet grower diets with either soybean meal (SBM) or cottonseed meal (CSM) as the major protein source. Feed was administered to both treatments so as to achieve the body weights recommended by the breeder. Pullets receiving the CSM diet gained less weight than those receiving the SBM feed, even though they consumed approximately 15% more feed than SBM controls. This led to an improvement in body weight uniformity.

Key Words: Broiler breeder pullets, Cottonseed meal

841 Comparison of broiler performance and carcass characteristics when fed B.t., parental control or commercial varieties of dehulled soybean meal. C.A. Kan*¹, H.A.J. Versteegh¹, T.G. Uijttenboogaart¹, H.G.M. Reimert¹, and G.F. Hartnell², ¹ID-Lelystad, P.O. Box 65, 8200 AB Lelystad, The Netherlands, ²Monsanto Company, 800 N Lindbergh Blvd, St. Louis MO 63617.

The nutritional value of diets containing solvent extracted dehulled soybean meal from (transgenic) B.t. soybeans and soybean meal from control and commercial lines of soybeans—all comparably processed—on broiler performance was evaluated and effect on carcass yield and body composition assessed. The following soybeans were included in the study: a non-transgenic soybean parental control line (A3237), two test lines (726 and 781) and seven commercial varieties (A1900, A2069, A2247, A2869, A3244, A4341 and A4922). The study lasted for 41 days and each treatment group consisted of ten replicate pens (5 with males and 5 with females) starting with 12 broilers and culled to 9 broilers per pen at 13 days. Day old sexed commercial Ross 508 broilers were used and bodyweight and feed intake were measured per pen at 41 days. At 42 days 4 broilers per pen were slaughtered and yields were determined. The carcasses were dissected later and cut-up yields of the valuable parts determined. Dry matter, protein and fat contents of breastmeat were determined on the excised material. Birds performed exceptionally well with body weights and feed conversion averaging over 2400 g and less than 1.60, respectively, at day 41. The data were analysed by an ANOVA procedure. There were no significant treatment x sex interactions. The effect of sex was (as could be expected) significant for some traits. All performance (final weight, feed conversion), carcass yield (weight, slaughter, evisceration, breastmeat, thigh, drumsticks, wings, remaining yields) and breastmeat composition (dry matter, protein and fat) measurements of broilers fed B.t. soybean meal were comparable ($P > 0.05$) to those fed their respective controls and the population fed commercial soybean meals. B.t. soybean meal is substantially equivalent to non-B.t. soybean in nutritional value.

Key Words: Soybean Meal, Nutritive Value, Broiler Body Composition

842 Evaluation of identity preserved soybean meal and amino acid density in broilers. R A. Swick*¹ and K. Huang², ¹American Soybean Association, Singapore, ²Gold Coin Services, Singapore.

A broiler study was conducted in Malaysia to compare performance of broilers fed diets containing identity preserved (IP) U.S. soybean meal (SBM) or commercially available (CA) SBM obtained from a local feed mill. Each meal was incorporated into diets containing 90%, 100% and 110% of NRC recommended minimums for amino acids (constant energy) resulting in a 2 x 3 factorial arrangement of treatments. Equal numbers of feather sexed Cobb 500 broilers were grown in 48 slatted floor pens (70 per pen) for an initial total of 3,360 birds. Analytical results of the SBM for CP (Kjeldahl), CF, DM, lys, met, thr, available lys, urease, protein dispersibility index, protein solubility in 0.2% KOH and initial predicted ME(n) were: IP- 49.8, 2.49, 88.3, 3.07, .72, 1.92, 2.86, .02, 28.7, 77.8, 2513; CA- 48.2, 2.01, 89.1, 2.96, .67, 1.88, 2.73, .02, 28.0, 76.4, 2506 respectively. Starter, grower and finisher diets were least cost formulated based on the nutrient values analyzed and prevailing local market prices for corn, corn gluten meal, meat and bone meal, SBM, palm oil, D,L-methionine, L-lysine HCL, L-threonine, vitamins and minerals. At 49 days, no differences were detected in performance of birds fed the different soybean meals ($P > .05$). Feed cost and feed cost per kg liveweight however, were less with the IP meal because of its higher nutrient levels. For amino acid density (across soybean meal sources), body weight (g) and feed conversion were: 90%: 2.228^a, 2.042^a; 100%: 2.443^a, 1.955^b; 110%: 2.465^a, 1.950^b. No SBM by amino acid density interactions were detected ($P > .05$). In conclusion, the results show that commercial diets should be formulated based on analyzed nutrient levels of SBM and that cost-performance should be considered before formulating with higher than recommended amino acid levels.

Key Words: Soybean meal, Identity preservation, Amino acids

843 Chemical analysis and feeding value of heat damaged soybean meal. Budi Tangendjaja*¹ and Robert A. Swick², ¹Research Institute for Animal Production, Bogor, Indonesia, ²American Soybean Association, Singapore.

An evaluation of soybean meals (SBM) collected from a heat damaged commercial shipment to Indonesia was conducted. Three distinct samples with colors of dark, tan and normal from the damaged shipment were compared to two other samples from a different shipment considered to be undamaged and of acceptable quality. SBM samples were analyzed chemically for proximate, protein solubility in 0.2% KOH (KOHPS), protein dispersibility index (PDI), urease activity, amino acids and available lysine (AL). Each SBM was incorporated into the same starter diet formulation and fed to broilers in battery cages from 0 to 3 weeks of age. There were 7 birds per cage and 7 cages per replicate with a completely randomized arrangement of treatments. Data was subjected to statistical analysis using the MSU-Stat program. SBM samples did not differ in proximate composition but KOHPS and PDI decreased as color became darker, from 75.4 to 72.3% and from 21.8 to 15.3% respectively. PDI was more affected by heat damage than was KOHPS. The darkest SBM was lowest in total lysine and threonine compared to undamaged SBM. Birds fed diets containing the darkest SBM had 15% less body weight (524 vs. 617g; $P < .05$) and 10% poorer feed:gain ratio (1.602 vs. 1.451; $P < .05$) after three weeks compared to those fed undamaged SBM. Feed:gain ratio was negatively correlated to total lysine (-.99) and AL (-.97). KOHPS and PDI were less strongly correlated to bird performance. In conclusion, feeding value of soybean meal is impaired by heat damage resulting in darkened color. Available lysine and PDI are useful measures of damage in commercial SBM samples.

Key Words: Soybean Meal, Broilers, Protein Dispersibility Index

844 Effect of storage time on the quality of different sources of soybean meal. B. Tangendjaja*¹, E. Wina¹, and R. A. Swick², ¹Research Institute for Animal Production, Bogor, Indonesia, ²American Soybean Association, Singapore.

An experiment was conducted to measure changes in quality of different sources of soybean meal (SBM) stored under tropical conditions. Samples of U.S. dehulled (USD), Brazilian dehulled (BD) and Brazilian non-dehulled (BND) SBM were collected and divided into 6 sealed polyethylene bags each containing 10 kg. One sample of each meal was stored in a warehouse under ambient conditions (ave 27° C and 60-85% RH) and the remaining five were stored in a freezer at -30° C. Each month one bag of each SBM was taken out of the freezer and allowed to be stored in the warehouse. At end of the 5 month period, the SBMs were analyzed for moisture, protein, fat, urease activity (UA), protein dispersibility index (PDI), protein solubility in 0.2% KOH (KOHPS), amino acids, digestible amino acids predicted by NIR, available lysine and 3 week broiler performance. PDI value decreased from 24-30% to 16-25% during 5 months storage but KOH PS did not change significantly. Moisture content increased slightly during storage but protein and fat did not. Total amino acids did not change during storage but digestible lysine predicted by NIR decreased at an average rate of -.019% per month. Individual decreases were: USD -.016%, BD -.025%, BND -.017% NIR digestible lysine per month. No differences in available lysine were detected. UA increased slightly during the 5 month period from 0.10-0.15 to 0.21-0.28 pH unit change. Each SBM sample was incorporated into a balanced diet and fed to 3 replicates of 7 birds per battery cage from 0 to 21 days. Body weight was not affected ($P > .05$) but feed:gain was negatively affected from 1.47 at time zero to 1.52 after five months storage under warm and humid conditions ($P < .05$). In conclusion, SBM quality decreases measurably during storage under tropical conditions. PDI and NIR digestible lysine are useful indicators of these changes.

Key Words: Soybean meal, Protein dispersibility index, Storage

845 Effect of heating solvent extracted soybean in the presence of cysteine or sulfite on ileal true digestibility of protein in broiler chicks. E.L. Miller*, Y.X. Huang, O.C. Fabb, B. Rayner, and S. Kasinathan, Department of Clinical Veterinary Medicine, University of Cambridge.

The objective was to test whether the previously demonstrated effect of cysteine (C) or sulfite (S) in increasing reactive SH and reducing the

heating time needed to reduce trypsin inhibitor (TI) content of soybean resulted in improved ileal true digestibility (TD) of protein. Petroleum spirit-extracted dehulled soybean (TI 58.4 mg/g DM) was adjusted to 780 g/kg DM and heated alone or with either sodium metabisulphite (11.8 g/kg DM) or cysteine (15 g/kg DM) for 25, 35, 55 or 75 minutes at 95°C. Reactive SH, determined by reaction with 4-vinyl pyridine and HPLC separation, was increased by C and S and decreased with heating time. Heating decreased TI 3.9 times faster in the presence of S but not of C. Each of these 12 preparations was included as the sole source of protein in diets formulated for chicks to provide 150, 200 or 250 g CP/kg diet. A diet with enzyme hydrolysed casein plus amino acids (E) as the sole source of protein at 200 g CP/kg diet was used to measure endogenous loss. Chromic oxide was the marker. The diets were offered to 3 cages of 3 chicks (E to 9 cages) ad libitum for 3 days (8 to 10 d of age). Food was removed overnight on day 10 and each cage was fed at timed

intervals ad libitum on day 11 for 4 hours before euthanasia with pentobarbitone sodium given intra peritoneum. TD was calculated as 1-slope of the regression of ileal N per g diet on diet N per g diet using diet E as a zero test dietary N level together with the 3 levels of each test material. TD (mean SEM) soybean alone 0.670.029, 0.780.037, 0.790.026, 0.870.009; +C 0.720.028, 0.860.023, 0.870.014, 0.860.018; +S 0.880.021, 0.890.014, 0.890.013, 0.880.010 at 25, 35, 55, 75 minutes respectively. TD of soybean alone increased with heating time to 75 minutes. The same maximum TD was achieved in 35 minutes with added C and in 25 minutes with added S. The TD achieved with added S was slightly but not significantly greater than the maximum achieved on heating soybean alone (difference 0.0250.0160, *t* 1.56).

Key Words: Ileal digestibility, Sulphite, Heat

AMSA Updates Session

846 Korean Pork 101. D.E. Burson^{*1}, D.B. Griffin², and W.N. Osburn³, ¹University of Nebraska, ²Texas A&M University, ³Michigan State University.

The changing economy and society in Korea combined with market liberalization is changing the Korean meat industry. Western style retailing is being adapted in Korea and has created a need for training. Therefore, the U.S. Meat Export Federation has established the Meat Education and Research Center (MERC) in Seoul, Korea to train butchers and meat retailers in the latest meat merchandising techniques. The National Pork Producers Council, the US Meat Export Federation, Korea, and meat scientists from the University of Nebraska, Texas A&M University and Michigan State University developed a train the trainer program, Korean Pork 101, for MERC instructors. Korean Pork 101 was designed to provide up to date information on pork quality, consistency and value. The course included topics of teaching and workshop methods, an overview of pork production in the U.S., pork quality, meat distribution and shelf life, fabrication value and merchandising, pork specifications, carcass fabrication and pork safety. The three day workshop was conducted with a series of lectures and discussion during an afternoon session and a laboratory demonstration in the evening. Approximately thirty instructors were trained and evaluations indicated that the program was valuable.

Key Words: pork, training, Korea

847 Advanced HACCP course update. N.G. Marriott^{*1}, ¹Virginia Polytechnic Institute & State University.

Since January 25, 2000 all inspected meat and poultry plants are required to have a food safety preventive program known as Hazard Anal-

ysis and Critical Control Points (HACCP). The American Meat Science Association (AMSA) and various professional members have been instrumental in the development of educational material, especially short courses, that has assisted the meat and poultry industry with the implementation of this food safety program. Regulatory requirements of HACCP plan assessment with an emphasis on verification and validation has been attributable to the International HACCP Alliance interest in the accreditation of an advanced HACCP course that will emphasize instruction about verification and HACCP plan validation. During 2000, the AMSA Continuing Education Committee accepted the challenge of the development of an advanced HACCP course to be accredited by the International HACCP Alliance. It was agreed that the content of this course would be developed by AMSA members. The AMSA Continuing Education Committee agreed upon a course content outline and one or more scientists for the development of this 2-day short course. It was decided that the course would be developed as PowerPoint presentations with appropriate handouts and supplementary materials that would be peer reviewed before the AMSA Continuing Education Committee would obtain accreditation from the International HACCP Alliance. The course content will become the property of the American Meat Science Association but available for members' use to present as a short course to the industry. More information about the course content will be discussed. Furthermore, a progress update of material development, peer review, accreditation by the International HACCP Alliance, and material availability to the American Meat Science Association membership will be provided.

Key Words: HACCP, AMSA, Course

Symposium on Concentrated Animal Feeding Operations Regarding Animal Behavior, Care, and Well Being

848 Physiological indicators of stress in domestic livestock. Donald C. Lay Jr.^{*}, *Livestock Behavior Research Unit, Agricultural Research Service-USDA, West Lafayette, IN.*

As with most mammals, domestic livestock will experience varying degrees of both psychological and physiological stress at some time during their life. The objective quantification of these stressful states and application of appropriate measures to limit excessive exposures to stressors is imperative. Proper management of an animal's exposure to stressors will maximize animal well-being and can have beneficial effects on animal production. Although scientists have recognized the deleterious effects of stress for more than 70 years, debates and questions on physiologically assessing its presence in humans and other animals continues to challenge researchers today. Because stress can be defined simply as any physiological change from homeostasis, traditional physiological measurements have relied on quantifying these alterations to homeostasis, such as deviations in heart rate, respiration rate, body temperature, and hormone concentrations. These measurements are still highly relied upon today. It is also well recognized that when these common alterations in baseline homeostatic mechanisms are dramatically altered, an organism's life strategies such as growth, disease resistance, and reproduction can be affected. Therefore, a great deal of research has concentrated on quantifying physiological alterations in these systems, such as

changes in growth and reproductive hormones, changes in populations of lymphocytes, and (or) outward signs of failure of these systems, such as low growth rates, infertility, and an increased number of diseased animals. An area of importance that has been relatively inaccessible are those changes that occur in the central nervous system. Because stress is commonly composed of both a physiological and psychological component, how the animal perceives the stress is critical to assessing its well-being. Physiological measures used thus far to assess the mental response to stress include neuronal activity and measurement of neurotransmitters. Scientists have done a good job of measuring all of these physiological alterations, unfortunately the underlying challenge that continues to confront scientists is how to define the degree of physiological change that translates into distress for the animal.

Key Words: Stress, Livestock, Well-being

849 Influence of stress on composition and quality of meat, poultry, and meat products. E. P. Berg^{*}, *University of Missouri.*

Stress experienced by meat-producing animals prior to slaughter not only influences lean and fat deposition, but also the physicochemical components involved in conversion of muscle to meat. Stressors that