

807 Response of cows and calves to gradient levels of a supplemented modified glucomannan when grazing tall fescue. D. G. Ely^{*1}, D. K. Aaron¹, J. Wyles¹, and V. Akay², ¹University of Kentucky, Lexington, ²Alltech, Inc..

Eighty-four Angus x Beefmaster cow/calf pairs were randomly allotted to eight, 10.5-ha, endophyte-infected (>90%) tall fescue pastures on May 6. The objective was to determine production responses to a daily supplement of 0, 10, 20, or 40g FEB-200(tm) (modified glucomannan, Alltech, Inc., Nicholasville, KY) carried in 0.45 kg/hd ground shelled corn (group-fed) until calves were weaned on October 28. Cows averaged 5.4 yr, 500 kg, and 5.6 body condition score (BCS) on May 6. Initially, calves averaged 109 kg at 74 d of age. Interim weights, BCS, and rectal temperatures of cows and weights of calves were taken at 35-d intervals. Cows in 0, 10, 20, and 40 g treatments lost 12, 16, 10, and 4 kg/hd (Linear, $P < 0.10$), respectively, from May 6 to July 15, but gained 44, 36, 49, and 52 kg/hd from July 15 to October 28. Total gain (May 6 to October 28) increased linearly ($P < 0.01$) as level of supplementation increased. Period BCS changes were nonsignificant, but overall BCS (May 6 to October 28) increased linearly ($P = 0.06$) as level of FEB increased. Rectal temperature change from May 6 to October 28 was greatest for 0 and least for 40 g FEBhd⁻¹d⁻¹ (Linear, $P < 0.01$). Calf gains were 63, 56, 57, and 65 (Quadratic, $P < 0.10$) from May 6 to July 15 and 98, 91, 92, and 99 kg/hd (NS) from July 15 to October 28. Overall calf gain response was quadratic ($P = 0.07$). Tympanic temperatures, monitored at 30-min intervals from July 21 through 24 in two pre-designated cows per pasture, were 38.5, 38.2, 38.6, and 38.4 °C (Cubic, $P = 0.08$) for 0, 10, 20, and 40 g FEB. Temperatures of the same cows, measured from August 22 through 25, were 38.7, 38.2, 38.3, and 38.4 °C (Quadratic, $P < 0.05$). These results demonstrate weight gains of cow/calf pairs grazing endophyte-infected fescue can be increased by supplementing with 40 g FEBhd⁻¹d⁻¹ even though body temperatures are not decreased.

Key Words: Fescue, Production, Cows

808 Birth season, preweaning stocking rates and sex effects on birth-to-harvest growth and carcass composition of Simmental-sired calves. F. M. Rouquette^{*1}, G. Estefan², J. W. Turner², and D. P. Hutcheson³, ¹Texas Agricultural Experiment Station, Overton, ²Texas A&M University, College Station, ³Texas Agricultural Experiment Station, Amarillo.

Growth and carcass data were collected during a 5-year period from 375 fall-born and 160 winter-born $\frac{1}{2}$ Simmental x Hereford x Brahman calves reared at TAMU-Overton to quantify effects of birth season (fall vs. winter), preweaning stocking rates, sex of calf, backgrounding method and feedlot performance on calf performance from birth-to-harvest and carcass characteristics. Calves were grazed at 3 levels of forage mass (stocking rates, SR) preweaning and then sent directly to feedlot or backgrounded on either bermudagrass or rye-ryegrass pasture before entering the feedlot. All calves were fed in Pinpointers at TAMU-Amarillo prior to being harvested at a commercial packing facility. Fall-born calves grazed on low SR weaned heaviest, 305 kg, and winter-born calves grazed on high SR weaned lightest at 216 kg ($P < .05$). Differences in weaning weights between steers and heifers were greater

for fall-born (291 vs. 278 kg) than for winter-born calves (251 vs. 244 kg). Calves grazed at high SR pre-weaning exhibited compensatory gains during the stocker, backgrounding phase ($P < .01$); however feedlot ADG, gain:feed, average daily intake, and final weight of calves were not affected by preweaning SR. At termination of the backgrounding phase, winter-born calves entered the feedlot heavier (424 vs. 334 kg) and older (16 vs. 12 mos) than fall-born calves ($P < .01$). Cattle were harvested at a relatively uniform, visual backfat and thus, no major differences in carcass traits were detected due to pre-or post-weaning management. When finished to a visual backfat of $>.76$ and <1.27 cm, 65% of cattle graded USDA Select with an average USDA Yield Grade of 1.9. This sire-dam combination resulted in good growth rate of calves with high cutability and lean carcasses.

Key Words: Pasture, Stocking Rate, Cow-Calf

809 Performance of early-weaned calves grazing Tifton 85 bermudagrass and receiving three levels of supplemental concentrate. J. M. B. Vendramini^{*1,2}, L. E. Sollenberger¹, J. D. Arthington², J. B. Dubeux, Jr.¹, and S. M. Interrante¹, ¹Department of Agronomy, University of Florida, Gainesville, ²Range Cattle Research and Education Center, University of Florida, Ona.

Early weaning of calves may increase pregnancy rates of primiparous beef cows, however, there is a relatively little information on nutritional management of the early-weaned calf. The objective of this study was to evaluate the performance of early-weaned calves grazing Tifton 85 bermudagrass (*Cynodon* sp.) pastures and receiving three levels of concentrate. Calves were weaned on 6 Jan. 2003 at an average age of 84 d. They grazed annual ryegrass (*Lolium multiflorum*)-rye (*Secale cereale*) mixtures pastures until 14 May 2003, when they were moved to experimental pastures where they remained until 13 Aug. 2003. Three levels of supplementation (1.0, 1.5, and 2.0% BW; 14 and 72% CP and TDN, respectively) were evaluated in a completely randomized design. Experimental units were 0.15-ha pastures, each divided into three paddocks for rotational stocking (7-d grazing and 14-d rest period). Two calves were assigned as testers to each pasture, and additional animals were used to maintain a similar herbage allowance. Every 21 d, calves were weighed and grazing time during daylight was recorded. Herbage mass was measured every 21 d using the disk plate meter methodology. Hand-plucked samples were collected every 21 days and were analyzed for CP and in vitro OM digestibility. Calf ADG (0.54-0.72 kg), stocking rate (10.6-14.2 AU/ha) (AU = 500kg LW), and gain per hectare (1100-1780 kg) increased linearly ($P < 0.10$) as supplementation rate increased. There was no variation ($P > 0.10$) in forage CP and in vitro OM digestibility among treatments but there was a linear decrease ($P < 0.01$) in herbage allowance as supplementation rate increased. Average grazing time decreased linearly ($P < 0.05$) from 274 to 206 min/d as supplementation rate increased from 1.0 to 2.0%. Based on our initial studies, increasing the amount of supplement fed to early-weaned calves increases animal performance and pasture stocking rate, but the economics of its use depend upon supplement cost and calf prices.

Key Words: Calves, Tifton 85, Supplement

PSA-Nutrition: Amino Acids

810 Comparison of methionine sources based on an equimolar trial design with broiler chickens in Brazil. S. Vieira¹, D. Hoehler^{*2}, A. Lemme², A. Kessler¹, S. Pophal¹, A. Ebert¹, and G. Eichner¹, ¹Federal University of Rio Grande del Sul, Brazil, ²Degussa Corporation, Kennesaw, GA.

Methionine is the first limiting amino acid in commercial poultry diets and is commonly supplemented as DL-methionine (DL-Met, 99%) or liquid DL-methionine hydroxy analog-free acid (MHA-FA, containing 88% of active substance). Some controversy still exists about the proper trial design and statistics which should be applied in trials comparing the two sources. In the present trial, 2730 male day-old Ross 308 broilers were fed a commercial starter diet until day 6. From day 7 to 40, chicks

were assigned to 13 dietary treatments housed in floor pens receiving corn/soybean-based diets supplemented with DL-Met (0.030 / 0.06 / 0.10 / 0.14 / 0.19 / 0.24%) or equimolar levels of liquid MHA-FA (0.034 / 0.068 / 0.114 / 0.159 / 0.216 / 0.273%) in the starter (day 7-21) and grower (day 22-40) period. Basal diets were formulated to be deficient in Met but adequate in all other nutrients and energy. Each dietary treatment consisted of 6 replicates with 35 birds per pen. Broilers performed well, maximum responses of weight gain, feed conversion, and breast meat yield (% of carcass) were significantly improved by about 10% to maximum responses of 2417 g, 1.613, and 28.5%, respectively. Responses showed the Met deficiency of the basal diets. Exponential regression revealed a relative effectiveness on equimolar basis of liquid MHA-FA for weight gain, feed conversion, and breast meat yield from

7 to 40 days of age of 59% (significant), 93% (not significant), and 64% (significant), respectively. These figures correspond to relative effectiveness figures of liquid MHA-FA on a weight/weight basis of 52%, 82% and 56%, respectively. The present data agree with numerous recent data as well as with an extensive recent literature survey for broilers, which resulted in a recommended relative bioefficacy figure of 67.8% on a weight/weight basis for liquid MHA-FA for performance criteria in broiler chickens. The data also demonstrate that the trial design - weight/weight or equimolar comparison of the two methionine sources - does not affect the validity of the test.

Key Words: Broilers, Amino Acids, Methionine Sources

811 Very young turkeys utilize 2-hydroxy-4-(methylthio) butanoic acid (HMTBA) effectively as a methionine (M) source. R. Gonzalez-Esquerria, M. Vazquez-Añon, T. Hampton, T. W. York, C. W. Wuelling, and C. D. Knight, *Novus International, Inc., St. Charles, MO.*

The relative efficacy of an 88% aqueous solution of HMTBA (Alimet feed supplement, Novus International, Inc.) vs. d, l-methionine (DLM; dry 99%) as a M source was estimated in very young turkeys using a 2 x 4 factorial with a basal treatment design. A basal sorghum/soy diet deficient in M but adequate in all other nutrients was added HMTBA or DLM at various equimolar levels (0.00, 0.05, 0.10, 0.15 and 0.20 %). Each diet was fed to 8 cages of 12 BUT toms from 1 to 21 days of age. Performance was measured at 7, 14 and 21d of age. A positive response to added M source on body weight gain (BWG) and feed conversion was observed for all ages ($P < 0.01$) proving the basal diet was deficient in M. Changes in BWG closely followed those in feed intake. Performance parameters were not different between M sources at any level ($P > 0.1$). To estimate the relative efficacy of HMTBA vs DLM, BWG per data were plotted versus supplemented M intake or M level using linear regression (LIN) or fitting separate exponential curves for each source of M (EXPI). The goodness of fit of each model was tested using the Schwarz Bayesian (BIC) and the Akaike (AIC) Information Criteria. Better goodness of fit was obtained by using M intake rather than M level at all ages and for both LIN and EXPI models. Relative efficacy obtained by using M intake was 113 ± 24 , 94 ± 17 , and $99 \pm 18\%$ for LIN, and from 113 to 114%, 93 to 94%, and 99 to 100 % for EXPI for toms at 7, 14 and 21d, respectively. An improvement in the goodness of fit was obtained when using LIN rather than EXPI. It is concluded that statistically and biologically the appropriate model for testing bioefficacy should include M intake as the independent variable and not M levels. For the current data, LIN is more appropriate than using EXPI. The confidence intervals for all estimates of relative efficacy included 100% thus HMTBA is equivalent to DLM as a source of M for very young turkeys fed commercial type diets.

Key Words: 2-hydroxy-4-methylthio Butanoic Acid, Methionine, Turkeys

812 The methionine requirements of chicks and hens fed corn and peanut meal or soybean meal based diets. G. M. Pesti*, R. I. Bakalli, and J. P. Driver, *The University of Georgia, Athens.*

Dietary arginine is a known methionine antagonist. Peanut meal (PNM) is higher in arginine than soybean meal (SBM). We hypothesized that chickens fed corn and peanut meal based diets would have higher methionine (MET), or rather methionine plus cystine (TSAA) requirements than those fed corn and SBM based diets. Two identical experiments were conducted with starting broiler chicks in battery brooders to compare the Met requirements when corn and PNM or corn and SBM based diets were fed. The data presented are pooled from both experiments. Chicks fed the corn-SBM based diet performed better than those fed the corn-PNM based diet. Further, chicks fed the most deficient corn-SBM diet (0.72% TSAA) gained 503 g/16 days, compared to 639 g when the highest levels of TSAA were fed while chicks fed the most deficient corn-PNM diet (0.61% TSAA) gained 193 g/16 days, compared to 610 g when the highest levels of TSAA were fed. The results showed that chicks require approximately 0.82% TSAA regardless of the protein source fed. A six-week experiment was conducted with Leghorn hens housed 2 per cage with 4 cages per replicate and 4 replicates per treatment. Feed consumption and egg production were very similar for PNM and SBM fed hens; PNM, (84.0 ± 0.6 HDEP); SBM, (86.2 ± 0.5 HDEP). The best overall performance was by hens fed PNM with 0.15% added Met (89.5 ± 1.0

HDEP). Significant effects of Met supplementation were noted for production, egg weight and % shell. There were no significant TSAA level by protein source interactions, and the requirement was found to be $< 0.63\%$ TSAA for hens consuming 117g feed/day. Significant differences between PNM and SBM were noted for % shell, egg specific gravity and body weight change. The egg specific gravity and % shell results indicate that more study is needed on the Ca and P contents and availabilities of PNM. Reduced body weight gains from the PNM fed hens suggests that we overestimated the energy content of our PNM sample. Our hypothesis was proved incorrect: chickens fed corn-PNM based diets need the same amount of Met as chickens fed corn-SBM based diets, nothing extra.

Key Words: Methionine, Peanut Meal, Broiler

813 The response of broilers to feeds limiting in threonine in the period 7 to 21 days of age. R. M. Gous¹, S. Van Cauwenbergh², C. Relandeau², and D. J. Burnham^{*3}, ¹University of KwaZulu-Natal, Pietermaritzburg, Natal, South Africa, ²Ajinomoto Eurolysine SAS, Paris, France, ³Ajinomoto Heartland LLC, Chicago, IL.

Two trials were conducted to measure the response of starting broilers to digestible threonine (THR). In each, a summit dilution technique was used to measure the response in protein gain and feed intake to a range of feeds limiting in THR. In all studies, three dilution series were used: the first, in each case, was designed to measure the response to digestible THR. In both trials, oil was added to each feed in the second dilution series, to ascertain whether an additional response could be obtained, particularly at the highest protein contents. In the third series in trial 1, synthetic THR was added to each diet in the series, thereby producing a more balanced protein series, where the ratio between THR and protein was higher than in the original series. This was a means of testing whether THR was the first limiting amino acid in the original dilution series. In the second trial, synthetic lysine (LYS) was added to the feeds in the third dilution series in place of THR. The results of this series would provide information on the response to diets differing in their LYS: THR ratio. The responses to THR in all five series in which THR was first limiting was similar, confirming that the addition of oil as an energy source, and L-lysine HCl as a source of lysine, had no influence on the response to dietary THR. By fitting the Reading Model to the data the coefficient of response was 55.08 mg THR/g protein gain when the three series in Trial 2 were combined, and 57.89 when all five series (Trials 1 and 2) were combined. The contents of THR in the body and feathers are about the same, i.e. 44g THR/kg protein, so it is not necessary to separate the body and feather protein when determining the response in protein gain to dietary THR. The coefficient of response obtained suggests that dietary THR was being utilised at an efficiency of $44/55.08 = 79.9\%$ in Trial 2. When the two trials were combined, the efficiency was 76.01%. The coefficient of response obtained by fitting the Reading Model to the data is of value both in estimating the amount of digestible THR required /g protein gain, as well as the efficiency of utilisation of THR during that stage of growth

Key Words: Threonine, Broiler, Amino Acids

814 Impact of L-threonine supplementation in reduced protein diets for broilers. C. Relandeau¹, L. Le Bellego^{*1}, J. Bartelt², F. Hutterer², R. Khidr³, and R. Leitgeb⁴, ¹Ajinomoto Eurolysine S.A.S., Paris, France, ²LAH, Cuxhaven, Germany, ³Desert Research Centre, Mataria, Egypt, ⁴University of Bodenkultur, Vienna, Austria.

A conventional diet was compared to diets with a lower content of protein and different levels of L-threonine. A total of 293 Ross 308 broiler chicks were allocated to 4 treatments with respective 4 pens each as replicates. Birds were fed a starter diet from day 0 to 21 and a grower diet until day 36. The protein level in the diets of treatment (T) 1 was 210 and 200 g/kg in the starter and grower feed, respectively and 10 g/kg lower in the diets of T2, T3 and T4. Threonine contents in T1 were 7.8 and 7.4 g/kg in the starter and grower diets, respectively. L-threonine supplementation was 0, 0.4 and 0.6 g/kg, in T1, T2, T3 and T4, respectively, so that total lysine:threonine ratio amounted 100:65, 62, 65 and 70, respectively. All other nutrient contents were equal in all diets. Growth performance was recorded per pen and slaughter performance individually on all birds. 7 chickens died. Protein and fat contents in carcasses were analysed on 12 birds per treatment. Live

weight at the end of growth period was 1956, 1870, 1958 and 1970 g in T1, T2, T3 and T4, respectively. Feed conversion ratio during the experimental period was higher in T2 than in T1, T3 and T4 (2.05, 1.90, 1.90 and 1.95, respectively, $P < 0.05$). Carcass weight in T3 was higher than in T2 (1568 and 1488 g, respectively, $P < 0.05$). Breast meat weights in T3 and T1 were also higher than in T2 (361, 362 and 324 g, respectively, $P < 0.05$). The chemical composition of the carcasses was not significantly influenced by the treatments. Supplementation with 0.04% L-threonine to diets with 10 g/kg lower content of crude protein improved growth and slaughter performance of broilers up to the level of T1. A lysine:threonine ratio of 100:65 was found to be optimal for growth parameters and breast meat deposition.

Key Words: Threonine, Reduced Crude Protein, Growth

815 Amino acid requirements of laying hens. G. P. Audren^{*1}, H. L. Classen¹, K. Schwan-Lardner¹, and K. Bolton², ¹Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada, ²Saskatchewan Agriculture Food and Rural Revitalization, Regina, SK, Canada.

The objective of this research was to examine the effects of dietary levels of amino acids on hen productivity and manure nutrient content. Treatments 1 through 3 provided 660, 720 and 780 mg of lysine per day, respectively through out the experiment, with diets adjusted in response to changes in feed intake. Treatment 4 delivered 780 and 720 mg of lysine per day in two 12 week phases. Hens in treatments 5, 6 and 7 were fed diets containing 660, 720 and 780 mg of lysine per kg of feed and diet levels were not corrected for changes in daily feed intake. Essential amino acids were kept at a minimum ratio to dietary lysine content in all diets. Two White Leghorn strains were used. Each treatment was replicated four times (15 hens per replication) per strain of birds. Hens were on trial from 18 to 42 wks of age and manure was collected from sample hens at 29 wks of age. Data were analysed as a 7 x 2 factorial analysis with treatment and strain as the main effects. Dietary treatments had no effect on egg production, body weight, mortality or egg shell quality. Hens fed treatments 3, 4, 6 and 7 produced larger eggs than those fed treatments 1 and 5, while hens from treatment 2 laid smaller eggs than those from treatment 3. There was no difference in the feed efficiency (total feed per egg mass) between hens fed treatments 1, 2, 3, 4, 6 and 7. Birds fed treatment 5 had similar feed efficiency to those fed treatment 1, but were significantly more feed efficient than birds fed other diets. Total nitrogen content of the feces was not affected by dietary treatment or hen strain. The results suggest that until 42 wks of age, based on egg size, hens require 780 mg of lysine per day. However, when based on feed efficiency, hens require only 660 mg of lysine per day.

Key Words: Egg, Amino Acid, Manure Nitrogen Content

816 A comprehensive summary of experiments to define factors that may affect the gain response to 2-hydroxy-4 methylthio butanoic acid (HMTBA) and dl-methionine (DLM) in broilers. M. Vazquez-Anon^{*1}, D. D. Kratzer², R. Gonzalez-Esquerria¹, G. F. Yi¹, and C. D. Knight¹, ¹Novus International, Inc., St. Louis, MO, ²E-SCI, Olivet, MI.

A survey of available publications was done by accessing NERAC and Novus databases from 1950 to 2003. The criteria for study selection were that both HMTBA (Alimet feed supplement and MHA feed supplement, Novus International, Inc.) and DLM (dry 99%) were present, weight gain was recorded, methionine (M) addition, age of birds and duration of study were defined, and a control treatment was present. Of 80 references identified, 56 complied with the criteria, which contained 88 experiments with 364 observations (OBS) for HMTBA and 340 for DLM. Between 1980 and 1999, 68% of the OBS were published, 54% were generated in USA and Canada, and 33% in the EU. Males were used predominantly (75%) over mixed sex (19%) and females (4%). The age at start and end of the study averaged 7.7 and 31.10 d, respectively, and 68% OBS used battery cages and 22% fed pelleted diets. Starter and grower diets were fed in 63% of the OBS, and finisher was fed in only 22%. Average nutrient profile of the diets was 0.28 0.04% M, 0.29 0.08 % Cys, 20.2.8% CP, and 3,139 188 Kcal/kg metabolizable energy. Addition of M averaged 0.15 0.18% with a range of 0.03-2 %. The liquid and dry forms of HMTBA, and the Na and free forms of DLM were tested in 67 and 33, and 7 and 93% of the OBS, respectively. Mean gain, feed conversion (FC) and intake (FI) of control treatment were 754 715 g, 2.31 0.9, and 1614 1531g, respectively. The addition of M improved

gain, FC, and FI 20, 19, and 8%, respectively. This database can be used to study the factors affecting the M activity of these products in broilers and to help develop hypotheses for future experimentation. Summary data also indicate a need for more research to be conducted under commercial conditions with pelleted diets.

Key Words: Broilers, 2-hydroxy-4-methyl-thio Butanoic Acid, Methionine

817 Summarized experimental results demonstrate different dose responses of broiler gain to 2-hydroxy-4 methylthio butanoic acid (HMTBA) and dl-methionine (DLM) with multiple putative variables. M. Vazquez-Anon^{*1}, D. D. Kratzer², R. Gonzalez-Esquerria¹, G. F. Yi¹, and C. D. Knight¹, ¹Novus International, Inc., St. Louis, MO, ²E-SCI, Olivet, MI.

The objective was to determine if broiler gain responses to HMTBA (Alimet feed supplement and MHA feed supplement, Novus International, Inc.) and DLM (dry 99%) are different or affected differently by variables that may contribute to the overall methionine (M) response. Data from 88 controlled experiments where HMTBA and DLM were compared in the same study and the levels of addition did not exceed commercial levels of 0.3% were used to create a database. Best predicted gain models were generated for each M source using PROC REG STEPWISE procedure of SAS. R-square and CV of the final prediction models were 0.7, 38% and 0.6, 41% for HMTBA and DLM, respectively. The variables present in both M source models that positively contributed ($P < 0.05$) to the overall M response were level of M, age of bird at end of study, year of study, dietary Lys and energy, pelleted diets, antibiotics, and males. As gain of the basal diet and age at start of study increased, the gain response to M addition decreased ($P < 0.05$). The resulting models for the two M sources were different. Dietary M and CP, coccidiostats, and M source form (liquid vs dry) were only present ($P < 0.05$) in the HMTBA model. Dietary Cys, type of pen, Europe and USA-Canada were only present ($P < 0.1$) in the DLM model. The DLM model described a quadratic response that reached maximum at 0.25% addition, while the HMTBA model described a linear response that resulted in numerically higher predicted gain at 0.25% and greater. These results demonstrate that the M sources have different dose responses ($P < 0.05$). However, gain predictions for the two M source models compared under the average conditions of the database were not significantly different.

Key Words: Broilers, 2-hydroxy-4-methyl-thio Butanoic Acid, Methionine

818 Effect of dietary tryptophan on growth and stress of broiler chicks. A. Corzo^{*1}, M. T. Kidd¹, J. P. Thaxton¹, and B. J. Kerr², ¹Mississippi State University, Mississippi State, ²United States Department of Agriculture.

The need for dietary Trp and its effect on stress of broiler chicks from 0 to 20 d of age was evaluated. Ross x Ross 508 male chicks were used in two studies, a diet-validation and a dose-response study. The first study compared the titration diet (corn-soybean meal-gelatin byproduct based diet) against two corn-soybean meal control diets (marginal and high in dietary lysine). Day-old chicks were randomly distributed across a closed-curtain sided house (24 floor pens; 13 chicks/pen), and fed the experimental diets. Growth and feed intake were determined at 20 d of age. The control diets had higher BW ($P < 0.001$) and feed intake ($P < 0.001$) than the titration diet; however, feed conversion of the chicks was similar among treatments. A second study estimated the Trp needs for growth of chicks from 0 to 20 d of age. The titration diet was fed to chicks (49 floor pens, 13 chicks/pen; 7 replicates/trt) providing 0.13% total Trp to which 0.02% increments of L-Trp were supplemented to 0.25% of diet at the expense of a filler. Using regression analysis (95% of minimum or maximum response), it was determined that chicks optimized BW, feed intake and feed conversion at 0.21, 0.20, and 0.22% dietary Trp, respectively. Blood plasma free Trp displayed a sigmoidal response in agreement with live performance needs. Plasma cholesterol, heterocyte/lymphocyte ratio, high/low density lipoprotein ratio and corticosterone levels were unaffected by dietary Trp, suggesting that no stress effect was imposed with Trp deficiency. Plasma glucose increased in a linear manner with dietary Trp, perhaps as a result of adrenergic driven glycolytic events, rather than gluconeogenic events

associated with physiological stress. Present results are in agreement with current NRC (1994) recommendations of 0.20% total Trp.

Key Words: Tryptophan, Stress, Plasma Corticosterone

819 Standardized ileal amino acid digestibility in broiler nutrition. M. L. Locatelli¹, V. Ravindran², and A. Lemme¹, ¹Degussa Corporation, Kennesaw, GA, ²Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand.

Broiler diets formulated based on digestible amino acids (AA) rather than on total AA allow a more accurate prediction of animal performance. Recent evidence suggests that the determination of ileal AA digestibility is preferable to the traditional excreta digestibility method. The concept of standardized ileal digestibility (SID) as a mean of overcoming the limitations of apparent ileal digestibility (AID) estimates is proposed. The apparent ileal AA digestibility of several major raw materials for growing broilers were determined and standardized by correcting for basal endogenous losses. In the digestibility assays, each assay diet was offered ad libitum to three pens (4 birds/pen) of male broilers from 35 to 42 days of age. On day 42, the digesta was collected from the terminal ileum, pooled within a pen and, analyzed for CP, AA, and the marker (acid insoluble ash). Basal endogenous losses were estimated from five published datasets based on data generated using the enzyme-hydrolysed casein method. SID was calculated using the following formula: $SID = AID + ((\text{endogenous CP or AA losses (g/kg DM intake)}/\text{CP or AA of the raw material (g/kg DM)} \times 100))$. The SID (%) of CP, Met, Met+ Cys, Lys and Thr were: 90, 94, 90, 92, 85 for corn; 90, 91, 86, 90, 85 for soybean meal; and 65, 72, 62, 69, 62 for meat and bone meal, respectively. The strongest effect of standardization on digestibility estimates was observed for cereal grains. The difference between standardized and apparent ileal digestible AA varied 3-17 percentage points for corn and wheat, while it ranged only 1- 3 for soybean meal and meat and bone meal. Among AA, the digestibility of Thr was affected the most by standardization, due to the high concentrations of Thr in endogenous protein. Diets formulated on standardized ileal digestible AA offer better prediction of animal performance, particularly when poor quality ingredients with relatively low AA digestibility are used.

Key Words: Broilers, Amino Acids, Standardized Ileal Digestibility

820 Variations in the digestible lysine requirement of broilers due to sex, performance parameters and rearing environment. A. R. Garcia^{*1}, A. B. Batal¹, and D.H. Baker², ¹University of Georgia, Athens, ²University of Illinois, Urbana.

Three experiments were conducted with broilers to evaluate variations in the digestible lysine requirement (DLR) for body weight gain (BWG) and gain/feed ratio (GF) due to sex and rearing environment from 7 to 21 d. Chicks were sexed immediately after hatch, placed in either starter batteries or floor pens, and fed a corn-soybean meal diet with 23% CP and 3,200 Kcal ME/kg up to d 7 at which time the chicks were sorted and allocated to the experimental diets. Diets were formulated to be isonitrogenous and isocaloric, varying only in the levels of digestible lysine (DL). The DL levels used were 0.70, 0.80, 0.90, 1.0 and 1.1% in experiment 1, 0.80, 0.88, 0.96, 1.04 and 1.12% in experiment 2, and 0.89, 0.97, 1.05, 1.13 and 1.21% in experiment 3. The requirements were estimated by one slope broken-line methodology, fitting the data to a quadratic curve and determining the first point at which the quadratic response curve intersects the plateau of the one slope brokenline. Estimated requirements reported herein are based on results of broken-line analysis. When lysine was deficient the female broiler always out gained the males, but the opposite was true when lysine was adequate. In all three experiments the estimated DLR based on BWG was higher for males (0.97%) than for females (0.93%). However, the estimated DLR based of GF was either not different between males and females or was slightly higher for the females. As it has been reported previously, the estimated DLR based on GF was higher than that based on BWG for both males and females in all three experiments. The differences in the DLR according to the rearing environment were not consistent in the

three experiments, suggesting that rearing conditions have little or no effect on the DLR.

Key Words: Lysine, Sex, Rearing Environment

821 Chick responses to diets differing in essential and nonessential amino acids. C. A. Fritts^{*}, A. Corzo, and M. T. Kidd, *Mississippi State University, Mississippi State.*

Utilization of crystalline amino acids have allowed for the reduction of crude protein in broiler diets. However, there is a point at which supplementation of all amino acids does not support adequate growth. An experiment was conducted to evaluate the effects of low protein diets adjusted for essential and nonessential amino acid content in chicks. Diets were formulated to contain NRC (1994) recommendations for essential amino acid content using corn and soybean meal of known composition. Dietary treatments consisted of a 22% high crude protein (HP) and an 18 % low crude protein diet (LP). The LP diet was then individually supplemented with Gly, Leu, Asp, Glu, Ala, or Pro to equal those values formulated in the HP diet. In addition, another dietary treatment consisted of the LP diet supplemented with all supplemented amino acids to equal those in the HP diet for a total of nine dietary treatments. For the first 5 d all chicks were fed a 23% CP diet and then fed the test diets from 5 to 21 d. Each diet was fed to 10 pens of 6 male chicks from a commercial broiler strain (Ross 308) in electrically heated battery brooders. Pen BW and feed consumption were taken at 5, 13 and 21 d. No significant differences were found between birds fed the LP diet with all amino acids added back and the HP diet for BW gain and feed conversion ratio (FCR) for 5 to 13 and 5 to 21 d. Birds fed the LP or LP diets supplemented with only one amino acid were significantly lower for BW gain and FCR from 5 to 13 d. Feed intake was not affected by dietary treatments. Addition of individual amino acids to LP diets had variable effects on BW gain and FCR for all age periods measured. Results of this study suggest that chicks fed LP diets should meet all essential and nonessential amino acid needs to equal performance of birds fed the HP diets. Although the combined response of all amino acids added back to the LP diet was best, 5 to 21 d live performance responses were improved by the addition of Gly, Leu, and Asp.

Key Words: Crude Protein, Amino Acids, Broiler

822 Effect of dietary lysine and stock density on broiler performance and breast meat quality. C. Berri¹, C. Relandeau², L. Le Bellego^{*2}, and M. Picard¹, ¹INRA Station de Recherches Avicoles, Nouzilly, France, ²Ajinomoto Eurolysine S.A.S., Paris, France.

Responses to increased dietary lysine concentrations were evaluated on 1584 Ross 308 male broilers between 21 and 42 days of age housed according to two bird densities. The experimental design comprised 8 factorial treatments : 2 bird densities (22 or 44 broilers / 2 m²pen) x 4 lysine levels (0.95%, 1.05%, 1.15% and 1.25%). There were 6 repetitions per experimental treatment. Birds were weighed individually at day 21 and 42. Feed consumption was recorded per pen. Body weight gain and feed conversion were calculated over the experimental period. 384 broilers were dissected at 42 days of age (48 per treatment). Final pH and water losses were measured on the pectoral muscle. Density adversely affected feed intake (169 ± 1 and 160 ± 1 g/b/d with 22 and 44 birds per pen, respectively, P<0.05), growth rate (97.4 ± 0.5 and 91.0 ± 0.7 g/b/d, P<0.05) and feed conversion (1.730 ± 0.008 and 1.760 ± 0.006, P<0.05). Except for feed intake, there was no interaction between the effects of bird density and dietary lysine. An increase in dietary lysine from 0.95% to 1.05% resulted in an increased growth rate (91.8 ± 1.6 and 95.5 ± 0.8 g/b/d, P<0.05), reduced feed conversion (1.783 ± 0.008 and 1.742 ± 0.009, P<0.05) and increased breast meat yield on body weight (17.1 ± 0.1 and 17.7 ± 0.1 %, P<0.05). Performance and body composition traits were not significantly improved for concentrations of lysine higher than 1.05%. However, final breast pH was linearly increased from 0.95% (5.91 ± 0.01) up to 1.15% (6.02 ± 0.01) lysine in the diet and water losses tended to be correlatively decreased (1.10 ± 0.06 and 0.85 ± 0.03 %, P<0.05). This result opens new ways of research for the definition of an amino acid requirement and on metabolic pathways involved in variations of breast muscle pH.

Key Words: Lysine, Growth, Meat Quality