diet. Besides brewery, cows received corn silage, concentrate, and accesss to a rye-grass pasture during 4 h/d. Brewery supplementation at the 75% level increased blood pH (P<0.01), reduced glucose (P<0.001), and tended to increase protein (P=0.10). Besides, there was a general correlation within glucose and protein, glucose and glutamic-oxaloacetic transaminase (GOT), pH and GOT, protein and GOT. In conclusion, high levels of brewery supplementation increase blood pH, tended to increase protein and reduce glucose in dairy cows.

Key Words: Dairy Cow, Blood Metabolites, Mexico

1315 Timed-embryo transfer (Gyr/Holstein) in recipient cows exposed to a synchronized ovulation. BA Barrios, LA Guillen, JC Acua, and CF Arechiga*, [1]*Universidad Autonoma de Zacatecas. Zacatecas, Mexico.*

The purpose of the present work was to evaluate heat induction and pregnancy rates in response to a frozen/thaw embryo transfer (Gyr/Holstein embryos) in the uterine horn ipsilateral to the corpus luteum of recipient cows exposed to a synchronized ovulation. Experiment was done from April to August. Twenty-six cows from different locations and genetic background were exposed to a synchronized -ovulation protocol (d 0, GnRH; d 7, PGF2a; d 9, GnRH; d 10, checking estrus instead of timed AI; d 17, embryo thawing and deposition). Cows were rectally palpated at each farm on d 10 of treatment and signs of estrus were observed. However, cows were not inseminated but rather and embryo was deposited in the uterine horn ipsilateral to the corpus luteum palpated at d 17. During embryo transfer cows were rectally examined, feces were removed, and perianal region was washed. Then the embryo was deposited using a Cassou AI gun passing through the cervix of the uterus and leading it into the uterine horn ipsilateral to the ovary that contains a corpus luteum. Sixty days after embryo transfer, cows were diagnosed for pregnancy and 19.2% of the recipient cows were pregnant (i.e., 5/26). One of the cows received two embryos and the cow delivered both calves alive. In conclusion, the synchronized-ovulation protocol could be utilized for synchronization of cows included in embryo transfer programs. However, in this preliminary study, pregnancy rates were low probably due to the heterogeneity of the cows included in the trial.

Key Words: Synchronized Ovulation, Embryo Transfer, Mexico

1316 Meat quality characteristics of loin eye and tenderloin muscles of native Korean (Hanwoo) steers. Y.K. Lee[1], K.H. Kim*[1], Y.S. Kim[2], S.S. Sun[1], and M.G. Baik[1], [1]*Chonnam National University, Kwangju, Korea,* [2]*University of Hawaii at Manoa, Honolulu.*

The objective of this study was to investigate postmortem glycolysis, histochemical, and meat quality characteristics of longissimus dorsi (LD) and psoas major (PM) muscles of Hanwoo (native Korean) steers. Four steers weighing about 550 kg were slaughtered, then 20 g of LD at the 13th rib and PM at the 4th lumbar vertebra were collected at 1, 2, 6, 12, and 24 hr postmortem to measure changes in metabolite concentrations and pH. At 24 hr later, 1 cm^3 of LD and PM samples were cut for histochemical analysis. At 1, 3, 7, 14, and 21 day postmortem, LD samples between 6th and 12th rib and PM were collected for TBA value and shear force measurements. Three 1.8 cm diameter cores were prepared for shear force measurement from 2.54 cm thick steaks that were vacuum packaged and cooked in a water bath at 70°C. ATP and pH in PM declined faster (p<0.05) than those in LD during the 24 hr postmortem period, and remained lower at 24 hr after slaughter (0.47 vs 0.62 μmoles/g muscle, 5.92 vs 5.64). Glucose-6 phosphate in PM increased faster (p<0.05) than in LD muscles, and remained higher (11.5 vs 5.5 μmoles/g muscle). LD had a lower (p<0.05) proportion of type I fiber than PM (51.1% vs 58.3), but higher (p<0.05) proportion of type IIb fiber than PM (18.9% vs 9.0%). The shear force to cut cooked PM was lower than that for LD in 1 and 7 day aged samples, but no difference was observed between the two muscles in 21 day aged samples. The TBA value increased gradually during the 21 day aging period in both muscles. The increase in TBA value was similar in both muscles up to 14 days, but at 21 day the TBA value of PM was significantly higher than that of LD. In summary, this study demonstrated that the rate of postmortem glycolysis is faster in the PM than in the LD. The study also indicated that PM muscle needs less aging time than LD muscle for optimum meat quality.

Key Words: Native Korean steer, Meat Quality, Postmortem metabolism

1317 Characterization of forage trees as strategic feed sources for goats under semiarid rangeland conditions of Tamaulipas, Mexico. R. Hernandez[1], A. Tewolde[1], S. S. Gonzalez*[2], E. Gutierrez[3], H. Diaz[4], and F. Briones[1], [1]*U. Autonoma de Tamaulipas,* [2]*Colegio de Posgraduados,* [3]*U. Autonoma de Nuevo Leon,* [4]*U. Autonoma Agraria Anotonio Narro.*

Ten locally available forage trees under semiarid rangeland in the State of Tamaulipas were identified and characterized as main feed sources for goat based production systems that predominate in the area (22 C average temperatures; 500 mm average rainfall in August- December). The forage trees included Guajillo (Acacia berlandieri), Gabia (A. rigidula), Huizache (A. romeriana), Granjeno (Celtis spinosa), Pata de gallo (Chloris virgata), Cruceto (Condalia lycioides), Nacahua (Cordia boissieri), Vara dulce (Eysenhardtia polystachya), Escoba (Fraxinus greggii), and Charrasquillo (Pithecellobium elastichophyllum). Density was estimated by the Point Quarter Center method (Bruce, 1986) using the formula of Arvanitis and Portier (1997): $D = 1/x^2$, where D is plant density by m^2, and x is the average distance between each sampling. Results showed densities (%) of: A. berlandieri 29.99, C. virgata 29.91, C. boissieri 13.29, A. romeriana 7.47, A. rigidula 5.48, C. spinosa 4.06, F. greggii 3.32, E. polystachya 2.65, C. lycioides 2.25, P. elastichophyllum 1.53. Production (kg/ha) of biomass, wood and forage was higher for A. berlandieri (3871, 2879, 993, respectively) and lower for P. elastichophyllum (44, 39, 5, respectively). Proximal analysis and in vitro DM digestibility (IVDMD) values (%) ranged from 82 to 94, 11 to 21, 26 to 58, 16 to 38, 5 to 17, 11 to 46 for DM, CP, NDF, ADF, ashes and IVDMD, respectively. The CP (21%) and IVDMD (46%) values were higher for C. spinosa. Intake of plant parts by goats, measured by direct field observation showed: foliage in A. romeriana, C. virgata, A. berlandieri, A. rigidula, C. lycioides, E. polystachya, P. elastichophyllum; leaves in C. spinosa, F. greggii; fruits in C. boissieri, C. virgata; pods in A. berlandieri; stems in F. greggii. Six of the forage trees (A. romeriana, C. boissieri, C. spinosa, A. rigidula, A. berlandieri, C. lycioides) are used as fuel wood by local farmers.

Key Words: Forage Trees, Goats, Semiarid Rangelands

ASAS Nonruminant Nutrition: Specialty Grains and Amino Acids

1318 Soybean meal from Roundup Ready® or conventional soybeans in diets for growing-finishing pigs. G. L. Cromwell*[1], M. D. Lindemann[1], J. H. Randolph[1], E. P. Stanisiewski[2], and G. F. Hartnell[2], [1]*University of Kentucky, Lexington,* [2]*Monsanto Co., St. Louis, MO.*

Dehulled soybean meal (SBM) prepared from genetically-modified, herbicide-tolerant soybeans containing the CP4 EPSPS protein (Roundup Ready® [RR]) and near-isogenic conventional (C) soybeans were assessed in an experiment with growing-finishing pigs. The soybeans were grown in yr 2000 under similar agronomic conditions, the RR soybeans were sprayed with Roundup®, and both were processed at the same plant. The C-SBM and RR-SBM were indistinguishable in composition (DM: 90.3, 91.0%; CP: 51.5, 51.2%; NDF: 4.95, 4.85%; ADF: 3.50, 3.94%; lysine: 3.16, 3.09%; meth+cys: 1.47, 1.51%). Crossbred pigs (n=100) were fed fortified corn-soy diets containing C- or RR-SBM from 24 to 111 kg BW. Diets contained 0.95% lysine initially, then lysine was reduced to 0.80 and 0.65% when pigs reached 54 and 87 kg BW. There were 10 pens (5 pens each of barrows and gilts)/treatment with 5 pigs/pen. All pigs were scanned at 104 kg mean BW, and all barrows were killed at the end of the test for carcass measurements and tissue collection. ADG (833 vs 854 g), ADFI (2.53 vs 2.64 kg), feed:gain (3.04 vs 3.09), scanned backfat (BF, 18.8 vs 19.1 mm) and longissimus area (LEA, 34.9 vs 33.8 cm^2), and calculated carcass lean (52.9 vs 52.5%) were not different (P>0.05) for pigs fed C- and RR-SBM. Gilts gained slower, but they were more efficient and leaner (P<0.05) than barrows. Responses to type of SBM were similar for the two genders. Carcasses

were not different (P>0.05) for barrows fed C- and RR-SBM (71.8 vs 71.2% dress, 26.8 vs 27.4 mm 10th rib BF, 37.8 vs 35.5 cm^2 LEA, 48.1 vs 47.3% fat-free lean). Longissimus samples from barrows fed C-SBM tended to have less fat than those fed RR-SBM (3.0 vs 3.4%; P<0.06), but water, protein, and ash were similar (72.8 vs 72.5%; 23.4 vs 23.3%; 1.05 vs 1.05%). The CP4 EPSPS protein was not detected in loin tissues of any of the pigs fed RR-SBM. The results indicate that RR-SBM is essentially equivalent in composition and nutritional value to C-SBM for growing-finishing pigs.

Key Words: Pigs, Soybeans, Biotechnology

1319 Comparison of apparent ileal amino acid digestibility values of high oil (HOC), high oil/high oleic acid (HOHOC), and low phytate (LP) corn diets fed to finishing pigs. J. W. Frank*[1], G. L. Allee[1], and T. E. Sauber[2], [1]*University of Missouri, Columbia, MO,* [2]*Dupont Specialty Grains, Johnston, IA.*

Two experiments were conducted to evaluate the apparent ileal amino acid digestibility values of multiple corn varieties. In both experiments pigs were surgically fitted with T-cannulas and allowed a minimum of 2 weeks to recover. All animals were fed twice daily (0600 and 1800 hr) at a rate of .09 × $BW^{.75}$ for a five day adjustment period, followed by two days of twelve-hourly collections. Pigs were allowed ad-libitum access to a nipple waterer. Samples were immediately frozen (-20 °C) as collected. At the end of both studies pooled samples from the two day collection were sub-sampled, freeze dried, ground, and analyzed for amino acid content along with the corn based diet. In experiment 1, six crossbred barrows (initial BW = 101.8 kg) were arranged as two 3 × 3 Latin squares and housed in 2.43 × 1.83 m pens at a temperature of approximately 23 °C. The three dietary treatments consisted of HOC, HOHOC, and a typical corn equivalent (TC). Tryptophan digestibility was greater in HOHOC (64.2%) compared to TC (54.2%), but not different than HOC (61.6%; $P < .10$). In contrast proline digestibility was greater in TC (74.3%) and HOC (71.9%) compared to HOHOC (64.7%; $P < .05$). There were no other differences in apparent amino acid digestibility. In experiment 2, five crossbred barrows (initial BW = 89.3 kg) were used in a crossover design and housed in stainless steel metabolism crates. The two dietary treatments were LP corn and a typical corn equivalent (TYP). Phosphorus digestibility was greatest in the LP corn compared to the TYP corn ($P < .01$). Tryptophan digestibility was also greater in LP corn compared to TYP corn (62.0 vs. 50.9%; $P < .05$).). As in experiment 1, there were no other differences in amino acid digestibility. In conclusion most amino acid digestibility values were not different in the high oil, high oil/high oleic acid, and low phytate corn varieties compared to their typical corn equivalents.

Key Words: Pigs, Corn, Amino acid digestibility

1320 Effects of low-phytic acid corn on growth performance, bone strength, and serum osteocalcin concentration in growing-finishing pigs. M. W. Klunzinger*, K. D. Roberson, G. M. Hill, D. W. Rozeboom, and J. E. Link, *Michigan State University.*

A 91-d experiment was conducted to evaluate whether low-phytic acid corn (NDLP, Exseed Genetics) (90% phosphorus (P) availability) could replace dent corn (DC) without adversely affecting growth performance or bone parameters in growing-finishing pigs. Total P and phytate P were 0.24 and 0.16% in DC; 0.32 and 0.03% in NDLP, by analysis. Pigs were blocked by initial BW (18.5 to 22.5 kg) into four pens per treatment (trt) of eight crossbred pigs per pen. Two trts were fed; trt 1 contained DC and trt 2 contained NDLP. Three phases were fed; each was four wks in length. Dietary calcium and non-phytate P were computed to provide 0.75 and 0.36, 0.63 and 0.30, or 0.55 and 0.28% in phases I, II, and III, respectively. Total P was computed to provide 0.57, 0.50, or 0.47% for trt 1; and 0.47, 0.40, or 0.36% for trt 2, in phases I, II, and III, respectively. Dicalcium phosphate concentration was decreased by 0.73, 0.78, and 0.85% units in trt 2, for phases I, II, and III, respectively. One gilt per pen was chosen, based on average pen BW (92 to 106 kg), for slaughter at 91d. All third and fourth metacarpals (MC) and metatarsals (MT) were used to analyze bone-breaking strength. Blood was collected from two pigs per pen at 90d for serum osteocalcin (OC) analysis (an indicator of bone turnover). Gain/feed (trt 1 = 316, trt 2 = 350, $P > 0.09$), BW (trt 1 = 97.3 kg, trt 2 = 98.7 kg, $P > 0.71$), and ADG (trt 1 = 840 g/d, trt 2 = 860 g, $P > 0.57$) were not affected. There were no differences in bone strength of third and fourth MC and fourth MT bones ($P > 0.28$). Overall, MC and MT bone strength was higher (15.04 vs. 12.83 MPa, $P < 0.01$) for gilts fed trt 1 vs. trt 2. This was due to a difference ($P < 0.01$) in third MT bone strength. Serum OC was not affected (trt 1 = 297 ng/mL, trt 2 = 276 ng/mL, $P > 0.92$), suggesting no difference in bone turnover. This study proposes that NDLP corn can be formulated with 90% P availability and replace dent corn without adversely affecting pig performance.

Key Words: Low-phytate corn, Bone strength, Pig

1321 Comparision of broiler performance when fed diets containing YieldGard® corn, YieldGard® and Roundup Ready® corn, parental lines, or commercial corn. M.L. Taylor*[1], G.F. Hartnell[1], M.A. Nemeth[1], B. George[2], and J.D. Astwood[1], [1]*Monsanto Company,* [2]*Colorado Quality Research.*

Broiler chickens (Cobb x Cobb) were used to compare the broiler performance and processing parameters of YieldGard® corn (YG) and YieldGard® and Roundup Ready® corn (YG X RR) (both containing the Cry1A(b) protein and the latter also containing the maize EPSPS protein) with their parental lines and four commercial lines of corn. From days 1-20, broilers were fed a starter diet with approximately 50% w/w corn, and from days 20-42, broilers were fed a grower/finisher diet with approximately 60% w/w corn. Feed and water was provided ad libitum. Birds were housed in concrete floor pens and the environment controlled for light and temperature. Eight treatments (5 male and 5 female pens/treatment with 10 birds/pen) were assigned using a randomized complete block design. The standard randomized block analysis of variance (ANOVA) statistical model was used to analyze the data. Means were compared to each other at the 5% level of significance. An additional analysis compared the fit of YG corn and YG x RR corn with the population of responses from the commercial varieties using a linear mixed model procedure in SAS (P<0.05). Performance parameters (live weight, feed intake on a per bird basis, feed efficiency, and adjusted feed efficiency) were similar (P>0.05) among broilers fed the eight treatment diets. On a weight basis or percentage basis, carcass measurements of live/chill weight, thighs, drums (weight basis only), wings, and fat pad weights were similar across treatments (P>0.05). Drum measurements as a percent of chill weight and breast meat weight were similar for YG corn and YG x RR corn and their parental lines and multiple commercial lines. No differences were observed in the percentage of moisture, protein, and fat in breast meat or thigh meat across treatments. Results support there were no biologically relevant differences in performance parameters, carcass yield, and meat composition between broilers fed the YG corn or YG x RR corn and their parental lines or commercial lines. In conclusion, YieldGard® corn and YieldGard® and Roundup Ready® corn were nutritionally equivalent to their corresponding parental lines and four commercial lines when fed to broilers.

Key Words: Corn, Broilers, Performance

1322 Comparison of swine performance when fed diets containing Roundup Ready® corn (GA21), parental line or conventional corn. E. P. Stanisiewski*[1], G. F. Hartnell[1], and D. R. Cook[2], [1]*Monsanto Company, St. Louis, MO,* [2]*Akey, Inc., Lewisburg, OH.*

One hundred sixty pigs (80 barrows and 80 gilts) were used in a growth trial (72 to 117 kg body weight) to determine the effect of corn variety; Asgrow RX826, feed mill purchased corn (CPFM), Parental line DK626 and Roundup Ready® line DK626RR, on growth performance and carcass characteristics. Line DK626RR is a glyphosate-tolerant variety containing event GA21 (mEPSPS protein). Pigs were given ad libitum access to corn-soybean meal based diets and water throughout the trial. Each diet utilized one of the four corn varieties and all diets contained the same percentage of corn. Dietary amino acid levels were standardized across diets with crystalline amino acids. Barrows and gilts were penned (4 pigs per pen) separately in 1.5 x 2.4 m pens on concrete slats in a mechanically ventilated building. Pig and feeder weights were recorded weekly. Pigs were slaughtered at approximately 117 kg body weight and carcass data were collected. Over the duration of the trial, no significant (P>.05) gender by dietary treatment interactions were observed for any criteria measured. No significant differences (P>.05) were observed in response to corn variety for average daily body weight gain (ADG), average daily feed intake (ADFI) or feed efficiency (FG). As expected, barrows had greater (P<.05) ADG (880 vs 821 g/d) and

ADFI (2.81 vs 2.49 kg/d), and poorer (P<.05) FG (3.19 vs 3.03) compared with gilts. There were no overall treatment effects on chemical composition of muscle. Based on these data, DK626RR corn has a feeding value for pigs similar to its parental variety as well as commercially available varieties.

Key Words: Pigs, Corn

1323 Comparison of broiler performance when fed diets containing Roundup Ready® corn event NK603, parental line, or commercial corn. M.L. Taylor*[1], G.F. Hartnell[1], M.A. Nemeth[1], B. George[2], and J.D. Astwood[1], [1]*Monsanto Company,* [2]*Colorado Quality Research.*

Broilers (Ross x Ross) were used to compare performance and processing parameters using the Roundup Ready® corn event NK603 containing the CP4 EPSPS protein with its parental line and five commercial lines of corn. From days 1-20, broilers were fed a starter diet with approximately 55% w/w corn; from days 20-42, broilers were fed a grower/finisher diet with approximately 60% w/w corn. Feed and water were provided ad libitum. Birds were in concrete floor pens and the environment controlled for light and temperature. Eight treatments (5 male and 5 female pens/treatment and 10 birds/pen) were assigned using a randomized complete block design. The standard randomized block analysis of variance (ANOVA) statistical model was used to analyze the data. Means were compared at the 5% level of significance. An additional analysis compared the fit of NK603 with the population of responses from the commercial varieties using a linear mixed model procedure in SAS. Performance parameters (live weight, feed intake, and feed efficiency) were similar (P>0.05) among the broilers fed diets of the eight treatments. Carcass measurements of live/chill weight, breast meat (expressed as percent of chill weight), thighs, drums, and wings were similar across treatments (P>0.05). Fat pad weights of broilers fed diets containing NK603 were not different from those fed diets containing one commercial line (1.5% vs 1.6% of live weight, respectively, P>0.05) and were less than the parental line and four commercial lines (all 1.7% of live weight, P<0.05). No differences were observed in percentages of moisture, protein, and fat in breast meat or protein and fat in thigh meat across treatments. Moisture content of thigh meat was similar between the NK603, parental, and three commercial lines and approximately 1% higher than NK603 in two commercial lines. The results of this study show that there were no biologically relevant differences in performance parameters, carcass yield, and meat composition between broilers fed the NK603 event, the parental, or commercial lines, and all data generated are similar to historical values for Ross x Ross strains. In conclusion, the Roundup Ready® corn line containing the NK603 event was nutritionally equivalent to its corresponding parental line and commercial lines when fed to broilers.

Key Words: corn, broilers, performance

1324 Growth performance of broilers fed insect-protected (MON 810) or near isogenic control corn. G. Piva*[1], M. Morlacchini[2], A. Pietri[1], F. Rossi[1], and A. Prandini[1], [1]*Istituto di Scienze degli Alimenti e della Nutrizione, U.C.S.C., Facolt di Agraria, Piacenza,Italy.,* [2]*CERZOO, Piacenza, Italy.*.

The aim of the present work was to compare the nutritive value for broilers of insect-protected (Bt) corn containing the Cry1A(b) protein (MON 810) with near isogenic control corn (IC), each grown on three Italian farms located in Lodi, Cremona and Venezia provinces. The study utilized 432 Ross male broilers (72 birds in four pens for each of the six treatments). Nutritional analytes were not different (P<0.05) between IC and Bt corn. Diets were formulated to meet Ross broiler requirements and contained about 50% corn. Birds were fed diets for 42 days (first 21 days, grower phase; second 21 days, finishing phase). Feed intake, average daily gain (ADG) and feed:gain of birds fed Bt or IC corn did not differ (P<0.05) regardless of the source of the Bt and IC corn. Final live weight of birds was significantly (P<0.05) greater for the birds fed diets containing Bt corn as compared to IC corn from Lodi (2796 g *vs* 2707 g; P<0.05; +3.3%) and Venezia (2619 g *vs* 2506 g; P<0.01; +4.5%). When all performance variables from the birds fed the Bt treatments were averaged and compared with the mean of IC fed birds, ADG (63.4 *vs* 61.8 g/d), feed intake (125.7 *vs* 125.0 g/d) and feed:gain (1.98 *vs* 2.02) were similar (P<0.05) and final live weight was 2.7% greater (2693 *vs* 2621 g; P<0.01) for the Bt group. The difference could be due to Bt corn having a 72% lower level of fumonisin B_1 than IC corn. Aflatoxin and deoxynivalenol (DON) levels were low in all treatments. We conclude that performance of broilers fed Bt corn is at least as good as those fed IC corn.

Key Words: Broiler, Transgenic corn, Fumonisin B_1

1325 Evaluation of *Streptomyces lividans* and *Pichia pastoris* as extra-cellular expression systems for *Escherichia coli* phytase. C.H. Stahl* and X.G. Lei, *Cornell University, Ithaca, NY.*

Our previous research has shown that enzymatic properties and yield of individual phytases are greatly affected by the expression host utilized. The objective of this study was to determine the efficiencies of a bacterial *(S. lividans)* and a yeast *(P. pastoris)* system in expressing an *E. coli* phytase gene *(appA)*, and to compare the thermo-tolerances, pH profiles, and optimal temperatures of the recombinant phytases. The *appA* was inserted into *S. lividans* TK24, after being cloned into a vector under control of the pLT1 promoter with the Spe2 signal peptide of endoglucanase E2 from Thermomonospora fusca. For expression in *P. pastoris*, *appA* was inserted into the vector pPICZaA (Invitrogen, San Diego, CA) under control of the AOX1 promoter, and transformed into *P. pastoris* X33. An active phytase was expressed and secreted into the media by both hosts. The protein expressed in *S. lividans* (SLEP) was not glycosylated and was the same size (approximately 45 KDa) as the de-glycosylated phytase expressed in *P. pastoris* (PPEP) that had multiple levels of glycosylation. Both enzymes had an optimal temperature of 65°C, but the relative activity of PPEP was 32 and 25% higher ($P \leq .05$), respectively, at 45 and 55°C, and 52% lower ($P \leq .05$) at 75°C than that of the SLEP. The pH optimum of SLEP was 4, and was between 3.5 - 4 for PPEP. At pH 2 - 3.5, PPEP had approximately 50% more ($P \leq .01$) relative activity than SLEP. The thermo-tolerance of SLEP was higher ($P \leq .05$) at 45 and 55°C, but lower ($P \leq .05$) at 65 and 75°C than that of PPEP. In conclusion, *S. lividans* can be used to produce an active extra-cellular phytase that may have different biochemical traits than the phytase produced by *P. pastoris*.

Key Words: Heterologous protein expression, Gene, *Streptomyces lividans*

1326 Apparent and true ileal digestibility of amino acids in soybean meals as affected by heat treatments and trypsin inhibitors. S. W. Kim*[1], Z. H. Zhang[2], L. A. Johnson[3], and R. A. Easter[2], [1]*Texas Tech University,* [2]*University of Illinois,* [3]*Iowa State University.*

Heat treatment in producing soybean meal is an important factor affecting nutritional value of the material. Underheating can cause failure to eliminate trypsin inhibitors whereas overheating can reduce digestibility and availability of amino acids. This project was undertaken to investigate how different levels of heat treatment affect amino acid digestibility in growing pigs as it relate to the disappearance of trypsin inhibitors. Four soybean meals were processed under different cooking conditions. These treated soybean meals were compared with a control soybean meal and soy protein concentrate obtained from the Ohio State University. A casein based diet was used to measure endogenous protein losses based on the assumption that casein is fully digestible. The experiment were conducted as two replicates of 7 × 7 Latin Square. Fourteen surgically-cannulated pigs were used to determine ileal digestibility of amino acids in soybean meals. Both undercooking and overcooking of soybean meals decreased ($P < 0.05$) true and apparent ileal digestibility of amino acids. However adverse effect on ileal digestibility of amino acids was greater ($P < 0.05$) when soybean meals were undercooked than overcooked. Undercooked soybean meals contained significantly greater amount of trypsin inhibitors (38,300 and 32,800 TIU/g) than the control soybean meal (4,600 TIU/g) even though KOH solubilities of those soybean meals (78 and 69%) were close to that of control soybean meal (74%). The moderately overcooked soybean meal containing 15,700 TIU/g but a low KOH solubility (59%) had a lower ($P < 0.05$) true and apparent ileal digestibility of amino acids than control soybean meal but higher ($P < 0.05$) than undercooked soybean meals. Severely overcooked soybean meal had a low KOH solubility (40%) but the content of trypsin inhibitor (6,700 TIU/g) was close to that of control soybean meal. True and apparent ileal digestibility of amino acids were

lower ($P < 0.05$) than in control soybean meal but higher ($P < 0.05$) than in undercooked soybean meal.

Key Words: Ileal digestibility, Soybean meal, Pigs

1327 Effect of increased levels of crystalline nonessential amino acids on growth performance and nitrogen retention of broiler chicks fed low-CP diets. K. Bregendahl* and D.R. Zimmerman, *Iowa State University, Ames*.

In spite of meeting the requirements for essential AA, low-CP diets may not supply sufficient nonessential AA (NEAA) to sustain maximal growth performance of pigs and broiler chicks. Therefore, an experiment was conducted to investigate whether increased dietary levels of crystalline NEAA improve growth performance and N retention of broiler chicks fed low-CP diets. A total of 306 day-old broiler chicks was fed a common corn-soybean meal (SBM) diet (23% CP) for 1 wk, after which the chicks were allotted to one of five diets (D) in a completely randomized design (10 chicks per pen, 6 replications; 123 g initial BW). Chicks had free access to the isoenergetic diets (3.20 Mcal ME_n/kg), which were formulated to meet or exceed all NRC (1994) requirements. The diets consisted of a control diet (D1; 23.4% CP), D2 (18.3% CP), D3 (18.7% CP), D4 (19.4% CP), and D5 (20.3% CP). The CP content of D2 was reduced by altering the corn:SBM ratio in D1 and adding crystalline AA (Arg, Ile, Lys, Met, Thr, and Val) to 105% of NRC (1994) AA levels. Diets D3, D4, and D5 were formulated by replacing cornstarch in D2 with a 1:1 mix of Glu and Asp at 1, 2, and 3%, respectively. After 2 wk on test, chicks were weighed, fasted for 24 h, and two chicks per pen were euthanized. The whole-body N contents of the chicks fed D1 through D5 as well as six baseline chicks were determined. Treatment means were compared using orthogonal contrasts. Feed utilization (G:F; 0.753, 0.711, 0.716, 0.712, 0.723 for D1, D2, D3, D4, and D5, respectively) and N retention (1.19, 1.08, 1.10, 1.10, 1.11 g/d) of chicks fed D1 were superior ($P < 0.001$) to that of chicks fed D2 through D5, while ADG (43.9, 42.6, 42.5, 42.5, 42.6 g/d) and ADFI (58.3, 59.9, 59.4, 59.7, 59.0 g/d) did not differ ($P > 0.05$). No linear or quadratic effects ($P > 0.05$) of increasing the NEAA levels on ADG, ADFI, G:F, or N retention were observed. Based on these results, the inferior growth performance of chicks fed low-CP diets is not caused by a deficiency of NEAA.

Key Words: Low Crude Protein, Growth Performance, Nonessential Amino Acids

1328 Lysine to Protein ratios in growing-finishing pigs. E. O. Castaneda-Silva*[1] and J. A. Cuaron[2], [1]*Nutrimentos Concentra, S.A. de C.V.,* [2]*C. N. I. Fisiologia y Mejoramiento Animal, INIFAP, Queretaro, Mexico*.

Using sorghum-soy based diets, 3.23 Mcal ME/kg, two experiments were conducted to find the best total Lys concentration in dietary crude protein (CP), provided that other limiting amino acids (Thr, Trp, Met) were maintained in a constant (ideal) ratio to Lys, on a true ileal digestible basis. A nitrogen (N) balance experiment was conducted using 4 CP levels: 12, 15, 18 and 21% of the diet. In all cases, Lys was constant at 6% of CP. Twenty-four barrows, of an initial wt. of 47±2.8 kg were used. After a preliminary feeding period of 21-d, a 6-d total excretion collection phase was followed. Nitrogen retention was linearly increased (P<.01) by dietary CP: 18.58, 21.29, 21.21 and 24.73 g/d. In response to the increase in CP, efficiency of N retention was linearly decreased (P<.01): 43.20, 39.43, 34.12 and 34.10% of N intake. Giving equal importance to retention and efficiency of N retention, the best CP level was estimated at 14.7% of the diet. In Exp. 2, three Lys:CP ratios (5.0, 5.8 and 6.6%) were tested at 2 CP levels: 14.7 and 16.7% for growing (25-65 kg BW), and 13.5 and 15.5% for finishing pigs (66-107 kg BW). The CP level and the Lys:CP ratios interacted (P<.05) in voluntary feed intake, daily wt. gain and lean eye area. At lower CP, a positive linear response (P<.01) was observed after the increasing levels of Lys but, at higher CP, a quadratic effect (P<.01) was evident above the 5.8% ratio. Feed intake was: at lower-CP, 2.4, 2.3 and 2.5; at higher-CP, 2.4, 2.4 and 2.2 kg/d, in both cases for the 5.0, 5.8 and 6.6% Lys:CP ratios. In the same order, results for BW gain were: lower-CP, 0.72, 0.73 and 0.78; higher-CP, 0.74, 0.76 and 0.69 kg/d. Similarly, lean eye area was: lower-CP, 28, 32 and 30; higher-CP, 34, 30 and 33 cm^2. Following a broken line analysis, the best Lys:CP ratio was calculated as 5.8 Lys as % of CP.

Key Words: Lysine, Crude protein, Growing pigs

1329 Effect of synchronizing dietary protein and glucose supply on nitrogen retention of growing pigs. W.J.J. Gerrits*, K.P.C.M. Frijters, J.M. Linden, M.J.W. Heetkamp, T. Zandstra, and J.W. Schrama, *Wageningen Institute of Animal Sciences, Wageningen, The Netherlands*.

An experiment was conducted to test and quantify the effect of synchronizing the dietary supply of protein and glucose to pigs. Six barrows (40 kg) were subjected to one of two dietary treatments (synchronous or asynchronous supply of protein and glucose) in a change-over design. The synchronous treatment consisted of two complete meals: one at 0800 and one at 1600. At the asynchronous treatment, protein and starch were supplied in separate meals: the pigs consumed 95% of the daily protein supply with the 0800 meal and 99% of the starch supply with the 1600 meal. Daily intake of all nutrients and dietary ingredients was identical between the treatments. The gross energy intakes at 0800 and those at 1600 were equal for both treatments. Pigs were housed individually in climate controlled open circuit respiration chambers and fed at 2.1 x the energy requirements for maintenance. Faeces and urine were collected quantitatively for 13d. Heat production was measured by indirect calorimetry. Preliminary results indicate that synchronizing the dietary protein and starch supply did not affect apparent fecal digestibility of DM, N, energy, crude fat and ash (mean values of 88.5, 91.9, 88.9, 72.8 and 55.0, respectively; P>0.2). It did, however, markedly increase N retention from 0.91 (asynchronous) to 1.08 g N/kg $BW^{-0.75}.d^{-1}$ (synchronous) (P<0.01). The efficiency with which digestible N was retained increased from 49.5 (asynchronous) to 59.9% (synchronous; P<0.01). Due to technical problems, the results of the heat production measurements could not be used. In conclusion, the results of this non invasive study illustrate the potential effect that synchronization of dietary protein and glucose supply may have on nitrogen retention.

Key Words: Pigs, Protein Metabolism, Nutrient Synchrony

1330 Portal recovery of enteral supplied alpha-ketoglutaric acid in growing pigs. N. B. Kristensen*[1], S. G. Pierzynowski[2], H. Jungvid[2], and J. A. Fernandez[1], [1]*Danish Institute of Agricultural Sciences, Tjele, Denmark,* [2]*Gramineer Int. AB, Lund, Sweden*.

The present study was undertaken to study the portal recovery of alpha-ketoglutaric acid (AKG) fed to growing pigs. Five crossbreed Danish female pigs (50 ± 2 kg BW before surgery) were fitted with silicone catheters in A. iliaca externa, V. mesenterica and V. porta. The pigs were fed a barley-wheat-soybean meal based diet (3 % of BW/d). The average daily gain during the experimental period was 801 ± 55 g/d. During blood samplings the diet was divided equally into 24 daily meals, fed every hour and added 5 % (wt/wt) of glucose (Control) or 5 % (wt/wt) of AKG, i.e. 342 mmol of AKG / kg feed (AKGfeed). Three pigs received in a later experiment an equivalent amount of AKG by i.v. infusion into V. mesenterica (AKGiv). Portal blood flow was measured by down stream dilution of p-aminohippuric acid continuously infused into V. mesenterica. Blood plasma concentrations of AKG were measured by gas-liquid chromatography of O-ethyloxime ethyl esters of AKG. The arterial concentration of AKG increased ($P < 0.01$) from 18 to 25 ± 3 μmol/l with Treatment AKG compared with control. With Treatment AKGiv, the arterial concentration of AKG was 425 ± 27 μmol/l. The portal blood flow was not obtained for all pigs, however, the data obtained did not indicate any treatment effect on portal blood flow (131 ± 6 l/h; n=9). The portal net appearance of AKG (calculated as whole blood flux) increased ($P < 0.01$) with Treatment AKGfeed (35 ± 9 mmol/ kg feed) compared with control (9 ± 5 mmol/kg feed). The increased net portal appearance of AKG could account for 8 ± 2 % of the AKG added to the feed. When AKG was infused into the mesenteric vein it could be completely accounted for (100 ± 2 %) in the portal vein. These results suggest that enteral supplied AKG has a low availability (8 %) for liver and peripheral tissues in pigs. Thus a large fraction of AKG is probably metabolized within the digestive tract or in the intestinal mucosa.

Key Words: Alpha-ketoglutaric acid, Digestive absorption, Pigs

1331 The change of growth performance and carcass characteristics in finishing pigs treated with N-methyl-d,l,-aspartate(NMA). Gang Xi*[1], Zirong Xu[2], and Ping Xiao[2], [1]*University of Minnesota, St. Paul, MN,* [2]*Zhejiang University, Hangzhou, China.*

A total of 84 cross bred finishing pigs (average initial BW of 56±0.37 kg) were used to determine the effect of dietary N-methyl-d,l,-aspartate(NMA) on growth performance and carcass characteristics. There were 14 pigs (7 gilts and 7 barrows) per pens and 3 pens for each treatment. Treatments were: 1) corn-soybean meal without NMA; 2) added 50 mg/kg NMA to the diet. All pigs were given free access to feeds and water. After feeding trial, 8 pigs from each treatment (4 gilts and 4 barrows) were sacrificed to determine the carcass traits. The addition of NMA in diet improved the ADG 9.31% (p<.01) and the G/F 7.66% (p<.02) in finishing pigs. No difference was observed in ADFI between two treatments. Pigs fed NMA had 6.54% higher (p<.01) carcass lean proportion and 21.01% larger (p<.04) longissimus muscle area(LMA) compared to pigs fed the control meal. In addition, the carcass fat proportion of NMA treated pigs was 11.76% lower (p<.01) and back fat depth (10th rib) was 19.72% less (p<.01) than that of pigs without NMA in diet. There were no differences in dressing percentage, carcass skin proportion, and carcass bone proportion between two treatments. The weight of longissimus muscle, biceps femoris, and Semimembranosus were improved with 12.30% (p<.01), 10.09% (p<.01) and 14.44% (p<.01), respectively, with addition of NMA in diet, but no differences were found in quadriceps femoris and semitendinosus. Also, there were no differences in weight percentage of brain, heart, liver and kidney between two treatments. These results suggest that addition of 50 mg/kg NMA in diet will improve the ADG, G/F and increase muscle production and reduce the accretion of body fat in finishing pigs.

Key Words: NMA, Growth Performance, Carcass Characteristics

1332 Response of weanling pigs to dietary lysine sulfate fermentation product or L-lysine·HCl supplementation. B. R. Frederick* and E. van Heugten, *North Carolina State University, Raleigh.*

Two trials involving a total of 192 weanling pigs, 7.3 and 6.6 kg initial BW for trial 1 and 2 respectively, were conducted to determine the effect of a lysine·SO_4 fermentation product (Biolys®60, containing 46.8% free + 0.5% protein bound L-lysine) on pig performance. In each trial, 96 pigs (4 pigs/pen) were weaned and fed a commercial, prestarter diet for 8 d in trial 1 and 5 d in trial 2 to ensure adequate dietary adjustment to solid food. At that time pigs were allotted by weight to one of three lysine supplementation treatments: 1) control containing 0.90 and 0.70% lysine for the prestarter and starter period, respectively, 2) control with 0.20% lysine from L-lysine·HCl, or 3) control with 0.20% lysine from lysine·SO_4 product. Diets contained 110% of the ideal amino acids:lysine ratio and were iso-nitrogenous and iso-energetic within each period. Pigs consumed the prestarter, experimental diets for 7 d and 14 d and the starter, experimental diets for 24 d and 21 d in trial 1 and 2, respectively. Pigs were allowed free access to feed and water for the duration of the study. Data were analyzed as a randomized complete block design blocked by weight and pen was used as the experimental unit. Pigs fed the lysine-supplemented diets consumed more feed (P < 0.001) than control pigs, 814 vs 675 20 g/d in trial 1 and 520 vs 435 ± 17 g/d in trial 2, respectively. Lysine supplementation increased average body weight gain (P < 0.001) compared to the control, 457 vs 320 ± 11 g BW gain/d in trial 1 and 315 vs 226 ± 11 g BW gain/d in trial 2, respectively. Furthermore, lysine supplementation improved efficiency of feed utilization (P < 0.001) compared to the control, 563 vs 478 ± 8 g BW gain/kg feed intake in trial 1 and 607 vs 519 ± 8 g BW gain/kg feed intake in trial 2, respectively. However, feed intake, body weight gain, and efficiency of feed utilization did not significantly differ (P > 0.05) between L-lysine·HCl and lysine·SO_4 product treatments for the duration of both trials. Therefore, lysine·SO_4 product is a possible alternative to L-lysine·HCl in commercial, weanling pig diets.

Key Words: Pig, Lysine, Sulfate

1333 Effects of dietary supplementation of crystalline L-glutamine on the gastrointestinal tract and whole body growth in early-weaned piglets fed corn and soybean meal-based diets. D. Lackeyram*[1], X. Yue[1], and M.Z. Fan[1], *University of Guelph, Guelph, Ontario, Canada.*

This experiment was conducted to examine the effect of dietary supplementation of crystalline L-glutamine on the gastrointestinal tract and whole body growth in early-weaned piglets. A total of 36, 10-d old piglets with an average initial BW of 3.5 kg were used. Piglets were blocked by replication time, equalized for gender and allocated randomly to one of four dietary treatments in a randomized complete block design. Piglets were housed individually in an environmentally controlled room at 25 degrees Celsius with heating lamps in rubberized-floor pens. The control diet (GC) (n=18) contained 56% soybean meal and 16% corn and was formulated to meet NRC (1998) requirements for all nutrients. Three treatment diets (n=6) were formulated by supplementing the control diet with crystalline L-glutamine at the level of 0.8 (Gln1), 1.6 (Gln2), and 2.4% (Gln3), respectively. Diets were fed for a period of 12-d and piglets were allowed free access to feed and water. Piglets weaned on the Gln1 diet had a 59% greater *($P \leq 0.01$)* BW gain than the control group (92.4 ± 16.1 vs. 57.9 ± 10.9 g/d), whereas piglets fed the Gln2 and Gln3 diets did not differ *($P \geq 0.01$)* from the GC-fed animals. Piglets fed the Gln1 diet had heavier *($P \leq 0.01$)* stomachs than the control animals (0.61 ± 0.05 vs. 0.45 ± 0.04 g/kg BW/d). A 53 and 74% increase ($P \leq 0$ .01) in the weights of the small intestine in piglets fed the diets Gln1 and Gln2 were observed (1.10 ± 0.13 and 1.25 ± 0.14 vs. 0.72 ± 0.17 g/kg BW/d) respectively. Similar increases *($P \leq 0.01$)* in liver weight gains were observed between the GC and the Gln1, Gln2 and Gln3 groups (-0.04 ± 0.09 vs. 0.48 ± 0.21; 0.44 ± 0.16 and 0.22 ± 0.17 g/kg BW/d). These results suggest that the inclusion of crystalline L-glutamine at a level of 0.8% in corn soybean meal-based diets is effective in enhancing the BW gain, the small intestine growth and other visceral organ growth in early-weaned piglets, however the level of supplementation higher than 1.6% did not induce such effects.

Key Words: L-Glutamine , The gastrointestinal tract growth, Early-weaned piglets

1334 The performance and protein ,amino acid and phosphorus utilization of piglets were improved by phytase supplementation. Keying Zhang*, Daiwen Chen, Bing Yu, Xianmei Luo, and Yongyi Li, *Institute of Animal Nutrition, Sichuan Agricultural University,Yaan,Sichuan 625014,PR.China.*

Efficacy of phytase in improving utilizations of dietary protein and amino acids needs to be further investigated. In this study, forty eight Yorkshire x Landrace were used in two balance trials to study the performance and nutrient utilizations of 40-days-old pigs fed diets with or without supplementation of microbial phytase at the dose of 500 units per kg diet. In trial one, phytase was added into diets of normal available phosphorus (AP) (0.36%) or low level AP(0.26%).The decrease of AP from 0.36% to 0.26% resulted in the decrease of average daily gain (ADG), feed intake (FI) and feed conversion rate (FCR) by 17.2,7.4% and 11.2 respectively (P<0.01). ADG,FI and FCR were improved by 10.8%, 6.5% and 3.5% respectively after the addition of phytase (P<0.05). The improvement was greater for phytase addition into 0.26% AP than into 0.36% AP. The supplementation of phytase in 0.36%-AP diet did not affect the digestibilities of phosphorus(P)protein (CP) and amino acids(AA), and the retention of P. But CP biological value (BV) was improved by 3.3(P<0.05). However, phytase in 0.26%-AP diet improved P digestibility, P retention and BV of CP by 12.8,13.1 and 16.0 respectively(P<0.05). In trial two, two diets were designed with same AP (0.26%) but different lysine level (0.97% vs 0.92%). The decrease of lysine from 0.97% to 0.92% reduced ADG, FCR (p<0.01), and BV of CP (54.7% vs 51.5%)(P<0.1), but enhanced essential AA ileal digestibility p<0.05. The addition of phytase improved ADG and FCR (p<0.01),P digestibility and retention (P<0.01), BV of CP (p<0.25) and lysine ileal digestibility(p<0.25), with greater improvement at higher than lower dietary lysine level. It is concluded that dietary supplementation of 500U phytase /kg can significantly improve the performance of piglets and the utilizations of phosphorus and protein. The extent of improvement is affected by the dietary phosphorus and lysine level.

Key Words: Phytase , Nutrient Utilization , Piglets

1335 Metabolic adaptation to synthetic feed and different amino acid patterns. J. A. Nolles, V. V. A. M Schreurs, R. E. Koopmanschap, and M. W. A. Verstegen*, *Wageningen Institute of Animal Sciences (WIAS)*.

Metabolic adaptation to free amino acids as well as to 3 different methionine (MET) levels in the feed was studied in 36 male Wistar rats, assigned to 6 groups with 3 different dietary groups. The dietary groups were subdivided in an adaptation and a nonadaptation group. All diets contained 21% free amino acids. The pattern was equal to casein protein, accept for MET. Diet 1; MET level 50%, diet 2; 100% and diet 3; 200%. Postprandial oxidation of 1-^{13}C-methionine (13MET) was measured during 5 hours after a meal (t_0 = start meal, t in min) by recovery of ^{13}CO2 in the breath, expressed as rate % dose/30 min or cumulative % dose. For each diet, the nonadaptation group was tested after 5 days, the other group was tested after an adaptation period of 3 weeks. Incorporation of 13MET in several tissues was measured at t = 300, expressed as At % excess. Statistical analysis; t-test with Bonferoni correction. Nonadaptation groups: There was no difference in the oxidation rate between the 100% and the 50% group at t = 150 (2.4 0.27 vs 2.3 0.47 % doses/30 min). The 200% group was significantly higher (peak value 3.6 % doses/30 min 0.38, on t = 150). Our results indicate that percental oxidation rate in time of MET remains equal under normal and low MET supply. Only extreme high levels (200% group) cause an accute raise in oxidation. Adaptation to the diets caused a time lag of 60 minutes for maximal oxidation rate in all dietary groups. However the peak and the cumulative values did not change for the 100% (2.6 0.15 at t = 210, cumulative 20.3 0.51) and the 200% (3.5 0.10 at t = 210, cumulative 27.1 0.80) groups. Only the 50% group had a lower peak (1.6 0.12 at t = 210) and cumulative oxidation (11.8 0.44) after the adaptation period. Tissue samples of all organs showed that the incorporation of MET was the highest in the 50% group. The most pronounced result of this experiment was the adaptation effect on organ level. In general after the adaptation period 10 to 20% more 13MET was incoporated in all dietary groups. However the longissimus showed for all groups an increase of 40 to 50%. We therefore concluded that muscles play an important role in adaptation to different amino acid patterns in the feed.

Key Words: Breath-test, Adaptation, Amino Acids, Methionine, Protein Metabolism

1336 Cysteine and sulfite enhance reduction of trypsin inhibitor during heating of soybeans. Y.X. Huang and E.L. Miller*, *Department of Clinical Veterinary Medicine, University of Cambridge*.

Heat treatment of soybeans is a compromise to reduce trypsin inhibitor without causing protein damage. The objective was to determine whether sulfitolysis of disulfide bonds with cysteine or sulfite reduces trypsin inhibitor (TI) content of soya and can reduce the extent of heat treatment needed for reduction of TI. Dehulled soybeans were ground and extracted with petroleum spirit and adjusted to moisture of 100, 140, 180, 220 g/kg. The initial TI was 65 mg/g DM and 4.84 (SD 0.043) mmole/kg DM reactive SH determined with 4,4'-dithiodipyridine. Samples (4 g) of extracted soya were heated in screw cap test tubes at 99C for 5 minutes to rapidly bring the sample to temperature and then heated 10, 20, 40 and 60 minutes at 95C. TI decreased very little at 100 g/kg moisture but more rapidly with increased moisture. Reactive SH groups followed a similar pattern. TI was related exponentially to SH (TI mg/g = $0.2124e^{1.1512x}$; r 0.923) where x is SH mmole/kg. Urease activity (pH change) was linearly related to SH (y = 0.6699SH -1.2458; r 0.939). The rate of loss of TI under each moisture condition was determined as a second order reaction (reciprocal of TI v time plot). The moisture-adjusted soya was mixed with sodium metabisulfite (S) at the rate of 11.8 g/kg DM or with cysteine (C) at 15 g/kg DM, each supplying 0.25 mole SH per kg protein, and heated as for soya alone. Unreacted S or C were removed by washing and centrifugation over a 10,000 dalton membrane. Addition of C and S increased reactive SH. Values (mmole/kg DM) at 220 moisture for soya: 4.80, 4.48, 3.84, 3.57, 2.82; S 6.04, 7.39, 8.17, 6.19, 4.07; C 7.34, 10.49, 8.25, 11.99, 4.31 at 0, 10, 20, 40, 60 min. Addition of C did not increase loss of TI at 100 or 140 g/kg moisture but increased the rate of loss 1.9 and 3.3 times at 180 and 220 g/kg moisture. S was more active increasing rate of TI loss 3.0, 5.8, 6.2 times at 140, 180 and 220 g/kg moisture. Heating moist soya alone reduced reactive SH groups. Heating in the presence of S or C decreased the time to reduce TI to low levels and increased reactive SH.

Key Words: Trypsin inhibitor, Sulfhydryl, Sulfitolysis

1337 Effect of Zinc-Methionine on growth performance of Japanese quail (Coturnix coturnix japonica) fed with starting-growing diets. A. Montoya*[1], R. Barajas[1], and G. Contreras[1], [1]*FMVZ-Universidad Autonoma de Sinaloa*.

With the objective of determinate the effect of Zinc-Methionine on growth performance of Japanese quail fed with starting-growing diets, a complete randomized design experiment was conducted. Six hundred Japanese quail, one day old (male and female; BW = 10.4 g) were used. The animals were randomized divided in 12 groups of 50 quails. Each group was allocated in metalic crates with cement floor provided with wood saves. The quails were assigned to consume one of two diets in that consisted the treatment: 1) Diet with 21% CP and 3.2 Mcal DE/kg (Codoriniciarina^{TM}; PURINA MILLS, CO.) containing 40 ppm of Zn from unknown source (control); and 2) Diet similar to control, supplemented with additional 25 ppm of Zn from zinc-methionine (ZINPRO-100^{TM}; ZINPRO,CO.) designed as Zn-Met treatment. Quails were weight at starter and end of experiment (28 days), feed intake was recorded weekly, mortality were recorded daily, and animal deaths were not replaced. The data were analyzed as a complete randomized design experiment with six repetitions, taken a crate (50 quails) as one observation. Final weight was not affected (P>0.10) by treatments (mean = 193.5 g). Daily feed intake of the experiment was 18.94 g/day and a similar (P>0.10) for both treatment. The average daily gain of the experiment was 6.54 g/day, and was not influenced (P>0.10) by treatments. Zn-Met not improved (P>0.10) feed efficiency (experiment mean 0.35 kg gain/kg food). Mortality was unaffected (P>0.10) for Zn-Met supplementation (7.0 vs 6.67%). It is concluded, that supplementation with 25 ppm of Zn from Zn-Met to starting diets do not improve growth performance of Japanese quail.

Key Words: Zinc, Supplementation, Japanese quail

1338 Effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather:II. Respone under temperature-controlled in winter season. G. Contreras*[1] and R. Barajas[1], [1]*Universidad Autonoma de Sinaloa*.

To determinate the effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather under temperature-controlled in summer season, a completely randomized design experiment was conducted (four treatments; ten replicates by treatment). Thousand two hundred eighty Japanese quail (960 females and 320 males), they were divided in 160 groups of eight (six females and two males), and were allocated in wire cages (25 x 30 cm); groups of four cages (32 quails) formed an observation. The avian were randomized assigned to consume diets (21% CP; 2.9 Mcal DE/kg), in that consist the treatments, containing one of four levels (0, 100, 200 and 400 ppb) of supplemental chromium from chromium-methionine (Microplex^{TM}Zinpro,CO.MN). Mean daily feed intake by quail in the experiment was 31.7 g and was not affected (P>0.10) by treatments.The hatching was increased 12% (P<0.05) with Cr 100 ppb treatment. Percentage of egg hatching was not affected (P>0.10) by treatments (74%). Level of 100 ppb of Cr increased (P<0.05) in 22% the number of newly born quails by day (103 vs 84) with respect to zero Cr level, cubic effect (P<0.05) of Cr-Met supplementation was found (84, 103, 88 and 92 newly born quails for 0 to 400 ppb of Cr in diet). Hatchability in Cr-400 was higher (P<0.05) than control (64.8 vs 74%), a linear effect of chromium was detected (P<0.05). The weight of newly born quail was diminished (P<0.05) by chromium levels of 100 and 200 ppb with respect of Cr 0 ppb treatment, a quadratic (P<0.01) effect of chromium was observed, with values of 10.17, 9.82, 9.7 and 10.12 g for chromium levels of 0, 100, 200 and 400 respectively. It is concluded, that 100 ppb of supplemental Cr from Cr-Met, improve hatching and newly born quails by day of Japanese quail in dry tropic weather under temperature-controlled in winter season.

Key Words: Japanese quail, Chromium, Hatchability

1339 Effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather:I. Respone under temperature-controlled in summer season. G. Contreras*[1] and R. Barajas[1], [1]*Universidad Autonoma de Sinaloa*.

To determinate the effect of chromium-methionine level in diet on hatchability of Japanese quail in dry tropic weather under temperature-controlled in summer season, a completely randomized design experiment was conducted. Thousand two hundred eighty Japanese quail (960 females and 320 males), they were divided in 160 groups of eight (six females and two males), and were allocated in wire cages (25 x 30 cm); groups of four cages (32 quails) formed an observation. The avian were randomized assigned to consume diets (21% CP; 2.9 Mcal DE/kg), in that consist the treatments, containing one of four levels (0, 100, 200 and 400 ppb) of supplemental chromium from chromium-methionine (Microplex^{TM}Zinpro,CO.MN). Chromium 100 ppb increased (P<0.05) the average daily feed intake with relation of the remainder treatments (36.9 vs 36.3 g/day). The hatching was not affect (P>0.20)by treatments (mean value = 78%); egg hatching was similar (P>0.20) across treatments (66%). Supplementation with level of 100 ppb of Cr increased (P>0.05) in 19% the number of newly born quails by day (81 vs 68), and hatchability in 22% (55 vs 67.5%) with respect to control (Cr 0 ppb). Levels of 200 and 400 ppb tended (P=0.11) to decrease in 18% the number of newly born quails by day (68 vs 56) respect to control. Chromium 200 and 400 ppb had similar (P>0.20) hatchability than control (55 vs 46%). It is concluded, that 100 ppb of supplemental Cr from Cr-Met, improve hatchability and newly born quails by day of Japanese quail in dry tropic weather under temperature-controlled in summer season.

Key Words: Japanese quail, Chromium, Hatchability

PSA Nutrition: Amino Acids, Feed Ingredients, and Feed Processing

1340 Digestible lysine levels in the diets of broilers from 1 to 21 days of age. L. F. Araujo*[1], O. M. Junqueira[1], C. S. S. Araujo[1], and S. M. Baraldi Artoni[1], [1]*Universidade Estadual Paulista - UNESP/Jaboticabal - SP - Brazil*.

The purpose of this experiment was to evaluate different levels of digestible lysine on performance of chickens from 1 to 21 days of age. A total of 1000 one day-old chicks was fed diets with 5 levels of digestible lysine (1.18%; 1.30%; 1.42%, 1.54% and 1.66%) in four replications of 50 birds each. The same ideal relationship of Lis:Met+Cis:Met:Thr (100:71:39:63)was maintained in all diets. The basal diet was formulated according to the recommendations of Rostagno et al. (2000) with 3,100 kcal ME/kg and 22% crude protein. At 21 days of age, the best results were observed in broilers fed the diet containing 1.18% digestible lysine. As the level of digestible lysine increased in the diet, there was a reduction in feed intake, affecting weight gain. So that, the 1.66% level of digestible lysine produced lower weight gain and poorest feed conversion. From the results obtained in this experiment, it is possible to conclude that 1.18% digestible lysine is enough to maintain the requirements of broilers from 1 to 21 days of age. Financial Support: FAPESP. Proc. 98/06355-3

Key Words: Broilers, Lysine, Performance

1341 Dietary crude protein levels needed for broilers from three to six weeks of age as influenced by gender. Q. Jiang*, C. A. Fritts, and P. W. Waldroup, *University of Arkansas*.

Development of crystalline amino acids have allowed for a reduction in overall crude protein content in broiler diets. However at some point performance declines even though all nutrient recommendations are provided. The objective of this study was to determine the minimum level of CP that might be needed by broilers from three to six weeks of age. Because some studies have suggested that males and females may differ in their response to CP or amino acids, separate sex feeding of diets with different levels of crude protein was examined. Diets were formulated using corn and soybean meal of known composition to provide diets with 15 to 20% CP in increments of 1%. Crystalline amino acids were used to provide at least 100% of NRC (1994) recommendations. Dietary electrolyte balance was maintained at a minimum of 200 meq/kg. From one to 21 d of age chicks were fed 24% CP and then placed on test diets from 21 to 42 d. Body weight gain and feed conversion were determined and samples of birds processed at 42 d. Four pens of 25 males and four pens of 25 females were fed each CP level. Although males differed significantly from females in BW gain or feed conversion there were no significant interactions of gender and CP level. Diets with 17% supported BW and FCR that did not differ from that of birds fed diets with higher levels; lower CP levels resulted in a significant reduction in performance. Females had a higher percentage of breast meat and greater amounts of abdominal fat than males but there were no interactions between dietary CP and gender for any parts yield. A CP level of 17% supported breast yield equal to that of higher levels.

Key Words: Crude protein, Gender, Carcass yield

1342 mRNA that encode for proteins capable of transporting L-methionine and/or dl-2-hydroxy-4-(methylthio) butanoic acid are present in the intestinal epithelium of broilers. Y-X. Pan*[1], E. A. Wong[1], J. J. Dibner[2], and K. E. Webb, Jr. [1], [1]*Virginia Tech, Blacksburg, VA,* [2]*Novus International, Inc., St. Charles, MO*.

The presence of mRNA that encode for proteins capable of transporting L-methionine (L-Met) and/or dl-2-hydroxy-4-(methylthio) butanoic acid (HMB) in broiler intestinal epithelium was examined. Total RNA was extracted from duodenal, jejunal, and ileal epithelium collected from male broilers (42 d old, BW 2.03 kg). Poly(A)$^+$ RNA was isolated and size-fractionated by sucrose-gradient centrifugation when needed. Healthy oocytes at stage V-VI were collected from *Xenopus laevis* and then microinjected with either water, poly(A)$^+$ RNA, or size-fractioned poly(A)$^+$ RNA. The ability of the injected oocytes to uptake either L-Met or HMB was examined by incubating oocytes with [^{3}H]-L-Met or [^{14}C]-HMB 3-6 d post-injection. A greater uptake of L-Met ($P < 0.001$) and HMB ($P < 0.05$) by oocytes injected with poly(A)$^+$ RNA from all three segments of the small intestine was observed compared with water-injected oocytes. The greatest ($P < 0.05$) uptake occurred when poly(A)$^+$ RNA from the jejunum or ileum were injected. Injections from four different pools of sucrose gradient-fractionated poly(A)$^+$ RNA from all three intestinal segments induced more ($P < 0.01$) L-Met uptake than did water injection. There were three, four, and four different pools of sucrose gradient-fractionated poly(A)$^+$ RNA from the duodenum, jejunum, and ileum, respectively, that induced more ($P < 0.05$) HMB uptake than did water. Uptake of HMB was greater at pH 5.5 than at pH 7.5 and was independent of Na^+. Uptake of L-Met induced by all four poly(A)$^+$ RNA pools decreased dramatically when Na^+ was removed from the uptake buffer, which indicated that the majority of L-Met uptake was Na^+-dependent. These results indicate that there are multiple mRNA that encode for proteins capable of mediated transport of L-Met and/or HMB present in broiler intestinal epithelium.

Key Words: *Xenopus*, Chicken, Absorption

1343 Effects of amino acids and calcium levels on radiographic density and calcium excretion in broilers from 1 to 21 days of age. C. S. S. Araujo*[1], S. M. Baraldi-Artoni[1], L. F. Araujo[1], M. J. Q. Lousada[2], and O. M. Junqueira[1], [1]*Universidade Estadual Paulista - UNESP/Jaboticabal - SP - Brasil,* [2]*Universidade Estadual Paulista - UNESP/ Araatuba - SP - Brasil*.

An experiment was conducted in broilers to determine the effects of amino acids (AA) and calcium (Ca) levels on bone development and calcium excretion from 1 to 21 days of age. A total of 540 one-day old Avian Farms male chicks were randomly assigned to 6 treatments in a 3x2 factorial arrangement, considering the factors AA levels (100, 125 and 150% NRC, 1994) and Ca levels (75 an 100% NRC, 1994), in three replications and 30 birds each. The AA analyzed were methionine, lysine and threonine. Diets and water were available free choice. Experimental diets were comprised primarily of corn and soybean meal and were formulated to be isocaloric and isoproteic. Requirement levels for AA were accomplished when necessary by adding crystalline AA. Bone development was determined through radiographic density and tibia variables (tibia weight, tibia length, compact bone thickness and spongy bone