T74 Divergent selection for blood serum insulin-like growth factor I concentration does not change age of Angus heifers at puberty. A. Yilmaz[1], M. E. Davis*[1], and R. C. M. Simmen[2], [1]*Department of Animal Sciences, The Ohio State University,* [2]*Department of Animal Science, University of Florida.*

The objective of this study was to determine effects of divergent selection for blood serum insulin-like growth factor I **(IGF-I)** concentration on age of heifers at puberty. Data were obtained from an ongoing divergent selection experiment involving Angus beef cattle at the Eastern Ohio Resource Development Center. Selection was based on the mean IGF-I concentration of three blood samples taken at d 28, 42, and 56 of the 140-d postweaning test, which were abbreviated as **IGF28**, **IGF42**, and **IGF56**, respectively. Data were analyzed using SAS. All models used in the analysis included line-season and the random effect of sire nested within line-season. Age of dam and on-test age of calf were added to the models as a fixed effect and a covariate, respectively. Blood samples were collected weekly for 17 wk from 61 heifers in each of the fall- and spring-calving groups during the postweaning test period. Mean on-test age of heifers in the spring- and fall-calving groups were 260 and 265 d, respectively. Progesterone concentration was determined using RIA. Puberty was assumed attained if the progesterone concentration exceeded 2 ng/mL in a single or 1 ng/mL in two consecutive blood samples. Age at puberty was obtained by subtracting 7 d from the first date progesterone exceeded 1 or 2 ng/mL. Ten heifers (five high and five low line) did not attain puberty during the period in which blood samples were collected. Higher mean IGF-I concentration in the high line heifers (50.0 10.2 ng/mL; $P < 0.004$) did not result in a change in age at puberty (2.5 6.2 d younger in high line; $P = 0.71$). Mean age at puberty was 356 d. Residual correlations of age at puberty with IGF28, IGF42, IGF56, and mean IGF-I were -0.27 ($P = 0.10$), -0.20 ($P = 0.24$), -0.31 ($P = 0.06$), and -0.27 ($P = 0.10$), respectively. Cubic relationships were observed between age of heifers at puberty and IGF-I concentrations ($P = 0.0009$, 0.06, 0.08, and 0.003 for the cubic regression of age of heifers at puberty on IGF28, IGF42, IGF56, and mean IGF-I, respectively). These results suggest that changes in IGF-I concentration are not associated with changes in age of heifers at puberty, but some phenotypic relationships exist between these two variables.

Key Words: Insulin-like Growth Factor I, Age at puberty, Selection

T75 Effectiveness of performance testing for beef carcass traits to use embryonic cloning technique in Wagyu. K. Kuchida*[1], M. Ogasawara[1], S. Hidaka[1], T. Sakai[2], A. Minamihashi[2], and Y. Yamamoto[2], [1]*Obihiro University of A&VM, Obihiro-shi Japan,* [2]*Hokkaido Animal Research Center, Shintoku-cho Hokkaido Japan.*

Embryonic cloning can be a technique for producing multiple offspring from one embryo and can be used for a diverse range of comparative trials and performance tests. Embryonic clone testing could shorten the generation interval of traditional progeny testing and lead to efficiency of genetic improvement. The objective of this study were to investigate similarities for shape of muscle, fat area ratio to the muscle area (FATPER), and coarseness of marbling particle with computer image analysis on the quadruplets and quintuplets derived from each embryo, and on two sets of traditional progeny testing. Blastomeres obtained from Japanese Black donors were collected, and male clones were produced by cell fusion with electro-stimulation using enucleated oocytes from ovaries of Holsteins. Four and five clones were fattened with the method of Wagyu progeny testing until 21 months. Eight and nine half-sib steers from two sets of progeny testing were treated as control. The areas of *M. longissimus dorsi, M. trapezius, M. rhomboideus, M. semispinalis capitis, M. semispinalis dorsi, M. anterior serratus* and *M. iliocostalis* at the 6th and 7th rib, and FATPER of those muscles were measured by image analysis. Coarseness of marbling particles of *M. longissimus dorsi* was calculated by image analysis method. The ranges of carcass weight (CWT) and area of *M. longissimus dorsi* (RIBEYE) for two sets of embryonic clones were 369 to 435 kg and 336 to 393 kg, and 48.2 to 63.6 cm^2 and 38.5 to 50.4 cm^2, respectively. The ranges of CWT and RIBEYE for two sets of traditional progeny testing were 312 to 406 kg and 277 to 392 kg, and 38.0 to 54.8 cm^2 and 35.0 to 47.2 cm^2, respectively. This indicates that the degree of similarities for CWT and RIBEYE between embryonic clone steers were not high. The ranges of FATPER of *M. longissimus dorsi* were 35.0 to 37.6 % and 27.2 to 28.4 % for two sets of embryonic clones, and those for two sets of traditional progeny testing were 22.6 to 45.3 % and 25.4 to 40.9 %. This shows that the similarity of FATPER of *M. longissimus dorsi* on embryonic clones was high compared with that on half-sib progeny. The same trend was recognized for other muscles. Low similarity was recognized for the coarseness of marbling particles on embryonic clones as well as on half-sib steers.

Key Words: Embryonic clone, Wagyu, Image analysis

T76 Effect of calving difficulty on cow survival. S. McClintock*[1], J. Morton[2], K. Beard[3], and M. Goddard[1,4], [1]*University of Melbourne,* [2]*Department of Primary Industry,* [3]*Australian Dairy Herd Improvement Scheme,* [4]*Victorian Institute of Animal Science.*

Cow loss following different degrees of dystocia, and its associated cost was estimated for Australian Holstein-Friesian cows, for use in the calculation of the economic weights for bull breeding values for dystocia. Cow termination (i.e. non-survival through culling or death) due to the effects of dystocia was considered over two periods: before or after 21 days post partum. Two cost outcomes, death or sale, were considered. Separate estimates were made for primiparous and multiparous cows. Any degree of dystocia increased both the short and long-term likelihood of cow termination for all cows. Increasing severity of dystocia increased the likelihood of termination. Termination rates increased from early to late lactation for cows requiring surgery. Average cow loss cost was estimated to be A$1,071 for periparturient termination and A$713 for termination after 21 days. Termination patterns for cows with and without dystocia were not the same. Cows that had dystocia were more likely to be terminated early in the lactation or before a lactation record was initiated.

Key Words: Dystocia, Cost, Holstein-Friesian

Nonruminant Nutrition

T77 Effects of supplemental pantothenic acid during all or part of the grow-finish period on growth performance and carcass composition. J.S. Radcliffe*, B.T. Richert, L. Peddireddi, and S.A. Trapp, *Purdue University, West Lafayette, IN.*

Ninety barrows and 90 gilts were used in a 15-wk experiment to study the effects of supplementing pantothenic acid (PA) to the diet during all or part of the grow-finish period. Pigs were blocked by sex and weight (initial BW=29 kg), randomly assigned to pens (30 pens, 6 pigs/pen), and fed four phases of split-sex diets during the grow-finish period. Treatments included: 1) Control (13.2 ppm PA), 2) Control + 30 ppm PA added in the grower and finisher phases, and 3) Control + 30 ppm PA added in the finisher phases only. Pig BW and pen feed intake were recorded biweekly. Ultrasonic scans of tenth rib loin eye area (LEA) and backfat thickness were performed at 4-wk intervals on 3 pigs/pen. At the end of the experiment, pigs were harvested at a commercial slaughter facility and individual hot carcass weights, Animal Ultrasound System (AUS) backfat, and loin muscle depths (LMD) were recorded. There were no treatment x sex interactions (P>.10), and therefore, only the main effects of treatment are presented. Supplementation of PA did not affect (P>.10) ADG or feed efficiency. Overall ADFI was higher (P<.05) for pigs fed PA during the finisher phase only compared to pigs fed PA during the grower and finisher phases. However, overall ADFI was not different between the PA treatments and control fed pigs. Ultrasound LEA were larger (P<.003) at the end of the grower phase for pigs fed diets supplemented with PA. However, there were no differences (P>.10) in LEA at the end of the experiment. Tenth rib and last rib ultrasound backfat depths were not different (P>.10) between control fed pigs and PA supplemented pigs. Tenth rib carcass fat depths were numerically lower for pigs fed diets with supplemental PA, but differences were not significant (P>.10). Likewise, there was no effect of PA supplementation on carcass tenth rib LMD (P>.10). Carcass lean percent tended to be higher for pigs fed PA during the growing and finishing periods compared to control fed pigs. However, carcass weights were approximately

2.0 kg lighter (P<.05) for pigs fed supplemental PA during the grower and finisher periods compared to control fed pigs.

Key Words: Pig, Pantothenic acid, Growth

T78 Effect of supplemental *myo*-inositol in diets for weanling pigs. S. E. Crowe*, K. R. Roneker, M. Villa-Garcia, and X. G. Lei, *Cornell University, Ithaca, NY USA*.

Myo-inositol was considered an essential nutrient in 1950s and plays vital roles in metabolism. It is still unclear whether fast-growing animals such as young pigs could synthesize sufficient *myo*-inositol in the body to meet their physiological needs. The objective of this experiment was to determine whether supplementing pure *myo*-inositol in the diets for young pigs could improve their growth performance. A total of 24 weanling pigs (3-wk old, 7.1 kg body weight) were divided into three groups (n = 8) and fed a corn-soybean meal based diet supplemented with myo-inositol (99% pure) at 0, 400, or 800 mg/kg of feed. Individual growth performance including average daily gain, average daily feed intake, and gain to feed ratio, and plasma inorganic phosphorus concentrations were monitored weekly for 4 wk. Examination revealed no significant difference among the three treatment groups in either growth performance or plasma inorganic phosphorus concentrations. In conclusion, addition of *myo*-inositol to the corn-soybean meal diets for weanling pigs at 400 or 800 mg/kg did not appear to provide a beneficial effect over the control diet.

Key Words: *Myo*-inositol, Pig, Supplement

T79 Influence of dietary δ-Aminolevulinic Acid on growth performance and skin color in weaned pigs. J. W. Hong*[1], I. H. Kim[1], B. J. Min[1], O. S. Kwon[1], J. H. Lee[2], J. H. Kim[3], W. B. Lee[1], and K. S. Son[1], [1]*Department of Animal Resource & Sciences, Dankook University,* [2]*Easybio System, Inc., Seoul, Korea,* [3]*Agribrands Purina Korea, Seoul, Korea*.

A total of ninety six pigs (7.12±0.03kg average initial body weight) were used in a 28-d growth assay to determine the effects of dietary δ-aminolevulinic acid on growth performance and skin color in weaned pigs. Dietary treatments included 1) NC (without antibiotic), 2) PC (NC diet + 110ppm neomycin and oxytetracycline), 3) NCALA (NC diet + 0.1% δ-aminolevulinic acid) and 4) PCALA (PC diet + 0.1% δ-aminolevulinic acid). For d 0 to 14, average daily gain, average daily feed intake and gain/feed were not significantly different among the treatments. For d 14 to 28, pigs fed antibiotic diets (PC and PCALA) had higher average daily gain than pigs fed diets without antibiotic(NC and NCALA) with significant difference (P<0.03). For overall period, pigs fed antibiotic diets (PC and PCALA) grew faster than pigs fed diets without antibiotic(NC and NCALA) (P<0.05). However, pigs fed δ-aminolevulinic acid diets (NCALA and PCALA) had greater average daily gain compared to pigs fed without δ-aminolevulinic acid diets (NC and PC). The a∗-values(redness) of the skin color was increased by dietary δ-aminolevulinic acid (P<0.01). In conclusion, the results obtained from this feeding trial suggest that the dietary δ-aminolevulinic acid was an effective means of improving a∗-values of the skin color in weaned pigs.

Key Words: δ-Aminolevulinic acid, Performance, Pigs

T80 Selenium and measures of oxidative stress in the developing porcine fetus. C. E. Hostetler* and R. L. Kincaid, *Washington State University*.

To investigate the role of selenium (Se) in the developing porcine fetus, pre-pubertal gilts (n = 42) were randomly assigned to either Se adequate (0.39 ppm Se) or Se deficient (0.05 ppm Se) gestation diets 6 wk prior to breeding. Gilts were humanely killed at d 10, 20, 30, 45, 70 and 90 of pregnancy, and at term (d 114), for collection of maternal and fetal liver. Concentrations of Se in maternal blood and liver decreased (P < .05) during gestation in sows fed the low Se diet. Activity of cellular glutathione peroxidase (GPx) was decreased (P < .05) at d 30 and 45 in sows fed the low Se diet. Concentrations of total lipid peroxides (LPO) and hydrogen peroxide (H_2O_2), measures of cellular damage, were greater (P < .05) in liver homogenates from sows fed the low Se diet. The concentration of Se in the whole fetus was not affected by maternal diet, but fetal liver Se decreased (P < .05) if sows were fed the low Se diet. GPx activity in fetal liver was not affected by maternal diet; however, concentrations of LPO and H_2O_2 in fetal liver were greater (P < .05) in fetuses from sows fed low Se diet. Liver of sows fed the adequate Se gestation diet had greater (P < .01) concentrations of Se throughout gestation compared to fetal liver. These results indicate that maternal dietary Se intake affects fetal liver Se concentration and feeding low Se gestation diet increases oxidative damage to the fetus as measured by fetal liver hydrogen peroxide and total lipid peroxides.

Key Words: Trace element, Antioxidant, Pig

T81 WITHDRAWN. , .

T82 Effect of chromium methionine supplementation on egg size and serum concentration of glucose, protein, ferritin and iron in breeders of Japanese quail. G. Contreras*, L. García, A. Montoya, and R. Barajas, [1]*FMVZ-Universidad Autónoma de Sinaloa (México), Culiacan*.

To determinate the effect of chromium methionine supplementation on egg size and serum concentration of glucose, protein, ferritin and iron in breeders Japanese quail. In a complete randomized design experiment, six hundred forty Japanese quail (160 males and 480 females; 15 week old), were used. The animals were allocated in a controlled temperature barn. Groups of eight quails (2 males and 6 females) were placed in metal wire cages. Groups of 20 cages were randomly assigned to consume one of four diets in that consists the treatments: 1) Diet with 21% of CP and 2,900 Kcal of ME/kg (control); 2) Diet supplemntated with 100 μg/kg of Cr from chromium methionine (Cr100); 3) Diet supplementated with 200 μg/kg of Cr (Cr200); and 4)Diet supplementated with 400 μg/kg of Cr (Cr400). To obtain egg measurements, 560 eggs were collected from day 14 to 21. At 21 days the quail were slaughtered and blood samples were taken. Analysis for glucose, protein, ferritin and iron were performed. The Cr200 increased (P<0.05) feed intake (27.99 vs. 29.07 g/d). The Cr supplementation at any level decreased (P<0.05) the glucose concentration in blood, with values of 318, 231, 198, and 190 mg/dL for control, Cr100, Cr200, and Cr400, respectively. Protein in blood was increased (P<0.05) by Cr supplementation with values of 4.0, 5.63, 4.98, and 5.08 g/dL for control, Cr100, Cr200, and cr400, respectively. The Cr100 increased (P<0.05) ferritin blood concentration with respect to control diet (0.51 vs. 2.14 ng/mL). The concentration of iron in blood (1,085 μg/dL) was not affected (P>0.05) by treatments. Egg length was increased (P<0.05) by Cr100 and Cr200 (3.48 vs. 3.45 cm). Weight of egg (13.94 g), and width (2.72 cm) were not affected (P>0.05) by treatments. It is concluded, that chromium methionine supplementation modifies some blood metabolites in Japanese quail breeders.

Key Words: Chromium, Ferritin, Japanese quail

T83 Effect of chromium methionine supplementation on internal and external egg quality characteristics in Japanese quail. F. G. Ríos*, J. J. Portillo, C. Angulo, M. R. Hernández, and R. Barajas, *FMVZ-Universidad Autónoma de Sinaloa, Culiacan, México*.

To determine the effect of chromium methionine supplementation on internal and external egg quality characteristics in Japanese quail, 320 Japanese quail (240 females and 80 males), were grouped (six females and two males) and placed in metal wire cages, as part of two batteries, with five levels and four cages by level. In agreement of a complete randomized block design experiment, the animals were assigned to receive one of two treatments: 1) Diet with 21 % of CP and 2,900 kcal of ME/kg (control); and 2) Diet control but supplemented with 100 ppb of Cr from Cr-Met. During 100 weeks, 20 eggs from each treatment were collected weekly. The next measurements were weight, length, and width of eggs, dense albumin height, yolk height, and yolk color (L*a*b*), shell weight, and shell thickness. From these data, shape index, yolk index, and Haugh units were calculated. Egg weight was not affected (P>0.05) by treatments. Egg length was not modified (P>0.05) by diets. Egg width was similar (P>0.10) between treatments. Egg dense albumin height was increased (P<0.05) by chromium (5.45 vs. 5.61 mm). Yolk height and yolk color were equal (P>0.05) in both treatments. Shell weight was not affected (P>0.05) by treatments. Shell thickness was decreased (P<0.05) by chromium (0.18 vs. 0.17 mm). Haugh units were increased

(P<0.01) by chromium supplementation (0.922 vs. 0.932). It is concluded that chromium methionine supplementation improves internal quality characteristics of Japanese quail eggs.

Key Words: Chromium, Egg quality, Japanese quail

T84 Relative availability of calcium of different source for broiler chickens. E. Muniz*, A. Arruda, E. Pereira, C. Leseux, and N. Tsuzuki, *Universidade Estadual do Oeste do Parana, Brasil*.

An experiment was conducted to determine the relative bioavalaibility of calcium in carbochelate and two calcitic limestone A and B by utilizing analytical grade calcium carbonate as the standard source. The experiment was conducted in hot batteries with duration of 28 days with 12 treatments and 2 replicates for each sex with 12 chicks of the Cobb line per experimental unit. The completely randomized design with a 4 and 3 and 2 factorial arrangement was utilized. A total of 12 corn and soybean meal based rations at levels of 0.60, 0.75 and 0.90 percentage of Ca were utilized. Evaluations of pH, granulometry and solubility of the sources under study were done. To evaluate performance the ration intake, weight gain and feed conversion were determined. On the 29 day of age , two birds from each plot were slaughtered for tibia removal. The relative bioavalabilitity of Ca of the sources were determined by using as a response criteria, the percentage of tibia ashes making use of the abscissa method. Ca from carbochelate influenced negatively the broiler performance, impairing ration intake and hence weght gain, calcitic limestone were greatly similar to analytical degree CaCo3 in the evaluation of performance. There were no significant differences for sex in the performance for any source under study. For the evalution of length and diameter of tibia, it was found that this variable was a reflex of the broiler growth regardless of the factors. As the criterion percentage of ashes, it was observed that calcium carbochelate provide the broiler with a mineral deposition as efficient as those of limestones A and B. In relation to sex, male and female differed only in the criteria of percentage of bone ashs, females presenting higher mean. The relative bioavailabilities of Ca for the 3 source under study were 115, 106 and 94 percentage, respectively for Ca carbochelate, calcitic limestone A and calcitic limestone B. According to results it was concluded that although bioavalability among the sources range from 94 to 115 percentage, only carbochelate affect negatively the broiler performance indices, the other sources being similar in this variable.

Key Words: Calcium, Broiler, Nutrition

T85 The digestibility of phosphorus (P) in dicalcium phosphate in pigs. T.S. Stahly and T.R. Lutz*, *Iowa State University, Ames*.

The digestibility of dicalcium phosphate P in pigs was determined and the effects of the dietary Ca/ P regimen and stage of pig growth (10 or 30 kg BW) on its digestibility were evaluated. Pigs were self-fed diets containing .2, .3, .4, .5, .6 or .7% bioavailable P (aP, based on analyzed P x % availability [NRC, 1998] of P in each ingredient) from 7 to 32 kg BW. Fifteen sets of six littermate barrows were allotted within litter to one of six P regimens consisting of a basal, corn-soy-whey diet (.56% analyzed P) supplemented with incremental additions of dicalcium phosphate (17.94% analyzed P) at the expense of starch-limestone. Dietary calcium was either fixed in each of the 6 diets at 1.15% (1.1 to 1 Ca/total P ratio in highest P diet) or adjusted in each diet to achieve a 2.5 to 1 Ca/aP ratio. Dietary P digestibility and absorption-excretion were determined in each pig for 4 days at BW ($\pm$ 1.3 kg) of 10 and 30 kg. Digestibility of P in dical was estimated by subtracting basal diet contributions to P intakes and P absorption-excretions of each pig during each stage of growth and then regressing the daily intake of added dical P against dical derived P absorbed from the GI tract. The digestibility of dical P (slope of absorbed dical P/ intake of dical P, r^2=.89) was estimated as 68.1 $\pm$ 1.9% (inclusive of both Ca/P regimens and stages of growth). Digestibility of dical P in diets containing a fixed dietary Ca concentration (1.15%, dietary Ca/aP ratios of 5.8, 3.8, 2.9, 2.3, 1.9, and 1.6, respectively) was estimated to be 73.3 $\pm$ 5.8% (r^2=.77) and 70.5 $\pm$ 3.5% (r^2=.90) for pigs at BW of 10 and 30 kg, respectively. Similarly, digestibility of dical P in diets containing a constant 2.5 to 1 dietary Ca/aP ratio was estimated to be 72.1 $\pm$ 3.6% (r^2=.92) and 67.5 $\pm$ 4.9% (r^2=.84) for pigs at BW of 10 and 30 kg, respectively. These data highlight the opportunity/incentive for technologies aimed at improving P digestibility in P sources with relatively high (i.e. inorganic P sources) as well as low (i.e. plant P sources) phosphorus bioavailabilities.

Key Words: Phosphorus, Dicalcium phosphate, Digestibility

T86 Efficacy of microbial phytase in swine diets. R. N. Dilger*[1], S. A. Adedokun[1], J. A. Jendza[1], J. S. Sands[2], P. H. Simmins[2], and O. Adeola[1], [1]*Purdue University, West Lafayette, IN,* [2]*Danisco Animal Nutrition, Marlborough, UK*.

Three experiments were designed to assess both nutrient metabolism and growth performance of young swine fed microbial phytase-supplemented diets. Dietary treatments were similar between experiments and consisted of a positive control, basal, and basal plus either 500 or 1000 g/kg microbial phytase. In the first study, twenty four 15-kg crossbred barrows were assigned to crates according to a RCBD resulting in 6 pigs per diet to characterize the effect of phytase on apparent fecal digestibilities of DM and P. Diets were formulated at 165 g/kg CP with the positive control and basal diets containing 5.5 and 3.3 g/kg total P, respectively. A positive phytase effect was observed for apparent fecal digestibilities of DM (quadratic, $P < 0.05$) and P (linear, $P < 0.05$) fecal digestibility. The second study utilized 48 pigs in a 21-d growth performance trial arranged as a RCBD with 12 pigs (6 barrows, 6 gilts) assigned to the 4 dietary treatments. The positive control and basal diets (209 g/kg CP) contained 5.7 and 4.0 g/kg total P, respectively. A linear phytase effect ($P < 0.05$) was observed for average daily gain and feed efficiency at week 1 and overall. Final plasma P concentrations were also shown to be positively affected by phytase addition (linear, $P < 0.05$). In the third study, 128 crossbred were assigned to the 4 dietary treatments with 4 pens of gilts and 4 pens of barrows per diet according to a RCBD. The positive control and basal diets were formulated at 170 g/kg CP and contained 5.3 and 3.6 g/kg total P, respectively. ADG, ADFI, and G:F exhibited a linear phytase response ($P < 0.01$) at weeks 4 and 6 as well as overall. In conclusion, pigs fed phytase-supplemented diets gave results comparable to those fed phosphorus-adequate diets in both nutrient utilization and growth performance.

Key Words: Microbial phytase, Growth performance, Pigs

T87 Effects of the addition of phytase and monocalcium phosphate to sorghum-soybean meal diets on growing commercial pigs. H. Bernal-Barragan*, Z. Ruiz-Chavez, J. Colin-Negrete, E. Gutierrez-Ornelas, and H. Morales-Treviño, *Universidad Autonoma de Nuevo Leon*.

Two experiments were conducted to determine performance and phosphorus output of growing pigs fed diets supplemented with different amounts of phytase (as FTU) and monocalcium phosphate. Pigs of both genders were individually housed with *ad libitum* access to water and feed. Body weight and daily feed consumption were registered over the 5 week length of trial. On a single day of the fourth week, feces were quantitatively collected, in order to measure fecal phosphorus output. In experiment 1, 21 pigs (initial BW of 65 kg) were allotted (n = 7) in a complete randomized design, to one of three dietary treatments: 1) basal diet, sorghum-soybean meal (S-SBM) without addition of monocalcium phosphate (0.32% P), 2) Basal diet + 750 FTU phytase/kg, and 3) basal diet with addition of 9.40 kg monocalcium phosphate/ton (0.52% P), but without phytase. Additions of phytase (T2) and monocalcium phosphate (T3) increased (P = 0.08) ADG in 8.4% and 12.1%, respectively compared with the basal diet (ADG = 874 g). Daily feed intake and feed conversion were not affected by treatments ($P > 0.05$), but fecal phosphorus output was 34% higher ($P < 0.05$) for the diet added with monocalcium phosphate (T3), compared with diets T1 and T2. In experiment 2, 24 pigs (initial BW of 53.4 kg) were allotted (n = 6) in a complete randomized design, to diets added with 0, 3.5, 7.0 and 10.5 kg of monocalcium phosphate/ton, in order to achieve 0.35, 0.42, 0.49 and 0.56% of P, respectively. First three diets were supplemented with 750 FTU phytase/kg, but not the fourth diet. There were not treatment effects on ADG and feed conversion. Fecal phosphorus output increased (P = 0.18) 25%, 36% and 61% on diets T2, T3 and T4 respectively, related to diet T1. Results indicated that addition of either 0 or 3.5 kg monocalcium phosphate/ton plus 750 FTU phytase/kg may be enough to reduce phosphorus fecal output, without affecting the growth parameters of growing-finishing pigs.

Key Words: Phytase, Monocalcium phosphate, Pigs

T88 Phytase additions to conventional or low-phytate corn-soybean meal diets on phosphorus balance in growing pigs. E. G. Xavier*, G. L. Cromwell, and M. D. Lindemann, *University of Kentucky, Lexington.*

A balance experiment was conducted to assess the effects of phytase (Natuphos®, BASF; 750 units/kg) in diets containing low-phytate (LP) corn and LP-, low-oligosaccharide soybean meal (SBM) or near-isogenic normal (N) corn and N-SBM from near-isogenic soybeans. The corn and SBM were provided by Pioneer Hi-Bred International, Johnston, IA. The LP-corn, N-corn, LP-SBM, and N-SBM contained 0.28, 0.25, 0.77, and 0.70% total P and 0.10, 0.20, 0.22, and 0.48% phytate P with estimated P bioavailabilities of 75, 20, 50, and 20%, respectively. Twelve pigs (60 kg) were placed in metabolism crates and fed four diets (0.75% lysine) for a 5-d collection period. Feeding level was equalized within replicates and averaged 92% of ad libitum intake. Diets were (1) N-corn + N-SBM, 0.48% P; (2) N-corn + N-SBM + phytase, 0.38% P; (3) LP-corn + LP-SBM, 0.35% P; and (4) LP-corn + LP-SBM + phytase, 0.35% P. Ca was reduced from 0.55% in Diets 1 and 3 to 0.50% in Diets 2 and 4. Diet 1 was estimated to meet the requirement for total and bioavailable P, and Diets 3 and 4 contained no added P. Daily feed and P intake averaged 2.07, 2.03, 2.07, 2.09 kg/d and 9.91, 7.72, 7.24, 7.30 g/d for Diets 1-4, respectively. Daily P excretion in feces, urine, and both were affected ($P < 0.01$) by diet (4.94, 2.97, 2.69, 1.79 g/d; 0.26, 0.63, 0.04, 0.18 g/d; 5.20, 3.60, 2.73, 1.98 g/d), as were daily P absorbed and retained (4.97, 4.75, 4.56, 5.51 g/d; 4.71, 4.12, 4.52, 5.32 g/d). Apparent P digestibility was increased by feeding LP- vs N-diets and by phytase addition to both (50.1, 61.6, 62.9, 75.4%; $P < 0.01$). Total P in feces and urine was 2.93, 1.91, 1.68, 1.12% of DM ($P < 0.01$) and 2.9, 6.9, 0.5, 1.5 mg/dl ($P < 0.01$). Soluble P in feces, expressed as percent of total P, increased by 26% with feeding of the LP-diet and with phytase addition to either diet (1.31, 1.66, 1.65, and 2.08%), but these differences were not significant ($P > 0.20$). In urine, soluble P averaged 98% of total P. Total P excretion decreased by 31% when phytase was added to the N-diet, by 48% when the LP-diet was fed, and by 62% when phytase was included in the LP-diet.

Key Words: Pigs, Phosphorus, Phytase

T89 Ileal amino acid digestibility in pigs fed grain sorghum-soybean meal diets added with a phytase. M. Cervantes*[1], M. A. Barrera[1], F. Copado[2], J. L. Figueroa[2], W. Sauer[3], M. Cuca[2], and N. Torrentera, [1]*Instituto de Ciencias Agrícolas, UABC, Mexicali,* [2]*Colegio de Postgraduados, Montecillos, México,* [3]*University of Alberta, Canada.*

A digestion trial was conducted to evaluate the effect of adding a phytase to grain sorghum-soybean meal diets on the apparent ileal digestibility (AID) of amino acids (AA) in pigs. Six pigs (86.1 kg body weight) fitted with cannulas in terminal ileum were used in three experimental periods according to a replicated 3 x 3 Latin Square design. Treatments (T) were as follows: T1) basal, grain sorghum-soybean meal diet plus vitamins and minerals, T2) + 500 phytase units (FU), and T3) + 1 000 FU. The basal diet contained 17% crude protein. Yellow endosperm grain sorghum and hulless soybean meal were used in this trial. The enzymatic activity of the phytase used in this experiment was equivalent to 10 000 FU/g. Pigs were fed two times daily (0700 and 1900), the same ration at each feeding time. The AID (%) of the essential amino acids for treatments T1 to T3 were: Arginine, 85.3, 85.7, 85.8; Phenylalanine, 78.3, 78.8, 78.7; Histidine, 79.9, 80.0, 79.9; Isoleucine, 77.0, 77.6, 77.9; Leucine, 77.8, 78.1, 77.9; Lysine, 80.9, 81.2, 81.9; Methionine, 76.9, 76.0, 75.7; Threonine, 69.1, 68.2, 68.0; Valine, 74.8, 75.2, 75.3, respectively. There was no effect of phytase supplementation on the AID of the essential or the non-essential amino acids. Arginine had the highest AID, whereas threonine had the lowest AID value. The AID of the essential amino acids was higher than that of the non-essential amino acids. In conclusion, the supplementation of phytase containing 10 000 FU/g, to grain sorghum-soybean meal diets does not affect the AID of the essential or non-essential amino acids in finishing pigs.

Key Words: Phytase, Ileal digestibility, Amino acids

T90 Effect of phytase and/or pancreatin supplementation to grain sorghum-soybean meal diets on the apparent ileal amino acid digestibility in pigs. F. Copado[2], M. Cervantes*[1], J. L. Figueroa[2], M. Cuca[2], J. Yañez[1], and W. Sauer[3], [1]*Instituto de Ciencias Agrícolas, Universidad Autónoma Baja California, Mexicali,* [2]*Colegio de Postgraduados, Montecillos, México,* [3]*University of Alberta, Canada.*

A digestion trial was conducted to evaluate the effect of adding a phytase and/or pancreatin to grain sorghum-soybean meal diets on the apparent ileal digestibility (AID) of amino acids (AA) in pigs. Eight growing pigs (86.1 kg body weight) fitted with cannulas in terminal ileum were used in four experimental periods according to a replicated 4 x 4 Latin Square design. Treatments (T) were as follows: T1) basal, grain sorghum-soybean meal diet plus vitamins and minerals, T2) + 1 050 phytase units (FU), T3) + 591 mg pancreatin/kg feed, and T4) + 1 050 FU + 591 mg pancreatin/kg feed. The basal diet contained 18.2% crude protein. Yellow endosperm grain sorghum and hulless soybean meal were used in this trial. The enzymatic activity of the phytase used in this experiment was equivalent to 10 000 FU/g. Pancreatin digests not less than 100 times its weight of casein in 60 min at pH 7.5. The AID (%) of the essential amino acids for treatments T1 to T4 were: Arginine, 83.0, 82.6, 83.0, 82.2; Histidine, 75.6, 75.7, 75.1, 73.9; Isoleucine, 73.5, 73.0, 72.8, 72.2; Leucine, 73.2, 73.3, 72.3, 71.5; Lysine, 77.8, 77.7, 77.0, 76.3; Methionine, 67.5, 66.3, 62.9, 66.0; Phenylalanine, 74.6, 74.5, 74.0, 73.3; Threonine, 64.0, 63.6, 62.2, 61.8; Valine, 70.0, 70.0, 69.5, 68.4, respectively. Except for methionine, there was no effect of phytase or pancreatin supplementation on the AID of the essential AA. The AID of methionine tended to decrease with the addition of pancreatin to the basal diet. Arginine was the AA with the highest AID value, whereas threonine had the lowest AID value. In conclusion, the supplementation of phytase containing 10 000 FU/g, alone or in combination with pancreatin, to grain sorghum-soybean meal diets does not affect the AID of the essential amino acids in growing pigs.

Key Words: Pigs, Phytase-pancreatin, Ileal amino acid digestibility

T91 Phytase and crystalline amino acids supplementation to grain sorghum-soybean meal diets for growing pigs. F. Copado[2], M. Cervantes*[1], J. L. Figueroa[2], M. A. Barrera[1], J. Yañez[1], M. Cuca[2], S. Espinoza[1], and N. Torrentera[1], [1]*Instituto de Ciencias Agrícolas, Universidad Autónoma Baja California, Mexicali,* [2]*Colegio de Postgraduados, Montecillos, México.*

An experiment was conducted with 30 crossbred (Landrace-Hampshire-Duroc) pigs (20.9 kg av. initial body wt.) to evaluate the effect of adding crystalline lysine plus threonine and phytase to grain sorghum-soybean meal diets on the performance of growing pigs. Pigs were randomly allotted to five dietary treatments based on sex, weight and litter. Treatments were: 1) basal grain sorghum-soybean meal diet, 2) + 1 050 ppm phytase, 3) + .13% lysine + .05% threonine, 4) + 1 050 ppm phytase + 13% lysine + .05% threonine, 5) control grain sorghum-soybean meal diet. Diet of treatment 1 was formulated to supply 90% the requirement of digestible lysine for the 20 to 50 kg pigs; the control diet supplied at least 100% the requirements of all the essential amino acids. Crystalline lysine and threonine were added to T3 and T4 to match their content in the control diet. Vitamins and minerals were added to all diets to meet the animals requirements. Weight gain, feed and lysine intake, and feed conversion were: 1.01, .98, 1.09, 1.04, 1.03 kg/d; 1.81, 1.79, 1.69, 1.74, 1.90 kg/d; 12.1, 12.0, 13.0, 13.4, 14.6 g/d; 2.08, 1.77, 1.48, 1.77, 1.77, respectively. Supplementation of phytase or the level of lysine and threonine did not affect daily weight gain ($P>.24$), and feed ($P>.40$) and lysine ($P>.11$) intake. But, the supplementation of phytase, alone or in combination with crystalline lysine plus threonine, improved ($P<.01$) the feed conversion of pigs, as compared with those fed the basal diet. There was no difference ($P=.91$) in feed conversion between pigs fed the control diet and the average of the other treatments. These results indicate that phytase may improve the efficiency of feed utilization in growing pigs fed grain sorghum-soybean meal diets.

Key Words: Phytase, Swine, Crystalline amino acids