

of 17 blend of 24.5 group for comparison with the group fed 24.5 of contaminated grains in the diet increased linearly the ratio of hypothalamic 3,4-dihydroxyphenylacetic acid to dopamine (DA) concentrations and cortex 5-hydroxytryptamine (5HT) concentrations, while hypothalamic norepinephrine and tryptophan, and pons DA and homovanillic acid concentrations were linearly decreased. Hypothalamic and pons 5-hydroxyindoleacetic acid to 5HT ratios responded quadratically to the inclusion of contaminated grains. The feeding of contaminated grains

did not alter primary antibody response to SRBC but further studies on the secondary antibody response are warranted. It was concluded that the major effect of feeding *Fusarium* mycotoxin-contaminated grains to pigs is to alter brain neurochemistry.

**Key Words:** Antibody-mediated immune response, *Fusarium* mycotoxins, Neurochemistry

## Nonruminant Nutrition

**M96 Effect of dietary supplementation of 1% L-glutamine on the intestinal morphology of early weaned piglets 14d and challenged with transmissible gastroenteritis virus.** H. Herrera\*<sup>1</sup>, A. G. Borbolla<sup>1</sup>, H. Ramirez<sup>1</sup>, and G. Mariscal<sup>2</sup>, <sup>1</sup>Universidad Nacional Autonoma de Mexico, <sup>2</sup>INIFAP CENID Fisiología.

The aim of this work was to determine the effect of dietary supplementation of L-glutamine (Gln) on villous height (VH) and crypt depth (CD) in three portions of the small intestine of piglets weaned at 14d and challenged with the transmissible gastroenteritis virus (TGV) after d4 of weaned (W). Weaned pigs (35) of 14d of age and weight of 4.660.2 Kg were used in this study. Thirty pigs were randomly assigned to two different treatments (tx): 1) 0% Gln and 2) 1% of Gln supplemented (1% Gln) and housed in 6 pens (3 pens of 5 animals per treatment), in facilities appropriate for the animal's age. The 5 remaining piglets were slaughtered on 0d (14d of age) to obtain VH and CD as baseline measures. Both groups received the same diet and a daily oral dose of water or 1% of crystalline L-Gln according to the amount of feed consumed the previous day. Feed intake was registered in a daily basis. On d4 after weaning, the piglets were oro-nasally inoculated with  $1 \times 10^6$  infective doses of TGV. On d5, 14 and 21, 5 pigs by tx were slaughtered with pentobarbital to measure VH and CD. The samples were included in paraffin for a later histological evaluation. Ten villous samples of each intestine portion were measured with a graduated ocular (1mm/100). Comparisons were made in time between animals in the same treatment versus the baseline measures. Of each pig, 10 cm of the middle jejunum was sampled to isolate the virus and blood serum to detect antibodies with a Kit ELISA. In the jejunum of all the inoculated pigs the TGV was isolated but antibodies were not detected. In the duodenum of the 1% Gln group, the VH was smaller ( $P < 0.05$ ) at 5d than 0d (450 vs. 258, 389 and 409 m for 0,5,14 and 2d W). In jejunum the tx 1% Gln showed an atrophy of 61 and 33% ( $P < 0.05$ ) the 5 and 14 vs 0d (456 vs 177, 303 and 445 m), while tx 0% Gln the atrophy it was of 36% ( $P < 0.05$ ) in the 5 and 14 d (456 vs 288, 287 and 527 m). Atrophy in ileum for tx 1%Gln were 24 and 18% ( $P < 0.05$ ) the 5 and 14 d (268 vs. 202, 219 and 297 m), and in tx 0% it was 30 and 16% ( $P < 0.05$ ) in the same period (268 vs. 187 and 225 and 265 m). The supplementation of 1% Gln doesn't prevent the atrophy of the villous during the first five days of viral challenge, but it accelerates the recovery of the intestinal damage caused by the virus and the effect of the weaning.

**Key Words:** Glutamine, Wean, Small intestine

**M97 Effects of levels of organic acid complex and lactose in starter diet on growth performance and intestinal environments of weaned pigs.** Y. W. Shin\*, J. G. Kim, Y. H. Park, and K. Y. Whang, Korea university, Seoul, Korea.

A  $2 \times 3$  factorial experiment in a randomized complete block design was conducted to evaluate the effects of lactose and organic acid complex consisted of butyrate, formate, lactate and phosphoric acid on growth performance and intestinal environments for 21 d after weaning. A total of 360 weaned pigs were used. The dietary treatments were: 1) high level of lactose (HL) + 0% organic acids, 2) HL + 0.15% organic acids, 3) HL + 0.30% organic acids, 4) low level of lactose (LL) + 0% organic acids, 5) LL + 0.15% organic acids and 6) LL + 0.30% organic acids. Feed intake and body weight of pigs were measured at d 0, d 7 and d 21. Five pigs per treatment were sacrificed at d 0, d 3, d 7 and d 21 for sampling of intestinal digesta, ileal tissues and blood. The ADG and ADFI were numerically higher in treatment 2 than other treatments. Feed efficiency in treatment 3 tended to be higher than other treatments during the entire experimental period. But no significant difference was observed. Pigs fed diets containing organic acid complex and high level

of lactose showed better performance, in general, but it was not significantly different. The digesta pH was not different among treatments at d 3 and d 7. At d 21, treatment 3 had a higher pH of jejunal digesta ( $P < 0.1$ ). Treatments 3 and 2 also showed a higher leukocyte counts at d 3 and d 21 than other treatments, respectively ( $P < 0.1$  and  $P < 0.05$ ). In gastrointestinal microbiology, there was no favorable effect of organic acids and lactose supplementation except decreased number of coliform bacteria in treatment 3 at d 21 ( $P < 0.1$ ). Villus height and crypt depth were not different among treatments but villus height: crypt depth ratio was higher in treatments 2 and 5 at d 7 ( $P < 0.1$ ). These results suggest that organic acid complex and lactose have no interactive effect on growth and intestinal environments in weaned pigs.

**Key Words:** Pigs, Organic acid, Lactose

**M98 Bone mineral content gain is reduced in weaned pigs fed diets with low-buffer capacity and organic acids.** G. Biagi\*<sup>1</sup>, A. Piva<sup>1</sup>, T. D. Hill<sup>2</sup>, D. K. Schneider<sup>2</sup>, and T. D. Crenshaw<sup>2</sup>, <sup>1</sup>University of Bologna, Italy, <sup>2</sup>University of Wisconsin, Madison, WI.

Consumer preferences continue to pressure reliance on sub-therapeutic use of antibiotics in swine diets. Current experiments were designed to evaluate diet buffer capacity and use of organic acids for their potential to maintain growth and bone status during the most problematic period of nutritional management, immediately after weaning. Three trials were conducted using either all 6 (Trial 1) or a subset (Trial 2 and 3) of 6 dietary treatments. Treatments were: 1) Control, complex diet with plasma protein and carbadox; 2) Plant protein, high-buffer diet; 3) Plant protein, low-buffer diet; 4) Diet 3 + 1% citric acid; 5) Diet 3 + 1% fumaric acid; 6) Diet 3 + 0.2% Tetracid 500 (a protected combination of organic acids, JEFAGRO Technologies Inc.). No antibiotics were added to Diets 2 through 6. Reduced buffer capacity involved shifts in sources (tricalcium phosphate and calcium sulfate) and concentrations of Ca and P (0.75% Ca, 0.81% P, diet 2; 0.50%Ca, 0.65% P, diet 3) previously shown to reduce undesired gut microbes. In trial 1, 96 pigs (PIC Cambrough X Line 19) were weaned (3 wk) and randomly allotted to diet groups for a 6 wk trial (Phase I, 6 diets, 14 d; Phase II, 6 diets, 14 d; Phase III, common diet, 14 d). In Phase I, pigs fed Control diets gained faster and more efficiently ( $P < 0.01$ ) than those fed other diets, but no differences were detected ( $P > 0.10$ ) in growth or efficiency among groups during Phase II or III. Duration of Trials 2 and 3 were 28 d and only diets 2, 3, 5 and 6 were included. On d 0 and 28 of Trials 2 and 3, 30 barrows were scanned by dual energy x-ray absorptiometry (DXA), and bone mineral content gain (BMC) was calculated. Pigs fed low-buffer diets and organic acids had 50% lower ( $P < 0.01$ ) daily BMC gain (adjusted for differences in weight gain) over 28 d (10.8, 6.2, 4.8, and 5.6 g BMC/kg weight gain for pigs fed diets 2, 3, 5 and 6 respectively). The long-term consequences of feeding low-buffer diets and organic acids were not assessed in these trials.

**Key Words:** Bone, Buffer, Antibiotics

**M99 Effects of feeding antibiotics versus mannanoligosaccharides on the growth performance of weaning pigs.** J. Pulliam\*, R. Clift, S. Chattin, and A. G. Mathew, The University of Tennessee, Knoxville TN USA.

To compare effects of the Carbadox and a mannanoligosaccharide product on performance, a total of 48 crossbred (Yorkshire  $\times$  Landrace  $\times$  Duroc) pigs were weaned at approximately 21 days of age and blocked by gender, genetics, and weight. Pigs were randomly assigned to one of 4 treatments with each treatment consisting of 3 pens and 4 pigs per pen. Treatments included 55 mg Carbadox/kg of feed, 0.4% Bio-Mos<sup>®</sup> (mannanoligosaccharide) in the feed, a rotation of the above two treatments,

or an NRC based control diet with no growth promoting additives. Each group was allowed ad libitum access to water and the assigned treatment as a single phase diet. Pens were used as the experimental units. Performance parameters, including average daily gain, average feed intake, and feed conversion ratio, were measured for a 28-day period and compared across treatments. Feed intake and feed conversion ratio were measured for individual pens. No treatment effects ( $P \geq .05$ ) were noted for any of the growth parameters measured. Although not significant, the Bio-Mos<sup>®</sup> treatment produced a numerically higher weight gain and lower feed consumption, which resulted in an improved feed conversion ratio when compared to the other treatments. These data indicate that growth performance parameters were not significantly affected by the addition of Carbadox or mannanoligosaccharides in the diet. It is possible that the lack of statistical differences was due to the controlled environment of the experiment, which may have reduced the level of disease challenge presented to the pigs and thereby reducing the intensity of growth promoting benefits. Further research will be necessary to determine the potential for mannanoligosaccharides as an effective growth-promoting alternative to antibiotics.

**Key Words:** Antibiotics, Mannanoligosaccharides, Pigs

**M100 Effects of antibiotics versus mannanoligosaccharides on intestinal pH and volatile fatty acid concentrations in weanling pigs.** J. Pulliam\*, R. Clift, S. Chattin, and A. G. Mathew, *The University of Tennessee, Knoxville TN USA.*

Three replicate trials with a total of 36 ileal cannulated pigs were conducted to observe intestinal pH and volatile fatty acid (VFA) concentrations. Individual pigs were used as the experimental units and were weaned at approximately 21 days of age, blocked by gender, genetics and weight, and allotted to pens in groups of three. Pens were randomly assigned to one of four treatments including: 55 mg Carbadox/kg, 0.4% Bio-Mos<sup>®</sup> (mannanoligosaccharide), a rotation of the above two treatments, or an NRC based control treatment with no additives. Pigs were allowed ad libitum access to water and the assigned treatment as a single-phase diet for a 35day period. Ileal digesta were collected on days 14, 21, 28, and 35 of the trial. Pigs were sacrificed on day 35 and digesta were collected from the duodenum, jejunum, ileum, cecum, and spiral colon. Digesta were analyzed for pH and VFA including: Acetate, Propionate, Butyrate, Valerate, Isovalerate, and Isobutyrate. Intestinal pH of the Carbadox treatment was more alkaline and the Control treatment was more acidic when treatments were compared ( $P=.0017$ ). A site effect ( $P=.0001$ ) was also observed where the ileum was more alkaline and the cecum more acidic. Treatment effects were noted for ileal Butyrate ( $P=.0001$ ) and Acetate ( $P=.0174$ ) where Acetate and Butyrate concentrations were greater in the ileum for the Carbadox and Rotation treatments compared to the Bio-Mos<sup>®</sup> and Control treatments ( $P \leq .05$ ). Time (day) affected ileal Isovalerate ( $P=.0113$ ), Butyrate ( $P=.0001$ ), and Acetate ( $P=.0001$ ) concentrations. A site effect ( $P \leq .05$ ) was observed for all VFA concentrations. Treatment  $\times$  site interactions were observed ( $P=.0297$ ) for Valerate concentrations. These data indicate that dietary additives affected intestinal pH and VFA concentrations.

**Key Words:** Mannanoligosaccharides, pH, VFA

**M101 Use of probiotics in the diet of weanling and growing pigs.** A. C. Murry, Jr.\*<sup>1</sup> and A. Hinton, Jr.<sup>2</sup>, <sup>1</sup>*The University of Georgia*, <sup>2</sup>*Agricultural Research Service/United States Department of Agriculture, Athens.*

Sixty crossbred pigs (6 kg BW and 21 d of age) were used to evaluate the efficacy of probiotics containing *Lactobacilli* on growth performance and fecal microflora. Pigs were randomly assigned to receive one of four treatments: (a) control diet with antibiotics (CA); (b) control diet without antibiotics and supplemented with 0.2% probiotics in feed alone, (PBF); (c) control diet without antibiotics and supplemented with 0.2% probiotics in the feed and 0.1% in water (PBFW); and (d) control diet without antibiotics and supplemented with 0.1% probiotics in water alone (PBW). Diets were fed from d 0 to 56 after weaning. Pig body weights and feed intake were measured biweekly to determine growth and feed efficiency. Fecal grab samples were collected weekly and dissolved in anaerobic diluents and analyzed for lactic acid bacteria and *Escherichia coli*. From d 0 to 56, ADG, ADFI, and gain:feed ratio of pigs fed the CA diet were not different ( $P > 0.05$ ) from those pigs fed PBF, PBFW, and PBW. Colony forming units (CFU) of lactic acid bacteria of pigs fed the CA diet were not different ( $P > 0.05$ ) from CFU

in pigs fed PBF, PBFW, and PBW from d 0 to 14. Colony forming units of lactic acid bacteria were higher ( $P < 0.06$ ) at d 21 in pigs fed PBF and PBFW and higher ( $P < 0.03$ ) at d 28 in pigs fed PBF than CFU in pigs fed the CA diet. From d 0 to 28, *Escherichia coli* CFU of pigs fed PBF, PBFW, and PBW were not different ( $P > 0.05$ ) from CFU in pigs fed the CA diet. From d 35 to 56, CFU of lactic acid bacteria of pigs fed the CA diet were not different ( $P > 0.05$ ) from CFU in pigs fed PBF, PBFW, and PBW. Colony forming units of *E. coli* were higher ( $P < 0.001$ ) at d 35 in pigs fed the CA diet than CFU in pigs fed PBF and PBFW. *Escherichia coli* CFU were higher ( $P < 0.06$ ) at d 42 in pigs fed PBW than CFU in pigs fed PBF and PBFW and the CA diets. The results indicate that probiotics containing *Lactobacilli* can be supplemented without antibiotics in diets of weanling and growing pigs at a rate of 0.2% in feed and 0.1% in water without negatively affecting growth performance. Also, fecal microflora can be affected by the inclusion of probiotics during different stages of the growth period.

**Key Words:** Probiotics, Growth, Fecal microflora

**M102 Dietary supplementation with botanical compounds depresses piglet feed intake while fecal E. coli counts remain unchanged.** P. Bikker<sup>1</sup>, R. Fontanillas\*<sup>2</sup>, and N. D. Roura<sup>2</sup>, <sup>1</sup>*Institute for Animal Nutrition, De Schothorst, Lelystad, The Netherlands*, <sup>2</sup>*Lucta, S.A. Barcelona, Spain.*

A four week trial was carried out at the "De Schothorst" Institute for Animal Nutrition Lelystad (The Netherlands) to study the effect of feed supplementation with botanical compounds on the performance and fecal content of *E. coli* in weanling piglets. 300 piglets weaned at 26 days of age with an initial body weight of 8 kg were randomly allotted in five experimental treatments of 10 replicates (pens) with 6 piglets per pen. The experimental treatments were: T0 (control, no growth promoter), T1 (500 ppm cinnamaldehyde), T2 (30 ppm carvacrol), T3 (40 ppm salvia dalmacia) and T4 (400 ppm cinnamaldehyde + 10 ppm capsicum). The piglets received a phase 1 diet during week 1-2 and a phase 2 diet during week 3-4 post weaning based on wheat, barley, soybean meal and milk products and did not contain any antibiotic growth promoting substances. Feed and water were offered ad libitum. Weights of piglets and feed intake per pen were recorded at day 0, 14 and 28 of the trial. Average daily gain (g/d), daily feed intake (g/d) and feed conversion were calculated for each phase and for the whole trial. Fresh rectal samples of two piglets per pen from six replicates of each treatment were taken at 14 days post weaning. Samples were pooled per pen and analysed for *E.coli* (log cfu/g). Daily feed intake and average daily gain of piglets fed with diets supplemented with botanical compounds were between 2 and 10% lower as compared to the control group. Decreases were statistically significant ( $p < 0.05$ ) for feed intake of T1 group during phase 1 (332 vs 300) and T3 group during phase 2 (832 vs 767) and overall (574 vs 526) as well as for average weight gain of T3 for the overall period (392 vs 357). Furthermore, botanical compounds supplementation did not significantly change ( $p > 0.05$ ) the number of colony forming units of *E. coli* in the feces (from 7.1 to 7.9 log cfu/g).

**Key Words:** Weanling piglets, Botanical compounds, *E. coli*

**M103 Plant extracts enhance performance in broilers under Clostridium perfringens challenge.** C. Kamel\*<sup>1</sup> and R. McKay<sup>2</sup>, <sup>1</sup>*AXISS France SAS*, <sup>2</sup>*MLF Agresearch.*

Many plant extracts have been reported to improve animal performance and well-being especially under dietary or other enteric stressors. A pilot challenge model to reproduce necrotic enteritis (NE) from *Clostridium perfringens* inoculation in broiler chickens was commissioned to evaluate a commercial product standardized in the active substances from capsicum, cinnamon and origanum extracts (XTRACT Code 6990, Canadian registration 982063). A total of 162 animals were randomly allotted to 3 floor pens of 18 birds each for three treatments of a commercial diet differing only with the inclusion of XTRACT at 150 ppm or 300 ppm. *C. perfringens* broth was administered via feed with approximately  $10e7$  cfu per ml at 14 days of age. Feed intake and growth were measured at day 1, 14 and 21. Mortality was recorded daily and necrotic enteritis lesion score was recorded at day 17 for five randomly selected animals from each pen. Raw data means were analysed by Analysis of Variance. In general, the NE challenge was successful, resulting in post-challenge NE mortality (14-21 days) ranging from 22.2% to 44.5%. Broilers on XTRACT at 300 ppm and 150 ppm showed significantly

( $P < 0.05$ ) heavier liveweights in comparison to the control over the 1-14 days-of-age (XTRACT 300 ppm: 390 grams; XTRACT 150 ppm: 317 grams; control diet: 303 grams). Over the entire period, broilers fed the XTRACT at 300 ppm diet were 22% heavier ( $P < 0.05$ ) than the XTRACT at 150 ppm and control diets (XTRACT 300 ppm: 763 grams; XTRACT 150 ppm: 593 grams; control diet: 593 grams). Feed conversion ratio was similarly improved (XTRACT 300 ppm: 1.55; XTRACT 150 ppm: 1.72; control diet: 1.78). NE-mortality from days 14-21 was significantly reduced in the XTRACT at 300 ppm diet (XTRACT 300 ppm: 22.2%; XTRACT 150 ppm: 44.5%; control diet: 38.9%). Lesion score was unaffected by diet. In this study, broilers on XTRACT at 150 ppm showed improvements intermediate to those on XTRACT at 300 ppm and the control diet during the pre-challenge period, but did not maintain their advantage when challenged with *Clostridium perfringens*. The XTRACT at 300 ppm diet provided the most improvement ( $P < 0.05$ ) in broiler performance both before and after challenge with *Clostridium perfringens*.

**Key Words:** Plant extracts, Broilers, Necrotic enteritis

**M104 The effects of herbal plant mixture (MIRACLE 20<sup>®</sup>) supplementation on the growth performance, nutrient digestibility and serological changes in finishing pigs.** O. S. Kwon<sup>\*1</sup>, I. H. Kim<sup>1</sup>, J. W. Hong<sup>1</sup>, J. H. Kim<sup>2</sup>, Y. M. Seol<sup>3</sup>, B. J. Min<sup>1</sup>, W. B. Lee<sup>1</sup>, and K. S. Son<sup>1</sup>, <sup>1</sup>Department of Animal Resource & Science, Dankook University, <sup>2</sup>Agribands Purina Korea, Inc, <sup>3</sup>Hanpel tech. co. Ltd.

The objective of this study was to determine the effect of an herbal plant mixture (containing *Angelica gigas* Nakai, *Rehmannia glutinosa* Liboschitz, *Cnidium officinale*, *Glycyrrhizae glabra*, *Schizandra chinensis* and *Dioscorea japonica* Thunberg, MIRACLE 20<sup>®</sup>) supplementation on the growth performance, nutrient digestibility, serological changes and carcass characteristics in finishing pigs. Eighty crossbred [(Duroc × Yorkshire) × Landrace] pigs (81.58kg average initial BW) were used in a 45d growth assay. Dietary treatments included 1) NC (negative control; antibiotic-free diet), 2) PC (positive control; NC diet added 0.1% of chlortetracycline), 3) HPM (NC diet added 0.1% of herbal plant mixture), and 4) PHPM (PC diet added 0.1% of herbal plant mixture). There were four pigs per pen and five pens per treatment. Experimental diets were formulated to contain 3,365Kcal/kg of DE, 14.80% of CP, 0.89% of lysine, 0.74% of Ca and 0.54% of P for the finishing pigs. ADG was significantly increased in PC and HPM treatments compared with NC treatment ( $P < 0.05$ ). ADFI and G/F were higher in pigs fed herbal plant mixture and antibiotics than pigs fed antibiotic-free diet with no significant differences ( $P > 0.05$ ). Backfat thickness was not significantly different among the treatments ( $P > 0.05$ ). Digestibility of DM and N were not affected by the herbal plant mixture supplementation. There were no significant differences in total protein, albumin and IgG ( $P > 0.05$ ). In conclusion, PC and HPM treatments improved ADG compared to antibiotics free diet.

**Key Words:** Herbal plant mixture, Pigs, Performance

**M105 Effect of feeding germanium biotite on growth performance, nutrient digestibility and serum characteristics in nursery pigs.** W. B. Lee<sup>\*1</sup>, I. H. Kim<sup>1</sup>, J. W. Hong<sup>1</sup>, O. S. Kwon<sup>1</sup>, B. J. Min<sup>1</sup>, K. S. Son<sup>1</sup>, and Y. K. Jung<sup>2</sup>, <sup>1</sup>Department of Animal Resource & Science, Dankook University, <sup>2</sup>SEOBONG BioBestech Co., Ltd.

The objective of this study was determined the suitability of germanium biotite as a dietary supplement on growth performance, nutrient digestibility and serum characteristics in nursery pigs. A total of seventy five pigs (initial body weight  $21.18 \pm 0.15$ kg) were used in this experiment. This study was carried out for 21 days. The five treatments were control (CON, basal diet), GB0.5-200 (basal diet + 0.5% germanium biotite, 200mash), GB1.0-200 (basal diet + 1.0% germanium biotite, 200mash), GB0.5-325 (basal diet + 0.5% germanium biotite, 325mash) and GB1.0-325 (basal diet + 1.0% germanium biotite, 325mash). Each treatment had five replicates with three pigs per replicate. For overall period, average daily feed intake and gain/feed were not significantly different among the treatments ( $P > 0.11$ ). However, pigs fed GB1.0 diets had higher average daily gain than pigs fed GB0.5 diets with significant difference ( $P < 0.03$ ). Dry matter tended to increase as the particle size and dietary supplement of germanium biotite in the diet was increased. N and Ca digestibility were significantly different among the treatments

( $P < 0.01$ ). Supplementing germanium biotite in the diet reduced the fecal  $\text{NH}_3\text{-N}$  concentration. The fecal  $\text{NH}_3\text{-N}$  and butyric acid tended to increase as the particle size of germanium biotite in the diet was decreased ( $P < 0.01$ ). RBC and WBC were significantly different among the treatments ( $P < 0.03$ ). In conclusion, supplementing germanium biotite in diets for nursery pigs reduced fecal noxious gases.

**Key Words:** Germanium biotite, Performance, Pigs

**M106 Effect of dietary green tea on productivity and egg composition in laying hens.** C. J. Yang<sup>\*1</sup>, D. Uuganbayar<sup>1</sup>, S. S. Sun<sup>2</sup>, and J. D. Firman<sup>3</sup>, <sup>1</sup>Sunchon National University, Suncheon, Korea, <sup>2</sup>Chonnam National University, Chonnam, Korea, <sup>3</sup>University of Missouri, Columbia, MO.

This experiment was designed to evaluate the effects of green tea on productivity and egg composition in laying hens. One hundred eighty Brown Tetra layers (40 weeks old) were randomly allotted to 6 treatments (control, antibiotics, green tea .5%, 1%, 1.5% and 2% supplementation) groups and 5 replications per treatment. Diets were formulated to provide a minimum of 15% CP and 2750 kcal/kg ME. Diets were fed in mash form, and feed and water offered ad libitum. The control diet was based on a corn-soybean meal mixture. Hen-day egg production, egg weight, egg mass, feed intake, FCR and egg shell thickness were determined every week. Five eggs from each treatment were selected for egg quality, egg yolk cholesterol, TBA value and fatty acid composition analysis. Hen-day egg production was not affected by dietary green tea supplementation ( $P > .05$ ). The egg weight and egg mass were reduced in green tea .5% treatment ( $P < .05$ ). The feed intake was increased in 1% and 1.5% of green tea treatments. Egg shell thickness was reduced significantly in all treatment groups ( $P < .05$ ). The egg yolk cholesterol content was decreased significantly in 2% green tea treatments ( $P < .05$ ). The value of TBA in egg yolk was reduced in 2% of green tea supplementation compared to control ( $P < .05$ ). The yellowness of egg yolk was increased in dietary supplementation of 2% green tea ( $P < .05$ ). There were no significant differences in juiciness, texture and overall acceptability of the eggs ( $P > .05$ ). Palmitic acid content in eggs was increased in 1.5% green tea treatment but other fatty acids were not affected by any level of green tea treatment. These results indicate that dietary supplementation of 1 to 2% green tea didn't have negative effects on laying performance but dietary supplementation 2% of green tea could reduce the egg yolk cholesterol and increase the yellowness of egg yolk.

**Key Words:** Laying hens, Green tea, Egg yolk cholesterol

**M107 Effect of dietary Korean, Japanese and Chinese green tea on growth performance and body composition in broiler chicks.** C. J. Yang<sup>\*1</sup>, D. Uuganbayar<sup>1</sup>, K. Sayama<sup>2</sup>, N. Ishihara<sup>3</sup>, and I. S. Shin<sup>4</sup>, <sup>1</sup>Sunchon National University, Suncheon, Korea, <sup>2</sup>Shizuoka University, Shizuoka, Japan, <sup>3</sup>Central Research Laboratories, Taiyo Kagaku, Japan, <sup>4</sup>American Soybean Association, Seoul, Korea.

The objectives of this study were to determine the effect of Korean, Japanese and Chinese green tea on growth performance and body composition in broilers. One hundred sixty eight (1-day old) Ross broiler chicks were randomly allotted to 7 treatments with 4 replications (6 chicks per replication) and raised in battery cages. The seven dietary treatments were negative control (without antibiotics) and positive control (basal + .1% chlortetracycline) and 5 experimental diets (basal + .5% Korean green tea (KGT), (basal + 1% KGT), (basal + 1.5% KGT), (basal + 1.5% Japanese green tea (JGT) and (basal + 1.5% Chinese green tea (CGT), respectively. Basal and experimental diets were formulated to meet 23% CP and 3.2 Mcal/kg of ME. The basal diet was based on a corn-soybean meal mixture. Diets were fed in mash form, and feed and water offered ad libitum. The body weight gain was reduced slightly in broilers fed diets containing green tea supplements compared to antibiotics diet ( $P < .05$ ) but it was not significantly different compared to control ( $P > .05$ ). The feed intake was decreased significantly for KGT 1.5% ( $P > .05$ ) but not consistent in other treatments. Feed conversion ratio was not significantly different between both 1.5% KGT and JGT and antibiotics diets. Also, there were no significant differences in the feed intake among treatments with 0.5% KGT, 1.5% CGT and control ( $P > .05$ ). Green tea from different origins didn't have effect on the vital organs weight ( $P < .05$ ). The TBA content in chicken meat was slightly decreased when fed diets containing different levels of

green tea but there were no significant differences between green tea and control group ( $P > .05$ ). The cholesterol content in chicken meat was reduced significantly ( $P < .05$ ) in green tea 1.5% treatments. There was observed no significant difference ( $P > .05$ ) in plasma cholesterol content but it tended to decrease when increasing green tea levels in broiler diet. These results indicate that supplementation of green tea in broiler diet slightly reduces weight gain of chicks but decreases cholesterol content in broiler meat.

**Key Words:** Broiler, Green tea, Cholesterol

**M108 Effect of Dietary Korean, Japanese and Chinese Green Tea on Productivity and Egg composition in Laying Hens.** D. Uuganbayar<sup>\*1</sup>, C. J. Yang, Y. M. Cho, and I. C. Park, *Sunchon National University, Korea.*

The objectives of this study were to determine the effect of Korean, Japanese, Chinese green tea on productivity and egg composition in laying hens. One hundred sixty eight Brown Tetra laying hens (40 week old) were randomly assigned to 7 treatment groups. Layers were located in battery cage and environmentally regulated closed house and given ad libitum access to feed and water. Treatments were a control of corn-soybean based diet (15% CP, 2765kcal/kg ME, 3.9% Ca, .24 Pavail) and three diets containing 1% and three diets included 2% Korean (KGT), Japanese (JGT) and Chinese (CGT) green tea respectively. Hen day-egg production, egg weight, eggs mass, feed intake, FCR and egg shell thickness were determined every 7 days. Five eggs from each treatment were selected for egg quality, yolk cholesterol, TBA value and fatty acid composition analysis. Hen day-egg production was increased significantly at 1 to 2% of green tea supplement ( $P < .05$ ). The CGT 1% showed significant increase in egg production rate and significant decrease in egg weight compared to control ( $P < .05$ ). There was observed not significant difference between egg masses of the layers fed green tea diets ( $P > .05$ ). Feed intakes of 2% KGT, 2% CGT and 1% JGT diets were reduced significantly ( $P < .05$ ). Egg shell thickness was decreased significantly in layers consuming diets containing JGT at both levels of inclusion ( $P < .05$ ). Egg yolk cholesterol tended to decrease with green tea supplemented diets. The CGT in both level of inclusion reduced significantly egg yolk cholesterol content ( $P < .05$ ). There were no significant differences in  $\beta$  and D-homo-r-linolenic acids in the egg yolk from different dietary groups ( $P > .05$ ). These results indicated that dietary supplementation of green tea in layer diets had positive effects in egg production and reduction of egg yolk cholesterol.

**Key Words:** Green Tea, Laying hens, Egg yolk cholesterol

**M109 Feeding seaweed extract to nursery pigs alters circulating thyroid hormones.** J. L. Turner<sup>1</sup>, S. S. Dritz<sup>2</sup>, and J. E. Minton<sup>\*2</sup>, <sup>1</sup>New Mexico State University, <sup>2</sup>Kansas State University.

Alternative feed additives that may have value in replacing traditional antimicrobials in swine diets have received increased attention in recent years. Extracts of the seaweed *Ascophyllum nodosum* (AN) have been evaluated in nursery pig diets, and show some promise in supporting pig growth performance in the absence of other antimicrobials in the diet. However, the extract of this seaplant is relatively high in iodine. Thus, we hypothesized that feeding the product might affect the concentration of circulating thyroid hormones. Weaned pigs (initial mean wt 6.4 kg) were housed in pens in an environmentally controlled nursery. Pigs were fed diets containing 0 (control, n = 6) or 2% AN extract (n = 6) for 4 wk. After 14, 21, and 28 d on treatment diets, jugular blood samples were obtained and sera evaluated for triiodothyronine (T3) and thyroxine (T4) by radioimmunoassay. No treatment x day interaction was observed for either T3 or T4 (data in table). However, the overall concentration of T4 was increased ( $P < 0.05$ ) in pigs fed AN ( $48.1 \pm 1.6$  ng/mL) compared to pigs fed the control diet ( $42.2 \pm 1.6$  ng/mL). In addition, there was a strong tendency ( $P < 0.06$ ) for T3 to be elevated by feeding AN ( $994 \pm 70$  vs  $789 \pm 70$  pg/mL). In summary, feeding AN at 2% of the diet for 28 d elevated T4 by about 14% and T3 by about 26%. Although feeding AN at this level may have implications relative to the ability of pigs to respond to thermal challenge, this level of dietary AN inclusion is at least fourfold greater than the rate of inclusion found to maximize growth performance in weaned pigs.

	Day of Treatment			SEM
	14	21	28	
T3, pg/mL				
0%	778	812	776	43
2%	1,021	981	980	43
T4, ng/mL				
0%	37.1	45.4	44.0	2.9
2%	45.1	51.7	47.5	2.9

**Key Words:** Seaweed, Pigs, Thyroid hormones

**M110 Effect of supplementing meal (*Macrocystis pyrifera*) to wheat based diets for weaning pigs.** R. Gomez<sup>\*</sup>, M. Cervantes, N. Torrentera, and S. Baca, *Instituto de Ciencias Agrícolas. UABC. Mexico.*

An experiment was conducted to evaluate the effect of adding kelp (*Macrocystis pyrifera*) meal on the performance, incidence of diarrhea, and mortality of recently weaned pigs. Sixty-four crossbred (Landrace-Hampshire-Duroc) piglets weaned at 18-21d (5.79 kg av. Initial body wt.) were randomly allotted to four dietary treatments. There were four replicates of four pigs per treatment; the trial lasted three weeks. Treatments were: T1) wheat-soybean meal-milk whey basal diet, T2) + .10% antibiotic, T3) + 2.0% kelp meal, and T4) + 4.0% kelp meal. All diets contained the same amount of milk whey and were added with vitamins and minerals to meet the requirements of pigs within the range of 5 to 10 kg. Weight gain, feed intake, feed conversion, incidence of diarrhea and mortality were: 180, 180, 180, 170 g/d; 220, 270, 250, 240 g/d; 1.31, 1.47, 1.40, 1.52; 11, 10, 11, 11 pigs; 18.8, 6.3, 12.5, 12.5%, for treatments T1 to T4, respectively. None of the performance variables evaluated in this trial and the incidence of diarrhea were affected ( $P > .10$ ) by the addition of either the antibiotic or the kelp meal. But, the antibiotic and kelp meal reduced the mortality of piglets in 66 and 33%, respectively. Although the incidence of diarrhea was not affected, the difference in mortality indicates that the antibiotic and kelp helped to reduce the severity of diarrhea in these animals. Thus, these data may suggest that kelp may stimulate the baby pig immune system or that it partially protects the pigs against pathogens, but this effect is around 50% less effective than that of the antibiotic added to the diet at sub-therapeutic levels.

**Key Words:** Kelp meal, Weaning pigs, Performance

**M111 Supplementation of kelp meal (*Macrocystis pyrifera*) to wheat based diets for growing pigs.** M. Cervantes<sup>\*1</sup>, E. Chi<sup>2</sup>, J. Yañez<sup>1</sup>, J. Baeza<sup>2</sup>, N. Torrentera<sup>1</sup>, and M.A. Barrera, <sup>1</sup>Instituto de Ciencias Agrícolas, UABC, <sup>2</sup>Colegio de Postgraduados.

An experiment was conducted to evaluate the benefit of adding kelp meal (*Macrocystis pyrifera*) to wheat-based diets for growing pigs. Twenty-eight pigs (22.0 kg av. Initial body wt.) were randomly allotted to four dietary treatments; seven replicates per treatment, according to a complete block design. Treatments were: T1) wheat-based diet containing 100% the requirement of lysine, threonine, and methionine, T2) as in T1, + 1.5% kelp meal, T3) wheat-based diet containing 120% the requirement of lysine, threonine, and methionine, T4) as in T3, + 1.5% kelp. Average weight gain; intake of feed, lysine, and threonine, and feed conversion were: 610, 697, 603, 688 g/d; 1.56, 1.66, 1.52, 1.61 kg/d; 14.8, 15.8, 17.3, 18.3 g/d; 14.9, 15.8, 18.6, 18.5 g/d; 2.54, 2.38, 2.57, 2.34, respectively. Dietary amino acid level did not affect ( $P > .10$ ) daily weight gain or feed conversion, although it increased lysine intake. But, the addition of 1.5% kelp meal increased ( $P < .01$ ) 14.5% the weight gain, regardless of the amino acid level in the diet. Also, kelp meal tended ( $P < .10$ ) to improve 6.7 and 9.9% feed conversion, when diets contained 100 and 120% the amino acid requirements, respectively. The amino acid level or the addition of kelp to the diet did not affect feed intake. Lysine and threonine intakes were higher in pigs fed the 120% diets. Pigs fed the diet with 100% the amino acid requirements utilized lysine more efficiently than those fed the 120% diet. Also, the efficiency of lysine utilization was better when kelp was added to the diet. These results indicate that the 100% diet indeed supplied the total requirement of amino acids for growing pigs. Also, these data suggest that

kelp has one or more compounds that improve the availability and/or the efficiency of utilization of amino acids, and that it exerts a growth promoting effect on growing pigs.

**Key Words:** Kelp meal, Amino acids, Swine performance

**M112 Effect of kelp (*Macrocystis pyrifera*) meal supplementation to wheat based diets for finishing pigs.** J. Yañez<sup>1</sup>, M. Cervantes<sup>\*1</sup>, F. Copado<sup>2</sup>, N. Torrentera<sup>1</sup>, J. L. Figueroa<sup>2</sup>, and M. Barrera<sup>1</sup>, <sup>1</sup>*Instituto de Ciencias Agrícolas, Universidad Autónoma de Baja California, México*, <sup>2</sup>*Colegio de Postgraduados, Montecillos, México*.

An experiment was conducted to assess the effects of adding kelp (*Macrocystis pyrifera*) meal to wheat-based diets on the performance of finishing pigs. Forty crossbred (Landrace-Hampshire-Duroc) finishing (63.6 kg av. initial wt.) pigs were randomly allotted to four dietary treatments; five replicates of two pigs (one male and one female) per treatment. The treatments were: T1) basal diet, wheat plus lysine and threonine, T2) + 1.5% kelp meal, T3) + 3.0% kelp meal, and T4) + 4.5% kelp meal. The basal diet was formulated with wheat and crystalline lysine and threonine to meet or exceed the requirements of all the essential amino acids; a vitamin and mineral premix was also added to the basal diet to meet the requirements for these pigs. Weight gain, feed intake, feed conversion, back fat thickness, and loin area were: 707, 813, 776, 751 g/d; 2.15, 2.24, 2.03, 2.23 kg/d; 2.83, 2.70, 2.48, 2.74; 2.55, 2.42, 2.18, 2.55 cm; 26.2, 26.7, 29.8, 26.3 cm<sup>2</sup>, for treatments T1 to T4, respectively. Growth rate was 15.0% higher (P<.05) in pigs fed the diet added with 1.5% kelp meal, but no further effect was observed with higher levels. In fact, the daily gain in pigs fed the diets containing 3.0 and 4.5% kelp meal was similar to that of pigs fed the basal diet. Kelp meal did not affect (P>.10) feed intake. Feed conversion improved 12.8% with the addition of 3.0% kelp meal; no difference was observed between pigs fed the diet added with 1.5 or 4.5% kelp meal and those fed the basal diet. Also, back fat thickness was smaller (P<.05) and the loin area bigger in pigs fed the diet added with 3.0% kelp meal. These data suggest that kelp meal in diets based on wheat contains one or more compounds with anabolic or growth promoting effects on finishing pigs, although the mode of action is unknown.

**Key Words:** Kelp meal, Swine, Performance

**M113 Effects of kelp meal supplementation in lactation sow diet on the body condition of sows and early growth of piglets.** J. G. Kim<sup>\*</sup>, Y. W. Shin, H. J. Lim, Y. H. Park, and K. Y. Whang, *Korea University, Seoul, Korea*.

An experiment was conducted to evaluate the effects of dietary levels of kelp meal on the body condition of sows and the growth performance of piglets during lactation. Eighty cross breed sows (Landrace x Yorkshire) artificially inseminated with Duroc's semen were assigned to four dietary treatments. Basal diet was formulated to contain 16% crude protein, 3250 kcal/kg ME, and 3% of cellulose. Cellulose was replaced by kelp meal. Experimental diets contained 0%, 1%, 2%, or 3% of kelp meal. Post-farrowing body weight of sows was calculated by using gestation model. Weaning weights of sows and piglets were measured. The P2 back fat depth was measured both sides and an average value was used. Feed intake was increased until 7 days after farrowing. After 7 day, sows were allowed to consume diet on ad libitum basis. There was no difference in body weights and P2 back fat depth changes among treatments. But, sows in 3% kelp meal group tended to lose less body weight and P2 back fat during lactation. In piglets, average daily gain was linearly increased as kelp meal contents in sow diet were increased. A model was developed to adjust weaning day (21 day) and suckling piglet number (9 piglets). The results of this experiment suggest that addition of kelp meal in lactation sow diet would improve suckling piglet growth without affecting body condition of sows.

Item	0%	1%	2%	3%
Change of sows				
Body weight(kg)	-8.97	-10.40	-3.72	-5.20
P2 depth (mm)	±4.45	±2.99	±2.06	±2.99
Piglets				
ADG (g/d)	-4.23	-4.66	-4.19	-4.60
Body weight	±1.09	±0.75	±0.48	±0.71
ADG (g/d)	225.81	231.23	252.65	266.13
Body change(kg)	±16.75 <sup>b</sup>	±11.28 <sup>ab</sup>	±12.28 <sup>ab</sup>	±12.04 <sup>a</sup>

p<0.05

**Key Words:** Kelp meal, Sow, Piglets

**M114 A comparison of the effects of supplementations of probiotic and humad on egg production and quality during the late laying period in hens.** M. A. Yoruk<sup>1</sup>, M. Gul<sup>1</sup>, A. Hayirli<sup>\*1</sup>, and M. Macit<sup>2</sup>, <sup>1</sup>*Department of Animal Nutrition and Nutritional Diseases, School of Veterinary Medicine*, <sup>2</sup>*Department of Animal Sciences, College of Agriculture, Ataturk University, Erzurum 25700, Turkey*.

As an alternative to antibiotics, inclusions of probiotics and humads into rations as feed additives to promote growth and reduce subclinical infections is favorable due to a lack of harmful effects on consumers. This study was designed to investigate whether inclusions of probiotic and humad into diets of hens during the late laying period increase egg production and improve egg quality. Three hundred Hi-Sex Brown layers at age of 54 weeks were allocated randomly to receive a diet containing no probiotic and humad and diets containing either probiotic (0.1 and 0.2%) or humad (0.1 and 0.2%) for 12 weeks. Experimental units were 6 groups of birds with each containing 10 birds. Egg yield was recorded daily, whereas feed intake (FI) and egg weight (EW) were determined bi-weekly. Egg density, shape index, unbrokenness, shell length, yolk color, albumen index, yolk index, and Haugh unit were egg quality parameters. Twelve eggs from each experimental group were collected randomly to determine egg quality parameters every month. Data were analyzed using the Multivariate Analysis Procedure of SPSS with repeated measures option. Moreover, orthogonal contrasts to determine the effects of probiotic and humad and compare their effects and polynomial contrasts to evaluate the nature of responses to increasing levels of probiotic and humad were constructed. There were no orthogonal and polynomial effects of supplementations of probiotic and humad on FI and EW. Egg yields of hens supplemented with probiotic and humad were not different, but were greater than hens not supplemented with either. Egg yield and feed conversion efficiency (both kg feed per 100 eggs and kg feed per kg egg) linearly increased with supplementations of both probiotic and humad. There were no orthogonal and polynomial effects of supplementations of probiotic and humad on egg quality parameters. In conclusion, supplementations of probiotic and humad during the late laying period increase egg yield at similar magnitude, but do not improve egg quality.

**Key Words:** Probiotic, Humad, Hen

**M115 WITHDRAWN.** , ,

**M116 The effect of feeding processed soy protein on the growth performance in weanling pigs.** B. J. Min<sup>\*1</sup>, I. H. Kim<sup>1</sup>, J. W. Hong<sup>1</sup>, O. S. Kwon<sup>1</sup>, W. B. Lee<sup>1</sup>, K. S. Son<sup>1</sup>, J. H. Kim<sup>2</sup>, and W. C. Cho<sup>3</sup>, <sup>1</sup>*Department of Animal Resource & Science, Dankook University*, <sup>2</sup>*Agribands Purina Korea, Inc*, <sup>3</sup>*Genebiotech Co. Ltd.*

This experiment was to determine the effect of feeding processed soy protein on the growth performance in weanling pigs. One hundred twenty Duroc xYorkshirexLandrace pigs(6.34 ±0.70kg average initial BW) were used in a 35d growth assay. There were six pigs per pen and four pens per treatment. Dietary treatments included 1) NC(negative control; basal diet), 2) PC(positive control; add 5% HP300<sup>®</sup>, HAMLET PROTEIN A/S, as protein source), 3) PSP2.5(add 2.5% Pepsolgen<sup>®</sup>, Genebiotech Co. Ltd., as protein source), 4) PSP5.0(add 5% Pepsolgen

® as protein source), and 5) PSP7.5 (add 7.5% Pepsogen® as protein source). For d 21, ADFI was increased in pigs fed PSP diets compared with PC diet ( $P < 0.05$ ). ADG was tended to improve as concentration of PSP in the diets was increased. For d 21-35 and entire experimental periods, pigs fed PSP diets had more feed intake than pigs fed NC or PC diets ( $P < 0.05$ ). For the whole period, ADG was improved in PSP treatments compared with NC treatment (Linear effect,  $P = 0.05$ ). On d 21 and d 35, digestibilities of DM and N were higher ( $P < 0.05$ ) for pigs fed PSP diets than pigs fed NC diet and PSP2.5 treatment was the highest among the treatments. On d 21, digestibility of N was significantly improved in PSP treatments compared with PC treatment ( $P < 0.05$ ). In conclusion, feeding processed soy protein for weaning pigs increased growth performance and nutrient digestibility.

**Key Words:** Processed soy protein, Growth performance, Pigs

**M117 Potential for an animal-based fish meal analog protein as a replacement for fish meal in early-weaned pig diets.** M. E. Davis<sup>\*1</sup>, C. V. Maxwell<sup>1</sup>, Z. B. Johnson<sup>1</sup>, and P. L. Bond, Jr.<sup>2</sup>, <sup>1</sup>University of Arkansas, Fayetteville, <sup>2</sup>Mid-South Milling Company, Inc., Memphis, TN.

A total of 288 pigs (20 d of age;  $7.9 \pm 0.08$  kg BW) were fed one of four dietary treatments to determine the potential for an animal-based protein with similar composition to fish meal (fish analog) to replace fish meal in early-weaned pig diets. Pigs were sorted into nine weight blocks, and pigs within each weight block were randomly assigned to pens of eight pigs each. Four dietary treatments fed from d 0 to 14 (Phase 1) after weaning consisted of: 1) positive control with 8% fish meal, 2) negative control with SBM and Lys replacing fish meal, 3) positive control with fish analog replacing 50% of the fish meal, and 4) positive control with fish analog replacing 100% of the fish meal. Fish meal was replaced in each diet on an equal Lys basis. Dietary treatments fed from d 14 to 28 (Phase 2) after weaning were similar to those in Phase 1, although the positive control diet contained 6% fish meal during Phase 2. A common Phase 3 diet was fed from d 28 to 42 after weaning. From d 0 to 7, d 7 to 14, and d 0 to 14, pigs fed the positive control diet and those fed fish analog replacing 100% of fish meal had similar ( $P > 0.10$ ) ADG. From d 0 to 28, pigs fed the negative control diet had the highest ( $P < 0.05$ ) ADG, while there were no differences ( $P < 0.10$ ) in ADG between pigs fed the positive control diet and those fed fish analog at either replacement level. Gain:feed from d 0 to 7 was highest ( $P < 0.05$ ) when pigs were fed the positive and negative control diets compared to pigs fed fish analog at either replacement level. Although BW of pigs fed fish analog at the 100% replacement level was lower ( $P < 0.05$ ) than that observed in pigs fed the negative control diet at the end of Phase 1 and Phase 2, there were no differences between BW of pigs fed fish analog at the 100% replacement level and the positive control. This study indicates that fish analog protein results in comparable gain to fish meal when added to Phase 1 and Phase 2 diets for early-weaned pigs.

**Key Words:** Pigs, Protein, Fish meal analog

**M118 Comparison of swine performance when fed diets containing corn root worm protected corn, parental line corn, or conventional corn grown during 2000 in Nebraska.** R. L. Fischer<sup>1</sup>, P. S. Miller<sup>\*1</sup>, Y. Hyun<sup>2</sup>, G. F. Hartnell<sup>2</sup>, and E. P. Stanisiewski<sup>2</sup>, <sup>1</sup>University of Nebraska, Lincoln, <sup>2</sup>Monsanto Company, St. Louis, MO.

This study was conducted to evaluate growth performance and carcass quality measurements in growing-finishing pigs fed diets containing either Corn Root Worm Protected Corn (CRW0586) with event MON 863, the non-transgenic parental control corn (RX670), or two non-transgenic commercial corn hybrids (DK647 and RX740). The experiment used 72 barrows and 72 gilts with an average initial BW of 22.7 kg. The pigs were allotted using a randomized complete block design with a  $2 \times 4$  factorial arrangement of treatments. Barrows and gilts were housed separately in  $1.5 \times 4.8$  m pens ( $n = 6$ /pen). Pigs had ad libitum access to feed and water for the duration of the experiment. The experiment continued until the average BW was 117 kg, at which time all pigs were slaughtered. Real-time ultrasound measurements of tenth-rib backfat (BF) and longissimus muscle area (LMA) were recorded on the final day of the experiment. Carcass quality measurements were made 24 h post-mortem. Average daily gain, ADFI, and ADG/ADFI were not affected by corn line ( $P > 0.25$ ), but there was an effect of sex for all growth

traits, with barrows having greater ADG (0.96 vs 0.86 kg;  $P < 0.01$ ) and ADFI (2.52 vs 2.18 kg;  $P < 0.01$ ) than gilts and gilts having greater ADG/ADFI (0.39 vs 0.38;  $P < 0.01$ ) than barrows. Ultrasound measurements were similar among corn lines ( $P > 0.60$ ); however, a sex effect was detected for BF depth, with gilts having less ( $P < 0.01$ ) BF than barrows (1.98 vs 2.48 cm). Proximate analysis of longissimus muscle composition revealed no effect ( $P > 0.20$ ) of corn line or sex for protein, fat, and water percentages. In summary, there were no differences in growth performance or carcass measurements in growing-finishing pigs fed diets containing either Corn Root Worm Protected Corn with event MON863, its control, or the reference corn hybrids.

**Key Words:** Pigs, Transgenic corn, Growth

**M119 Performance comparison of growing-finishing pigs fed diets containing Corn Root Worm Protected corn (Event MON 863) or conventional corn hybrids.** G. E. Bressner<sup>1</sup>, Y. Hyun<sup>\*2</sup>, E. P. Stanisiewski<sup>2</sup>, G. F. Hartnell<sup>2</sup>, and M. Ellis<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, IL, USA, <sup>2</sup>Monsanto Company, St. Louis, USA.

This study compared growth and carcass traits of growing-finishing pigs fed diets containing Corn Root Worm Protected corn (event MON863/Trt. A), a non-transgenic genetically similar corn (Trt. B), and two commercial non-transgenic corn hybrids (Trt. C and D). The study used randomized complete block design with four trts, each based on a single corn hybrid. Hybrid pigs ( $n=160$ , 40 pigs/trt; equal numbers of barrows and gilts) were used. Test period was from 30 to 115 kg BW with pigs kept in single-sex groups of five. Pigs were given ad libitum access to feed and water. The study was carried out in a controlled environment finishing facility, with part-slatted, part-solid concrete floors. A three-phase diet program was used. Growing diets (30 to 50 kg BW) had 1.0% total lysine, 17.8% CP, and 3340 kcal ME/kg. Early- (50 to 80 kg BW) and late- (80 to 115 kg BW) finishing phase diets had 0.8 and 0.7% lysine, 15.0 and 13.5% CP, and 3368 and 3390 kcal ME/kg, respectively. Diets were formulated with a fixed corn inclusion level for all trts of 65, 72, and 76% for grower, early- and late-finishing phases, respectively. At the end of test, pigs were slaughtered at a commercial facility and carcass measurements taken. Treatment had no effect ( $P > 0.05$ ) on ADFI (2.60, 2.41, 2.54, and 2.46 kg for Trt. A, B, C, and D, resp.; SEM 0.08), ADG (0.86, 0.86, 0.89, and 0.91 kg, resp.; SEM 0.02), and G:F (0.34, 0.36, 0.35, and 0.37 kg/kg, resp.; SEM 0.01). Carcass measurements were similar ( $P > 0.05$ ) for the four treatments. Differences in performance between castrates and gilts were in line with previous research. Results indicate that performance of growing-finishing swine fed diets containing Corn Root Worm Protected corn (event MON 863) is equivalent to that of animals fed non-transgenic genetically similar corn and conventional corn hybrids.

**Key Words:** Swine, Growth, Transgenic corn

**M120 A comparison of swine performance when fed diets containing Roundup Ready® wheat (event MON 71800) and conventional wheat varieties.** B. A. Peterson<sup>\*1</sup>, Y. Hyun<sup>2</sup>, E. P. Stanisiewski<sup>2</sup>, G. F. Hartnell<sup>2</sup>, and M. Ellis<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, IL, <sup>2</sup>Monsanto Company, St. Louis, MO.

This study was conducted to evaluate growth and carcass traits of growing-finishing pigs fed diets containing Roundup Ready wheat (event MON 71800), the non-transgenic genetically similar control wheat (MON 71900) and four commercial varieties of non-transgenic wheat (Zeke, Hank, 926, and Express). The study was carried out as a randomized complete block design with six dietary treatments, each treatment based on a single wheat variety. Hybrid pigs ( $n=240$ ; 40 per treatment; equal numbers of barrows and gilts) were used. Pigs were grown from  $29.5 \pm 0.29$  to  $114.5 \pm 2.23$  kg BW in single-sex groups of five pigs and had ad libitum access to feed and water. The study was carried out in a controlled environment facility with part-slatted, part-solid concrete floors. A three-phase dietary program was used. Phase 1 diets (25 to 50 kg BW) contained 1.00% lysine, 18.9% CP, and 3,428 Kcal ME/kg. Phase 2 (50 to 80 kg BW) and Phase 3 (80 to 110 kg BW) diets contained 0.77 and 0.62% lysine, 16.0 and 15.0% CP, and 3,363 and 3,363 Kcal ME/kg, respectively. Diets were formulated with a fixed wheat inclusion level for all treatments of 70, 80, and 85% for Phases 1, 2, and 3, respectively. At the end of test period, ultrasound backfat thickness and longissimus area were taken at the tenth rib. Pigs fed the six wheat lines had similar ( $P > 0.05$ ) ADFI (mean 2.26 kg, SEM 0.06; range 2.20

to 2.32 kg), ADG (mean 0.85 kg, SEM 0.03; range 0.82 to 0.87 kg), and G:F ratio (mean 0.38, SEM 0.01; range 0.37 to 0.38). In addition, there was no effect ( $P > 0.05$ ) of wheat variety on ultrasound measurements. These results indicate that performance of growing pigs fed diets containing Roundup Ready wheat (event MON 71800) is equivalent to that of pigs fed diets containing non-transgenic control wheat or commercial wheat varieties.

**Key Words:** Swine, Growth, Transgenic wheat

**M121 Pea and Lupin (*lupinus albus*) as an alternative protein source in growing pig diets.** F. Masoero<sup>1</sup>, A. Prandini<sup>1</sup>, G. Piva<sup>\*1</sup>, M. Morlacchini<sup>2</sup>, M. Moschini<sup>1</sup>, and D. Diaz<sup>3</sup>, <sup>1</sup>Universit Cattolica del Sacro Cuore, Piacenza, Italy, <sup>2</sup>CERZOO, San Bonico, Piacenza, Italy, <sup>3</sup>Fondazione Parco Tecnologico Padano, Lodi, Italy.

The use of alternative Mediterranean feed protein sources into piglet diets was investigated. One hundred forty Duroc × (Large white × Landrace) piglets (10.4±2 kg live weight) were randomly assigned to 5 dietary treatments and raised in 35 pens (7 pens per treatment/4 animals per pen). Experimental treatments were identified by the protein source as: soy bean meal (control) (C); raw pea (RP); extruded pea (EP); Lupin (*lupinus albus* variety multitaglia) (L); extruded lupin (EL). Diets based on corn, wheat and barley plus synthetic amino acids were isoenergetic and isonitrogenous and supplied 18% crude protein, 1% lysine, 0.6% methionine + cystine, 0.64% threonine, 0.2% tryptophane and 9.84 MJ/kg NE. When used, RP and EP were included into diets at 20%, L and EL at 17%. Diets were fed *ad libitum* for the duration of the experimental period (42d). Animals were weighed at 0, 21 and 42d on trial. Pig mortality (1.6% for the all experiment) was recorded daily and dead animals were removed and weight was recorded. The pen feed consumption and weight were recorded weekly and the pen final weight was cleared from weight of removed animals. The pen average daily gain (ADG) was obtained and adjusted gain to feed ratio (G:F) of experimental periods was obtained by dividing the total weight gain of surviving and dead animals by the feed consumption per pen. The ADG, average daily intake (ADI) and G:F were not statistically affected by the treatment diets. Data suggest partial substitution of soybean with pea or lupin, either extruded or not, had no effect on animal performance and could represent an alternative valuable protein source in swine diet formulation.

**Key Words:** Swine, Lupin, Pea

**M122 Methods of improving the nutritive value of Jackbean for poultry industry in the tropics.** B. O. Esonu\* and A. B. I. Udedibie, Federal University of Technology, Owerri, Nigeria.

Methods of improving the nutritive value of the jackbean for poultry have been developed and tested by many researchers. The discrepancies between the findings of different researchers make it difficult to make clear and definite conclusions as to which method is most scientifically appropriate and relevant and can be used as a standard method for improving the nutritive value of this tropical legume for poultry. Besides the scientific aspect, the appropriateness of the method to be used must be based also on the local context and available facilities as well as economic viability. This paper, reviews five different methods farmers and feed millers could employ to improve the nutritive value of jackbean: 1. Dry urea treatment prior to toasting 2. Two-stage cooking 3. Sprouting 4. Cooking in Trona solution 5. Crack and cook method

**Key Words:** Jackbean, Nutritive value, Poultry

**M123 Growth performance of growing-finishing pigs fed low-protein, low-energy, grain sorghum-soybean meal diets.** J. L. Figueroa<sup>\*1</sup>, M. Mendez<sup>1</sup>, M. Cervantes<sup>2</sup>, and J. M. Cuca<sup>1</sup>, <sup>1</sup>Ganaderia, Colegio de Postgraduados, <sup>2</sup>Instituto de Ciencias Agrícolas, Universidad Autónoma de Baja California.

Two experiments were conducted to assess the effect of reducing the content of metabolizable energy in low-protein grain sorghum-soybean meal diets on the performance and carcass composition of growing-finishing pigs. In Exp. 1, 32 growing (35.3 kg initial weight) pigs were randomly allotted in a randomized complete block design to four diets, with four two-pig (a gilt and a barrow each) replicates. Diets were as follows: T1)

grain sorghum-soybean meal, 16.5% CP, 3265 Mcal/kg, control diet; T2) grain sorghum-soybean meal, 12.5% CP, 3265 Mcal/kg; T3) as in T2, but with 3165 Mcal/kg; T4) as in T2, but with 3065 Mcal/kg. Energy concentration was obtained by substituting grain sorghum with wheat bran and sand, until the energy level was reached. There was no effect ( $P > 0.05$ ) of CP nor ME on ADG (0.981, 0.932, 1.016, and 1.049 kg for T1, T2, T3, and T4, respectively), ADFI/ADG ratio (2.42, 2.508, 2.667, 2.459 kg/kg), ADLG (0.351, 0.358, 0.355, 0.378 kg), backfat thickness (38.9, 38.4, 37.4, 37.8 mm), longissimus muscle area (35.2, 36.48, 32.9, 36.64 cm<sup>2</sup>), and percentage of lean tissue (32.56, 33.8, 32.72, 32.74). There was an increase ( $P < 0.05$ ) in ADFI (2.362b, 2.287b, 2.673a, 2.532a) as ME was reduced. In Exp. 2, 32 finishing (56.2 kg initial weight) pigs were randomly allotted in a completely randomized design to four diets, with four two-pig (a gilt and a barrow each) replicates. Initial weight was used as a covariate for all variables. Diets were as follows: T1) sorghum-soybean meal, 13.5% CP, 3265 Mcal/kg; T2) sorghum-soybean meal, 9.5% CP, 3265 Mcal/kg; T3) as in T2, but with 3165 Mcal/kg; T4) as in T2, but with 3065 Mcal/kg. The ME concentration was obtained as in Exp. 1. There was no effect ( $P > 0.05$ ) of CP nor ME concentration on ADFI (2.825, 2.854, 2.878, 2.823 kg), ADG (0.968, 0.844, 0.783, 0.792 kg), ADFI/ADG ratio (2.994, 3.433, 4.22, 3.733 kg/kg), ADLG (0.317, 0.231, 0.317, 0.239 kg), backfat thickness (37.9, 37.7, 35.3, 39.3 mm), longissimus muscle area (44.72, 40.32, 43.94, 42.88 cm<sup>2</sup>), and percentage of lean tissue (35.52, 34.2, 36.47, 34.58). These results showed that the growth performance and carcass characteristics of growing and finishing pigs fed low-protein, grain sorghum-soybean meal diets are not affected by the decrease of dietary energy content.

**Key Words:** Pigs, Low-protein diets, Low-energy diets

**M124 Effect of amino acid intake on fecal digestibility of amino acids and on urinary amino acid excretion of adult roosters.** L. Babinszky\*, J. Tossenberger, and K. R. Kovacs, University of Kaposvar, Faculty of Animal Science, Hungary.

Urinary amino acid excretion of poultry is generally recognized to be very low. However, certain trial data show that poultry may have considerable levels of urinary amino acid excretion. Hence, the aim of our trials was to determine the effect of feeding diets with identical total but different digestible amino acid contents on the digestibility of amino acids and on the quantity of urinary and fecal amino acid excretion of roosters. The trials were conducted with 4 adult roosters per treatment, in two replicates (n=8/treatment). Prior to the trial a simple T-cannula was implanted in the terminal colon of the birds, allowing separate quantitative collection of faeces and urine (van Leeuwen et al., 2000). Nutrient content of the trial diets followed the NRC (1994) requirements. The two treatments of the trial were (i) a diet formulated using "low digestible" ingredients (LD), (ii) a diet formulated with "high digestible" ingredients (HD). The AMEn and total LYS, MET+CYS and THR contents of the two diets were similar (13.1 MJ/kg, 7.1-, 4.5-, 5.8 g/kg, respectively), the calculated digestible amino acid content, however, differed by 10 %. The experimental data were analyzed by means of ANOVA (SAS, 1991). Our results showed, that in the LD-group the apparent fecal digestibility of LYS, MET+CYS and THR was 84.5-, 89.6-, 82.8 %, respectively, while the same in the HD-group was 86.7-, 91.8 and 87.4 %. Digestibility measured in the HD-group was significantly higher in comparison to the LD-group ( $P < 0.05$ ). Birds in the LD-group excreted via the urine 17 mg/kg<sup>0.75</sup> LYS daily, the HD-group value was 22 mg/kg<sup>0.75</sup> ( $P < 0.05$ ), which were 34.2 % and 40.4 % of total excreted (fecal+urinary) LYS, respectively. MET+CYS and THR excretion showed similar trends. Our data show that adult roosters may have considerable levels of urinary amino acid excretion, which should be taken into account when determining the amino acid requirements of poultry.

**Key Words:** Rooster, Amino Acids, Urinary-excretion

**M125 Evaluation of the effects of dietary fat, conjugated linoleic acid and ractopamine on the fatty acid profiles of fat and muscle tissue of lean gilts.** T. E. Weber<sup>1</sup>, B. T. Richert<sup>1</sup>, M. A. Belury<sup>2</sup>, Y. Gu<sup>3</sup>, and A. P. Schinckel\*<sup>1</sup>, <sup>1</sup>Purdue University, <sup>2</sup>The Ohio State University, <sup>3</sup>Research Institute of Bastyr University.

Lean gilts (n = 180), with an initial BW of 59 kg, were assigned to a 2 × 2 × 3 factorial arrangement consisting of ractopamine (RAC; 0 or 10 ppm), conjugated linoleic acid (CLA; 1% of a product containing 60% CLA isomers or 1% soybean oil), and dietary fat in an 8-wk feeding trial. Dietary fat treatments consisted of: 1) 0% added fat; 2) 5% choice white grease; and 3) 5% beef tallow. RAC treatments were imposed when the gilts reached an average BW of 85.5 kg and lasted for the final 4-wk until carcass data were collected at an average BW of 112 kg. Lipids from fat tissues of the belly, outer, and inner layers of backfat and *longissimus dorsi* were extracted and analyzed for fatty acid composition (six pigs/treatment; 72 pigs total). Dietary CLA increased the concentration of saturated fatty acids (43.1 vs. 35.9%; P < 0.001), decreased the concentration of monounsaturated fatty acids (41.4 vs. 47.5%; P < 0.001), and decreased IV values (56.1 vs. 63.0; P < 0.001) of the belly fat. Dietary fat reduced the concentrations saturated fatty acids (41.6 vs. 45.0%; P < 0.01) and increased IV values (60.7 vs. 57.4; P < 0.001) in the belly fat. Dietary CLA increased the concentration of saturated fatty acids in both the inner (44.1 vs. 37.6%; P < 0.01) and outer (43.1 vs. 35.9%; P < 0.001) layers of backfat. CLA increased the IV values of both layers of backfat (67.6 vs. 62.5%, inner 68.0 vs. 65.7%, outer; P < 0.001). Pigs fed diets containing 5% animal fat had increased IV values of the inner (66.5 vs. 62.1; P < 0.001) and outer layers (68.1 vs. 64.3; P < 0.01) over pigs fed diets without added fat. CLA increased the total saturated fatty acids (44.6 vs. 38.4%; P < 0.001) and reduced the IV values 57.9 vs. 65.2%; P < 0.001) in the *longissimus dorsi* muscle. Ractopamine decreased the intramuscular fat content of the *longissimus dorsi* (1.95 vs. 2.43%; P < 0.01) and increased the IV values of the outer (68.0 vs. 65.7; P = 0.07) and inner layer (66.2 vs. 63.9; P = 0.02) of backfat. These results indicated that CLA results in more saturated fat.

**Key Words:** CLA, Ractopamine, Fatty acids

**M126 WITHDRAWN. . .**

**M127 A case for expanded spreadsheet use in animal science research.** N. D. Paton\*, Akey, Lewisburg OH.

Considerable effort is spent assembling datasets from research trials in preparation for statistical analysis. In many cases a spreadsheet such as Microsoft® Excel is used. Spreadsheets can be programmed to provide substantial amounts of information from data in the form of summaries and graphs before the statistical analysis is performed. These summaries assist the researcher in identifying problems and errors before a statistical analysis is made. These errors can be difficult or impossible to uncover if data has been passed to a statistical analysis package and checks are not performed there. Little emphasis has been placed on teaching students and researchers how to maximize the utility of spreadsheets. Consequently, many do not explore possibilities of dataset preparation beyond simple capabilities of summing and calculating averages for vectors of data. If researchers were aware of more complex formula they may develop spreadsheets that detect more errors allowing easier identification of problematic data. If spreadsheets were robustly built the same template sheet could be used to assemble numerous datasets in a rapid and efficient manner. In MS® Excel the use of the OFFSET, TRANSPOSE, MATCH, RAND, V and H LOOKUP, AND, OR, IF, CHOOSE, ISERROR and DATABASE (specifically DAVERAGE and DSUM) functions are of value to the animal science researcher. They facilitate rapid summarization of data. They ensure the continuity and interactivity of calculations that operate on raw data when summaries and means are calculated for analysis. Often discovery of an error in the raw data requires the regeneration of a summary before a statistical analysis is performed. If summaries are linked through formulas to raw data they change automatically when the raw data are altered. Formulas can be written to perform complex tasks. The programming of the spreadsheets is relatively simple and the uses of some of the above formula are detailed and can be easily taught. Spreadsheets are ubiquitous; most researchers have access to their use. Their utilization could be increased if effort was expended in learning more of their capabilities.

**Key Words:** MS Excel, Formulas, Dataset

## Ruminant Nutrition

**M128 In vitro gas production of Iranian barley silage treated and untreated by urea and formaldehyde.** A. Taghizadeh<sup>1</sup>, M. Danesh Mesgaran\*<sup>2</sup>, R. Valizadeh<sup>3</sup>, F. Eftekhar Shahroodi<sup>4</sup>, and K. Stanford<sup>5</sup>, <sup>1</sup>Ferdowsi university, Mashhad, Iran, <sup>2</sup>Ferdowsi university, Mashhad, Iran, <sup>3</sup>Ferdowsi university, Mashhad, Iran, <sup>4</sup>Ferdowsi university, Mashhad, Iran, <sup>5</sup>Lethbridge Research center, Alberta, Canada.

In Vitro gas production Technique was used to measure the production gas from barley silages as experimental feed. The feeds were barley silage (untreated)(BS), BS treated with urea (20 g kg<sup>-1</sup>, DM)(BSU) or formaldehyde (4 g kg<sup>-1</sup>, DM)(BSF) or urea and formaldehyde (20 g kg<sup>-1</sup> and 4 g kg<sup>-1</sup>, DM, respectively)(BSFU). One steer (42018 Kg, fed a diet containing (as fed) 700 g kg<sup>-1</sup> alfalfa hay/timothy and 300 g kg<sup>-1</sup> a 15% CP concentrate) was used as ruminal fluid donor for the preparation of inoculums. The production of gas was measured in each vial after 0.0, 2, 4, 8, 12, 15, 24, 48, 72 and 96 h of incubation. Gas production data were fitted to an equation of  $p = a + b(1 - e^{-ct})$ ; where (p) is the gas production at time, t, (a) is intercept and ideally reflects the fermentation of soluble and readily available, (b) is the fermentation of the insoluble (but with time fermentable) fraction, (c) is the fractional rate at which b is fermented per hour. The soluble fraction (a) for BS, BSU, BSF and BSFU was 3.392, 4.84, -2.33 and #1.05, respectively. The insoluble (but with time fermentable) fraction (b) was 222.39, 185.45, 231.29 and 204.15, respectively. The fractional rate of fermentation (c) was 0.0418, 0.041, 0.049 and 0.0398, respectively. The results showed that the soluble fraction (a) of BSU was significantly (p < 0.05) higher than the other feeds. The potential fraction (b) of both BS and BSF were significantly (p < 0.05) higher than those recorded for BSU and BSFU. The gas production fractional rate (c) was significantly (p < 0.05) lower for BSFU compared with the other feeds. The results showed that the using of urea and/or formaldehyde in barley silage caused to change the

fermentation parameters determined by In Vitro gas production Technique.

**Key Words:** Gas production, Barley silage, Urea

**M129 The effects of dietary crude protein concentration on nitrogen absorption and retention by feedlot steers.** A. Gueye<sup>1</sup>, C. R. Richardson<sup>1</sup>, J. H. Mikus<sup>1</sup>, G. A. Nunnery\*<sup>1</sup>, N. A. Cole<sup>2</sup>, and L. W. Greene<sup>3</sup>, <sup>1</sup>Texas Tech University, Lubbock, Texas, <sup>2</sup>USDA-ARS-CPRL, Bushland, Texas, <sup>3</sup>Texas Agricultural Experimentation Station, Amarillo, Texas.

Twenty seven crossbred steers (average BW = 353.2 ± 8.4 kg) were used in a metabolism trial with three collection periods (approximately 35, 95, and 155 d on feed) to evaluate the effects of dietary CP source and concentration on nitrogen balance by steers. Treatments were arranged in a factorial arrangement and consisted of three dietary CP concentrations (11.5, 13.0, and 14.5%) and three supplemental urea:cottonseed meal (CSM) ratios (100:0, 50:50, and 0:100 of supplemental N). During each nutrient collection period steers were housed in individual metabolism stalls and urine and feces excreted were collected and frozen. Collection periods consisted of a 2- to 5-d adaptation period followed by a 5-d collection period. On d 35 on feed, total N excretion increased linearly (P = 0.002) with increasing CP concentration. Nitrogen absorbed (g/d) and N retained (g/d) linearly increased (P < 0.0001 and P = 0.01, respectively) with increasing CP concentration. On d 95 on feed, total N excretion linearly increased (P < 0.0001) with increasing CP concentration. Nitrogen absorbed (g/d) and N retained linearly increased (P < 0.0001 and P = 0.001, respectively) when CP increased from 11.5 to 14.5%. On d 155 on feed, DM digestibility decreased linearly (P < 0.05) with increasing dietary CP. Fecal N excretion increased linearly (P < 0.0001) with increasing CP. Nitrogen absorbed (g/d) decreased linearly (P = 0.03) with decreasing urea:CSM ratio. Nitrogen