

clustered in English, Animal Sciences and Biology courses. Employment summaries indicate an increase in the number of jobs obtained in the non-traditional careers in the past four years. In 1999-2000, only two graduates accepted positions in the exotic or companion animal areas while 10 students accepted similar positions in 2001-02. Membership in Purdue Zoo Club has grown to more than 25 members. With the addition of two companion animal courses and a specialization in well-being/behavior, the curriculum should be more conducive to non-traditional ANSC students completing their degree in ANSC.

**Key Words:** Curriculum, Animal Sciences, Companion animals

**353 Integrating practical elements into a theoretical applied animal behavior course for Animal Science undergraduates.** K Laughlin\*<sup>1</sup> and A.J. Zanella<sup>1</sup>, <sup>1</sup>*Michigan State University.*

The teaching of applied animal behavior is of increasing importance to Animal Science undergraduates in North American universities. Building on the growing interest in animal welfare, and the potential opportunities for research and employment in this field, it is essential to deliver a body of students with a high level of knowledge, expertise and interest in this area of study.

The theoretical teaching of applied animal behavior principles in the classroom can be optimized by the integration of practical laboratory sessions, utilizing the wide range of facilities and livestock on hand at

most Land Grant universities in the US. We have developed a curriculum, in which parallel weekly laboratory sessions first familiarize students with the fundamental techniques of behavioral observation, including sampling and recording methods. Subsequent sessions gradually introduce greater complexity of experimental design, formulating and testing hypotheses, statistical analysis of data and interpretation of results. Throughout these lessons, we focus on different aspects of behavior (e.g. reproductive behavior, fear responses, social organization and motivation), thus consolidating information presented in lectures, whilst providing hands-on interaction with a variety of farm animal species. In collaboration with other organizations, we are also able to educate students on behavior and welfare issues of captive wild and companion animal species.

Students are required to submit reports throughout the course, which are graded on, among other things, the standard of scientific writing and critical evaluation of the study. The final assignment is an in-depth field research project, presented in written and oral form, allowing individuals to utilize the range of tools and techniques acquired during the semester, including peer review.

We propose that such an integrated teaching approach enhances the understanding of the theory underlying applied ethology, maximizes the appreciation of the practical considerations necessary in research, and stimulates a level of interest that may not be attained solely in the classroom.

**Key Words:** Animal Behavior, Undergraduate Teaching, Practical Experience

## Undergraduate Student Competitive Research Papers

**354 Injury levels of sows in gestation: stalls vs. group housing.** K.G. Bhend\* and G.W. Onan, *University of Wisconsin River Falls.*

In order to address increasing public concern about housing of gestating sows, alternative systems need to be investigated. It is imperative that quantitative objective data comparing sow welfare from various housing systems be obtained. This study compared traditional confinement stalls to an alternative group housing system with electronic sow feeders (ESF). In order to quantitate sow welfare an injury scoring system was established using a linear scale that accounted for location, number, and depth of injuries. The injury scores of pregnant sows housed in stalls (100 sows) and in dynamic groups in pens with ESF (100 sows) were recorded over a period of 60 days. Scores were compared in order to determine whether there were any differences in injury incidence and severity between sows in stalls versus pens with ESF. Total injury scores were found to be significantly higher in pens ( $P < 0.001$ ). Regression analysis of injury levels and body weight was also performed. As body weight of sows in stalls increased, injury scores increased ( $P < 0.01$ ). There was no significant effect of body weight on injury levels of sows in pens, however there was a trend toward decreasing total injuries with increasing weight. When injury scores were compared in the dynamic pens, it was found that subsequent groups of sows added to pens had higher levels of injuries than the initial groups ( $P < 0.01$ ). Two of the touted benefits of group housing of gestating sows include greater freedom of movement and greater opportunity for social interaction. The increased injury levels that result from aggressive social interaction, however, may offset any benefits.

**Key Words:** Sow Gestation Housing, Injury, Group Pens

**355 Performance of *HMGA1* as a candidate gene for growth traits in the pig.** N. T. Nguyen\*, K. S. Kim, H. Thomsen, J. Helm, and M. F. Rothschild, *Iowa State University.*

Quantitative trait loci (QTL) analyses using molecular markers have successfully detected several important genomic regions for growth and fatness traits in pigs. Knowledge of individual genes associated with human obesity may be important to understanding variation in the pig by providing candidate genes for growth and fatness traits. Our specific interest has focused on pig chromosome 7 (SSC7), which has been assigned several significant fat QTL. The improved comparative map between human and pig chromosomes has revealed large homology between the QTL regions of SSC7 and human chromosome (HSA) 6 as well as HSA15. A positional and biological candidate gene, the  $\langle i \rangle$ high

mobility group A1 (*HMGA1*) gene was studied as the *HMGA1* is involved in the regulation of cell growth and differentiation. Especially, the *HMGA1* protein may play a role in reducing adipocyte cell hyperproliferation. The *HMGA1* gene was then mapped to a position within the backfat and growth QTL region identified in a Berkshire x Yorkshire family. A single nucleotide polymorphism (SNP) identified in the gene was significantly associated with observed variation in F2 animals of a Berkshire x Yorkshire family, for backfat and growth traits using single marker analyses. Phenotypic associations of this polymorphism were also found to exist in several commercial populations. Our results suggest that the *HMGA1* gene is a good candidate for the growth and fat QTL reported in this region. Furthermore, this gene could be useful for marker-assisted selection of growth and fat traits in the pig.

**Key Words:** *HMGA1*, Pig Chromosome 7, Candidate Gene

**356 Effect of d  $\alpha$ -tocopherol alcohol or acetate in water soluble or emulsified form to the drinking water of weaning pig.** T.A. Specht\*<sup>1</sup>, D. C. Mahan<sup>1</sup>, N. D. Fastinger<sup>1</sup>, and R. L. Stuart<sup>2</sup>, <sup>1</sup>*Ohio State University, Columbus, OH,* <sup>2</sup>*Stuart Products, Bedford, TX.*

A study involving 80 weaning pigs evaluated the effects of d  $\alpha$ -tocopherol in alcohol or acetylated form added to the drinking water in a water soluble or emulsified form. The experiment was a 2 x 2 + 1 factorial conducted in four replicates as a RCB design. Vitamin E source (d  $\alpha$ -tocopherol or d  $\alpha$ -tocopheryl acetate) was the first factor while the second evaluated each in an emulsified or water-soluble form. A fifth group did not receive supplemental vitamin E in the diet or drinking water. Pigs were fed conventional nursery diets with 5% added fat and no supplemental vitamin E. Tap water served as the water source, but vitamin E was added to each group at 100 IU/L. Water mixtures were prepared daily, maintained at 4 °C, added as needed, with water disappearance calculated weekly. Pigs (18  $\pm$  1 d) were allotted to treatment pens based on weight and litter. Blood was collected at weaning and weekly for a 28-d period. Serum was analyzed for  $\alpha$ -tocopherol and triglyceride concentrations. The results showed that vitamin E source had no effect on ADG or ADFI. Pigs consuming the water soluble form of vitamin E tended to have higher gains ( $P < 0.05$ ) and higher feed intakes ( $P < 0.05$ ) than the emulsified form. Serum  $\alpha$ -tocopherol declined from weaning to 28-d in the control group. The pigs on vitamin E treatments had higher ( $P < 0.01$ ) serum  $\alpha$ -tocopherol from 7- to 28-d than the control group. The emulsified form of d  $\alpha$ -tocopherol form had higher serum  $\alpha$ -tocopherol concentrations than the water-soluble form at each measurement period but was significant ( $P < 0.05$ ) only at d 7

and 14. Serum triglycerides declined from weaning to 7 d postweaning and then increased steadily to 28 d. Serum triglyceride was not affected by vitamin E treatment. These results suggest that providing vitamin E in the drinking water of weaning pigs was effective in improving their vitamin E status and the emulsified form seemed to be superior.

**Key Words:** Vitamin E, Weaning, Pigs

**357 Feeding behavior of finishing boars and gilts on electronic feeders.** A. M. Crock\*, D. S. Casey, and J. C. M. Dekkers, *Iowa State University, Ames, Iowa*.

Feed efficiency is related to and can be improved by selecting for feeding behavior traits. Sex differences must be quantified and accounted for to accomplish this. The objective of this study was to evaluate differences in feeding behavior between boars and gilts at the end of the finishing period. Feeding behavior data was collected using single space electronic feeders on 221 littermate Yorkshire boars and gilts in seven contemporary groups over the last four weeks prior to the first pig being taken off-test. Intake and occupation time were recorded for each visit. The average number of pigs per pen was 11.4 and 12.4 for gilts and boars. Mean body weight was 67.6 and 92.3 kg at the beginning and ending of the four week period. Diurnal distributions of feed intake, number of visits, and occupation time were similar between boars and gilts, except the frequencies for boars were larger in the early morning and smaller during the peak periods of the day. Means per pig for feed intake per visit, occupation time per visit, feeding rate per visit, daily feed intake, number of visits, and occupation time per day were analyzed with a mixed linear model that included the fixed effects of sex and group, the covariates number of pigs per pen, beginning body weight, and ending body weight, and the random effects of pen and litter. Sex differences were not significant ( $P < 0.10$ ) for all traits except for feed intake per visit, but trends were consistent with literature: boars had less frequent but longer visits and ate more feed per visit and at a faster rate. In conclusion, sex differences in feeding behavior at the end of the finishing period seem consistent with differences reported in the literature for the entire grow-finish period. These results indicate that sex differences must be accounted for when selecting for feeding behavior traits to improve feed efficiency.

**Key Words:** Feeding Behavior, Sex Differences, Pigs

**358 Effects of field peas inclusion on intake and digestion in beef steers fed medium concentrate diets.** G.J. Williams\*, S.A. Soto-Navarro, M.L. Bauer, G.P. Lardy, D. Landblom, and J.S. Caton, *North Dakota State University, Fargo*.

Four ruminally and duodenally cannulated steers ( $703.4 \pm 41$  kg initial BW) were used in a  $4 \times 4$  Latin square to evaluate effects of field peas inclusion on intake and site of digestion in beef steers fed 55% concentrate diets. Steers were fed ad libitum at 0700 and 1900 daily and were allowed free access to water. Diets consisted of 45% grass hay (6.8% CP) and 55% concentrate mixture. Treatments consisted of: 1) control, no peas; 2) 15% peas; 3) 30% peas; and 4) 45% peas in the total diet, with peas replacing wheat middlings, soybean hulls, and barley malt sprouts in the concentrate mixture. Experimental period consisted of a 9-d diet adjustment period followed by a 5-d collection period. During collections, fecal output was measured using fecal bags, and duodenal samples were taken twice daily from all steers as follow: d 2, 0630 and 1230; d 3, 0800 and 1400; d 4 0930 and 1530; and d 5, 1100 and 1700. Total DMI ( $15.0, 13.7, 14.0, 13.2 \pm 0.5$  kg/d) and OMI ( $13.5, 12.3, 12.6, 11.9 \pm 0.4$  kg/d) decreased ( $P = 0.05$ ) linearly with pea inclusion. Apparent ruminal CP digestibility ( $17.3, 11.8, 0.9, 6.6 \pm 3.3\%$ ) and true ruminal CP digestibility ( $54.0, 49.0, 38.0, 45.0 \pm 3.1\%$ ) decreased ( $P \leq 0.03$ ) linearly with increasing field peas. Neutral detergent fiber intake ( $8.9, 7.9, 7.8, 7.0 \pm 0.3$  kg/d) and fecal NDF output ( $3.1, 2.9, 2.6, 2.3 \pm 0.2$  kg/d) decreased linearly ( $P \leq 0.03$ ) with increasing field peas. Acid detergent fiber intake ( $5.0, 4.6, 4.3, 3.8 \pm 0.1$  kg/d) and fecal ADF output ( $1.8, 1.7, 1.5, 1.4 \pm 0.1$  kg/d) decreased linearly ( $P \leq 0.03$ ) with increasing field peas. No effects were observed ( $P \geq 0.05$ ) for microbial efficiency or total tract digestibility of OM, CP, NDF and ADF. Inclusion of up to 45% field peas to beef steers consuming medium concentrate

diets reduces apparent ruminal and true ruminal CP digestibility, tends to reduce DMI but does not alter OM, NDF, or ADF digestibility.

**Key Words:** Field Pea, Digestibility, Cattle

**359 Comparison of tylosin and pharmacological zinc on acute phase reactant proteins and minerals.** J.G. Green\*, G.M. Hill, J.E. Link, M.M. Martínez, D.M. Dvoracek-Driksna, N.E. Raney, and C.W. Ernst, *Michigan State University, East Lansing, MI*.

Growth and health are improved by feeding an antibiotic (Ab) or pharmacological Zn as Zn oxide (ZnO) in nursery diets. During stress, acute phase reactant proteins (APP) initiate metabolic changes including plasma mineral concentrations. Our objective was to determine effects of dietary pharmacological Zn and/or the Ab, tylosin, on growth, serum and hepatic mineral (Zn, Fe, and Cu) concentrations and APP activity. Crossbred pigs ( $n = 80$ ) were weaned (7.1 kg, 19.7 d) and allotted by weight, sex and litter to dietary treatments fed in two phases (P1: d 0-7; P2: d 8-14). Diets met NRC (1998) recommendations and were as follows: 1) Control (C) 150 ppm Zn; 2) C + 2,000 ppm Zn; 3) C + Ab (tylosin, 88 g/kg); or 4) C + 2,000 ppm Zn + Ab. From d 15-27 pigs were fed a common diet (P3) with 150 ppm Zn and no Ab. Four pigs per treatment were bled on d 1, 4, 7, 11, and 14 post-weaning for determination of plasma alpha 1-acid glycoprotein (AGP), an APP. These pigs were killed on d 14 and liver tissue was harvested. All pigs were bled on d 1, 7, 14, and 27 post-weaning for determination of another APP, plasma ceruloplasmin (Cp), and Zn, Fe, and Cu concentrations. Feed disappearance and pig weights were recorded at dietary changes. After 14 d of Zn supplementation, pigs fed 2,000 ppm Zn had improved ( $P < 0.03$ ) ADG and G/F compared with pigs fed 150 ppm Zn. Adding Ab did not alter these parameters. Pigs fed 2,000 ppm Zn had higher ( $P < 0.05$ ) Cp activity than those fed 150 ppm Zn ( $0.206$  vs  $0.188$  U/mL respectively), whereas AGP was not affected by Zn or Ab. Plasma Zn and Fe were greater ( $P < 0.001$ ) in pigs fed the pharmacological Zn diets than in pigs fed 150 ppm Zn with or without Ab ( $163$  vs  $58$  g/g respectively). Hepatic Zn concentrations were 2.5-fold greater ( $P < 0.004$ ) in pigs fed 2,000 ppm Zn compared with those fed 150 ppm Zn with or without Ab. Because Zn and Ab had different effects on the variables studied, we conclude that these two growth promoters function by different mechanisms.

**Key Words:** Acute Phase Reactant Protein, Zinc, Antibiotic

**360 Effects of whole or rolled sunflower seeds on in situ ruminal disappearance in steers fed grass hay.** D. M. Spickler\*, T. C. Gilbery, M. L. Bauer, and G. P. Lardy, *North Dakota State University, Fargo*.

Nine ruminally cannulated crossbred steers ( $619 \pm 25$  kg) were used to evaluate effects of fat from sunflower seeds on fiber digestion and differences between whole and rolled sunflowers on in situ disappearance of hay and sunflowers. Steers were offered grass hay ad libitum (7.3% CP; 70.8% NDF) and were given 2 wk to adjust to dietary treatments. Treatments were sunflower meal (control; 0.15% of BW), whole sunflower seeds (0.25% of BW), and rolled sunflower seeds (0.25% of BW). Sunflower meal and sunflower seed treatments provided equal protein. Added dietary fat from sunflower seeds was 4.94% for rolled and 5.51% for whole (DM basis). Hay (2-mm grind; 5 g/bag) was incubated ruminally in situ for 96, 48, 36, 24, 12, 8, 4, 2, and 0 h and analyzed for DM, CP, NDF, and ADF. Whole and rolled sunflower seeds were masticated by ruminally evacuated steers, retrieved, and freeze dried. Masticated sunflower seeds (5 g) were incubated for 48, 36, 24, 12, 8, 4, 2, 0 h, and analyzed for DM, CP, ether extract (EE), and ADF. In situ data were fit to the model: disappearance =  $a + b \times e^{(-kt)}$ ; where  $a$  and  $b$  = rapidly and slowly degraded fractions,  $k$  = disappearance rate, and  $t$  = time. Hay intake ( $1.56 \pm 0.11\%$  of BW) was not different ( $P = 0.53$ ) among treatments. In situ disappearance rate of hay DM ( $3.90 \pm 0.44\%$ /h), CP ( $4.09 \pm 0.35\%$ /h), NDF ( $3.72 \pm 0.42\%$ /h), and ADF ( $3.85 \pm 0.52\%$ /h) was also not different ( $P \geq 0.10$ ) among treatments. Rolling sunflower seeds increased ( $P \leq 0.002$ ) rate of sunflower seed DM ( $7.18$  vs  $0.89 \pm 0.30\%$ /h), CP ( $8.25$  vs  $1.98 \pm 0.43\%$ /h), and EE ( $6.57$  vs  $1.15 \pm 0.55\%$ /h) disappearance compared with whole sunflower seeds. Rolling sunflower seeds did not affect ( $P = 0.51$ ) sunflower seed ADF disappearance rate ( $6.77 \pm 3.79\%$ /h). Rolling sunflower seeds increased rate of ruminal digestion. Feeding oil in the form of raw sunflower seeds

does not appear to affect ruminal fiber digestion. Increasing rate of ruminal oil release by rolling sunflowers also does not appear to affect ruminal fiber digestion.

**Key Words:** Sunflower Seeds, Supplementation, Cows

**362 Determining time of intramuscular fat deposition using ultrasound data.** C.A. Urdahl<sup>\*1</sup>, J.J. Harlan<sup>1</sup>, G.A. Younglove<sup>1</sup>, S. Nash<sup>2</sup>, S. Harrison<sup>2</sup>, J. Packham<sup>2</sup>, R. Panting<sup>2</sup>, D.M. Sanchez<sup>3</sup>, and J. Findlay<sup>2</sup>, <sup>1</sup>Chadron State College, Chadron, NE, <sup>2</sup>University of Idaho Cooperative Extension, ID, <sup>3</sup>University of Wyoming Uinta County Extension, Evanston, WY.

The ability to predict when market cattle move from select quality to choice quality grade would assist feeders in preventing over feeding of market cattle and thus reduce costs and possibly increase profit. Ultrasound technology has been used in the livestock industry for almost 50 years. However, most studies looking at intramuscular fat (IMF) deposition over time on feed have utilized different animals for measurements as steers were harvested in order to measure IMF. Thus, this study was conducted to evaluate IMF deposition over time utilizing ultrasound measurements. Fifty-seven crossbred steers were fed a traditional feedlot ration designed for growth to market weight within 150-160 days on feed. Intramuscular fat was measured using real time ultrasound on approximately days 60, 90, 120, and 150. Data were analyzed using the general linear model of SAS appropriate for a repeated measures design. Data collected to date suggest on average market cattle deposit the largest percent of backfat between approximately day 90 and day 120 (21% increase) as opposed to the other two time periods (12-12.5% increase).

**Key Words:** Intramuscular Fat, Ultrasound, Fat Deposition

**364 Effects of selenium source and physiological state on body, heart, and liver mass, small intestinal growth, and crypt cell proliferation in female rats.** B. C. Stegman<sup>\*1</sup>, J. B. Taylor<sup>2</sup>, L. P. Reynolds<sup>1</sup>, J. W. Finley<sup>3</sup>, D. M. Schafer<sup>3</sup>, and J. S. Caton<sup>1</sup>, <sup>1</sup>North Dakota State University, Fargo, <sup>2</sup>USDA, ARS, U.S. Sheep Experiment Station, <sup>3</sup>USDA, ARS, Human Nutrition Research Center, Grand Forks.

Sixty female Sprague-Dawley rats were used to evaluate effects of Se source and physiological state on body, heart, and liver mass, small intestinal growth, and crypt cell proliferation. Treatments were arranged in a 2 x 3 factorial with dietary Se source (Se-met vs Se-cys) and physiological state (non-pregnant, pregnant, and lactating) as factors. Rats were fed Se-deficient torula yeast diets from weaning to breeding (72 d) and then supplemented to provide 2 ppm of Se from either Se-met or

Se-cys. Rats were fed Se treatments for 17 d prior to necropsy. Data are reported as means pooled SEM. Body mass tended ( $P = 0.07$ ) to be lower in rats fed Se-cys compared with Se-met (313 vs 296 6.6 g). Compared with Se-cys, dietary Se-met increased ( $P = 0.04$ ) heart mass during lactation (1.06 vs 1.25 0.06), but not in non-pregnant or pregnant rats (Se-source x physiological state interactions;  $P < 0.06$ ). Liver mass was not affected ( $P = 0.70$ ) by Se source. Liver mass was highest in lactating, intermediate in pregnant, and lowest in non-pregnant rats ( $P < 0.01$ ; 23.5 vs 15.6 vs 11.2 0.6 g). Intestinal RNA and DNA were unaffected by Se source but RNA was higher ( $P < 0.01$ ) in lactating compared with non-pregnant or pregnant rats. Se-cys reduced ( $P < 0.03$ ) intestinal protein (mg/g) compared with Se-met in both pregnant and lactating rats (40 vs 62 and 50 vs 89 7.1 mg/g, respectively). Intestinal DNA:RNA, protein:DNA, and crypt cell proliferation were unaltered ( $P > 0.20$ ) by treatment. These data indicate that liver mass, intestinal RNA, and protein concentrations are impacted by physiological state. In addition, Se source influences heart mass and intestinal protein concentration. Crypt cell proliferation appears unaltered by amino acid source of Se or physiological state.

**Key Words:** Selenium, Intestine, Growth

**365 Evaluating chute-side ultrasound accuracy in market cattle.** J.J. Harlan<sup>\*1</sup>, C.A. Urdahl<sup>1</sup>, G.A. Younglove<sup>1</sup>, S. Harrison<sup>2</sup>, S. Nash<sup>2</sup>, J. Packham<sup>2</sup>, R. Panting<sup>2</sup>, and D.M. Sanchez<sup>3</sup>, <sup>1</sup>Chadron State College, Chadron, NE, <sup>2</sup>University of Idaho Cooperative Extension, ID, <sup>3</sup>University of Wyoming Uinta County Extension, Evanston, WY.

Carcass measurements on market beef are becoming increasingly difficult to obtain, as processing plants are less willing or able to allow outside people into facilities to acquire carcass data. Ultrasound technology, which has been used since the 1950's, has provided producers with the ability to collect carcass data on live animals. However, predicting intramuscular fat (IMF) has not proven to be accurate with chute-side service. Thus, this study was conducted to evaluate the accuracy of new software designed to measure IMF at chute-side utilizing ultrasound. Fifty-seven crossbred market steers were fed a tradition feedlot ration designed for growth to market weight within 150-160 days on feed. Steers were measured ultrasonically using chute-side methods and Central Ultrasound Processing for 12th rib fat thickness, longissimus muscle area and percent IMF on approximately days 90 and 150. Steers were harvested five days after the second scan and carcass data collected. In addition a one-inch steak was collected from the 12-13th rib region and chemically analyzed for fat content of the longissimus dorsi muscle. Data will be analyzed utilizing the general linear model of SAS.

**Key Words:** Ultrasound, Chute-side Accuracy, Carcass Quality

## Nonruminant Nutrition (Addendum)

**366 Comparison of antimicrobial alternatives in irradiated diets for nursery pigs.** T. P. Keegan<sup>\*</sup>, J. M. DeRouchey, J. L. Nelssen, M. D. Tokach, R. D. Goodband, S. S. Dritz, and C. W. Hastad, Kansas State University, Manhattan.

Previous research at Kansas State University indicated irradiation can effectively reduce the bacterial concentration in nursery diets. Our hypothesis for this research was that eliminating bacteria in the feed via irradiation would allow the impact of antimicrobial alternatives to be more easily measured. In a 27 d growth assay, 354 weaning pigs (PIC, 6.9 kg and 18 ± 2 d of age) were fed one of 9 experimental diets: 1) control diet with no antimicrobials, 2) irradiated control diet with no antimicrobials, and irradiated control diet with added; 3) Carbadox (50 g/ton), 4) Probios<sup>®</sup> (1.6% from d 0 to 14 and 0.8% from d 14 to 21), 5) BioSaf<sup>®</sup> (0.3%), 6) Biomate Yeast Plus<sup>®</sup> (0.1%), 7) Bio-Mos<sup>™</sup> (0.3%), 8) Bio-Plus<sup>®</sup> 2B (0.05%), or 9) LactoSacc<sup>®</sup> (0.2%). There were 8 pens/treatment and 5 pigs/pen. BioSaf<sup>®</sup>, Biomate Yeast Plus<sup>®</sup>, and Lacto Sacc<sup>®</sup> are all concentrated forms of selected live yeast cells while Bio-Mos<sup>™</sup> is a mannanoligosaccharide derived from yeast.

Probios<sup>®</sup> is a form of lactic acid bacteria and Bio Plus<sup>®</sup> 2B contains two bacillus strains. All antimicrobials were added after diets were irradiated. Neither irradiation nor feed additives in an irradiated-diet improved growth performance compared to the non-irradiated control. From d 0 to 27, ADG was 296, 300, 301, 290, 255, 285, 303, 295, and 284 g and Gain/feed (G/F) was 0.78, 0.79, 0.76, 0.71, 0.75, 0.76, 0.77, 0.79, and 0.76 for diets 1 to 9, respectively. Pigs fed the non-irradiated control diet, irradiated control diet or irradiated diets containing Carbadox, Bio-Mos<sup>™</sup>, or Bio-Plus<sup>®</sup> 2B had greater ADG ( $P < 0.05$ ) than pigs fed BioSaf<sup>®</sup>. Pigs fed Probios<sup>®</sup> had a poorer G/F ( $P < 0.05$ ) compared to all other test diets. Pigs fed the irradiated control or Bio-Plus<sup>®</sup> 2B had improved G/F ( $P < 0.05$ ) compared to pigs fed BioSaf<sup>®</sup>. In conclusion, irradiating the control diet or adding the feed additives to the irradiated diet did not improve growth performance. Eliminating the bacteria in the control diet by irradiation did not allow the impact of antimicrobial alternatives to be more easily measured.

**Key Words:** Nursery Pig, Irradiation, Feed Additive