242 Potassium source and level influence performance day 21 42 post-weaning. B. V. Lawrence*, J. D. Hahn, and S. A. Hansen, *Hubbard Feeds Inc, Mankato, MN*.

Two trials with terminal cross Duroc sired pigs were conducted to evaluate the influence of potassium (K) source and inclusion level in post-weaning diets. In Exp 1, 1,712 pigs (11.9 ± 0.3 kg) were assigned to either a control diet (0.22% Na, 0.44% Cl, and 0.78% K), or the Control diet supplemented to 0.96% K from KCl (0.23% Na, 0.56% Cl), KHC03 (0.22% Na, 0.33% Cl), or KCl balanced to the same Na and Cl (KCl Low Cl) as the $KHC0_3$ treatment (n = 8). Pens were weighed on d-0 and 21. In Exp 2, 950 pigs (13.0 ± 0.9 kg) were fed one of five diets. The control diet from Exp 1 was used and was supplemented with 0.09% or 0.18% K from KCl or $KHC0_3$ (n = 8). All diets contained 0.22% Na. Diets were formulated to 0.40, 0.48, 0.56, 0.33, and 0.33% Cl for the control, 0.09 and 0.18% added K from KCl and 0.09 and 0.18% added K from $KHC0_3$ respectively. During Exp. 2, pens were weighed on d-0, 14, and 28. In both experiments, Na and Cl levels were manipulated by altering levels of dietary NaCl and $NaPO_4$. Data was analyzed using the GLM procedures of SAS with pen as the experimental unit for gain, intake and feed conversion. In Exp 1, intake was unaffected by treatment (P>0.10). Gain increased in a KCL Low Cl< KHC03<KCl=control manner. Lower gains of the KCl Low Cl fed pigs at similar intakes resulted in a poorer gain to feed compared to the other treatments. During the first 14-d of Exp 2, gain and intake were not statistically different (P>0.10). Gain, however, was numerically higher for the 0.18% added K treatments resulting in an improvement (P<0.001) in gain to feed. From day 14 28, intake was not affected by treatment (P>0.10), however, gain and gain to feed were poorer (P<0.0001) when K level was increased compared with the controls. Gain and gain to feed were significantly lower (P<0.05) for the pigs fed diets with 0.18% added K from $KHC0_3$. These results suggest benefit to short-term (<14-d) K supplementation at 21-d post-weaning, however, long-term (> 21-d) K supplementation may be detrimental to gain and gain to feed, particularly if the supplemental K (0.18%) is supplied as $KHC0_3$.

Key Words: Potassium, Growth, Pigs

243 Inorganic anions (Animate® concentrate) stimulate growth in nursery pigs fed diets without antibiotics regardless of diet buffering capacity. T. D. Crenshaw*[1] and D. E. Axe[2], [1]*University of Wisconsin, Madison,* [2]*IMC, Lake Forest, IL*.

Diets with low buffer capacity (LB) have stimulated growth and altered ingesta microflora of nursery pigs compared with pigs fed diets with high buffer capacity (HB), or sub-therapeutic antibiotics in a herd with chronic salmonella problems. LB diets involved shifts in sources (calcium tribasic phosphate and calcium sulfate) and levels of Ca and P. The current objective was to determine if shifts in cation-anion balance, or the source of inorganic anions altered growth. A complex basal diet was altered to provide HB (0.80 % Ca, 0.80 % P) or LB (0.55 % Ca, 0.65 % P) diets with 3 sources, $CaCO_3$, $CaSO_4$, or Animate (a concentrated formulation of Animate for pigs as a source of Cl and SO_4). Antibiotics were not added to any diets. Crossbred (PIC Cambrough X Line 19) pigs (n = 96, 4 pigs per pen) were weaned (3 wk) and randomly allotted to 6 diets for a 32-d trial (P1, 15 d; P2, 17 d). In P2 and the entire trial pigs fed Animate gained more (P < 0.02) than pigs fed $CaCO_3$ or $CaSO_4$ regardless of diet buffering capacity. Feed intake increased (P < 0.02) in pigs fed Animate. No differences were observed in feed efficiency. The lack of response to diet buffer capacity is not consistent with earlier results and may be related to lower initial prevalence (< 20 %) of salmonella-positive pigs. Improved growth of pigs fed Animate was likely due to Cl rather than cation-anion balance or buffer capacity. Growth and feed intake responses to inorganic anions

		HB Capacity			LB Capacity			
		$CaCO_3$	$CaSO_4$	Animate	$CaCO_3$	$CaSO_4$	Animate	SEM
CAB[a]:		210	189	189	110	89	89	
Cl, %:		0.52	0.52	0.62	0.52	0.52	0.62	
Gain, kg/d	Period, d							
	0-15	0.21	0.20	0.22	0.24	0.21	0.25	0.02
	15-32[b]	0.59	0.58	0.64	0.57	0.58	0.66	0.02
	0-32[b]	0.41	0.40	0.44	0.41	0.41	0.47	0.02
ADFI, kg/d								
	0-15	0.30	0.29	0.30	0.31	0.29	0.34	0.02
	15-32[b]	0.84	0.82	0.88	0.82	0.84	0.93	0.03
	0-32[b]	0.59	0.57	0.61	0.58	0.59	0.66	0.02

[a]Cation-anion balance = (Ca + Na + K + Mg) - (1.8·P + Cl + S) mEq/kg in P2 diets;
[b]P < 0.02.

Key Words: Cation-Anion Balance, Chloride, Salmonella

244 Effects of diet acidification and buffering capacity on weanling pig growth. M. Walsh*, D. Sholly, K. Saddoris, R. Hinson, A. Yager, A. Sutton, S. Radcliffe, B. Harmon, and B. Richert, *Purdue University, West Lafayette, IN*.

A study utilizing 192 weanling pigs evaluated the effects of diet acidification and buffering capacity on pig growth. Pigs (19.1 d average age) were assigned to one of three dietary trts:1) Basal control diet (NC); 2) Diet 1 + 55 ppm carbadox (CB); 3) Dietary acid (DA): diet 1 + .4% organic acid based blend (fumaric, lactate, citric, propionic, and benzoic acids) for d 0-14 followed by .2% inorganic acid based blend (phosphoric, fumaric, lactic, and citric acids) for d 14-28. Each trt was formulated with either limestone or calcium sulfate as a calcium source to change the buffering capacity. Pigs were allotted based on genetics, gender, and initial BW (average of 5.9 kg) and were housed at 6 or 7 pigs/pen. Pen feed intake and individual BW were recorded weekly. Treatments were fed throughout the trial in two phases: d 0-14 and 14-28. During phase 1, pigs fed CB had greater ADG (P<.10) and BW (P<.03) than pigs fed the NC with pigs fed DA being intermediate. During phase 2 and overall, pigs fed CB had greater ADG (P<.01) than pigs fed NC and DA (Overall ADG: 298 vs 252 and 268 g/d, respectively). Pigs fed CB had greater ADFI (P<.04) during phase 2 and overall than pigs fed the NC with pigs fed the DA being intermediate. On d 28, pigs fed CB were heavier than pigs fed NC or DA (14.3 vs 12.9 and 13.4 kg, respectively; P<.001). Overall G:F was greater (P<.06) for pigs fed CB than pigs fed the NC with DA pigs being intermediate. During phase 1, pigs fed diets with limestone as a calcium source tended to have greater ADG (P<.09) than pigs calcium sulfate. During phase 2, pigs fed calcium sulfate had greater G:F (P<.05) than pigs fed limestone. Overall, there was no effect of calcium source on pig growth. In conclusion, pigs fed CB were 1.4 kg heavier and pigs fed DA were 0.5 kg heavier at d 28 post-weaning than the NC pigs. Altering diet buffering capacity had its greatest influence on pig growth during phase 2 when the simplest diet was fed, but did not affect the response to CB or DA.

Key Words: Pigs, Acidification, Buffering Capacity

245 Effects of diet and water acidification on weanling pig growth and microbial shedding. M. Walsh*[1], D. Sholly[1], K. Saddoris[1], R. Hinson[1], A. Sutton[1], S. Radcliffe[1], B. Harmon[1], R. Odgaard[2], J. Murphy[2], and B. Richert[1], [1]*Purdue University, West Lafayette, IN,* [2]*Kemin Americas, Inc., Des Moines, IA*.

This study utilized 205 pigs in a 34 d nursery trial. Pigs (19.2 d of age) were assigned three dietary trts: 1) Basal control diet (NC); 2) Diet 1 + 55 ppm carbadox (CB); 3) Dietary acid (DA); diet 1 + .4% organic acid based blend (fumaric, lactate, citric, propionic, and benzoic acids) for d 0-7 followed by .2% inorganic acid based blend (phosphoric, fumaric, lactic, and citric acids) for d 7-34. These three diets were factored with or without water acidification (WA) of 2.48 mL/L of a propionic acid based blend (KEM SAN™). Pigs were allotted based on genetics, sex, and initial BW (Avg=5.54 kg) with 6 or 7 pigs/pen. Pen FI and individual BW were recorded weekly. Treatments were fed

in three phases: d 0-7, 7-21, 21-34. Feces were collected on d 6, 20 and 33 (3 pigs/pen) for measurement of pH and *E.coli*. No trt effects (P>.05) were observed during phase 1. During phase 2, pigs fed CB had greater ADG (P<.03) and G:F (P<.06) than pigs fed DA and tended (P<.10) to have greater ADG than pigs fed NC. During phase 3 and overall, pigs fed CB had greater (P<.0001) ADG (overall; 389 vs 348 and 348 g/d, respectively), ADFI and d 34 BW (18.8 vs 17.3 and 17.3 kg, respectively) than pigs fed NC and DA. Phase 3 G:F was greater for pigs fed DA than pigs fed NC (P<.05). Phase 3 ADG was improved by WA across all diets (P<.01), while WA increased ADFI only in pigs fed CB and NC but not DA (P<.04). Pigs receiving no WA had greater overall G:F (P<.03) than pigs receiving WA. Feeding CB tended to reduce *E.coli* on d 33 compared with pigs fed DA (P<.10). Pigs fed DA tended (P<.10) to have lower fecal pH than pigs fed CB on d 20. Pigs receiving WA tended (P<.10) to have lower fecal pH than pigs receiving no WA on d 33. In conclusion, pigs fed CB were 1.5 kg heavier at d 34 post-weaning than both NC and DA. The combination of DA with WA resulted in decreased ADFI and overall growth performance, while all other treatment combinations improved pig growth above the NC alone.

Key Words: Pigs, Carbadox, Acidification

246 Effects of diet acidification and antibiotics on weanling pig growth and microbial shedding. M. Walsh*, D. Sholly, K. Saddoris, R. Hinson, A. Yager, A. Sutton, S. Radcliffe, B. Harmon, and B. Richert, *Purdue University, West Lafayette, IN*.

Two hundred ten weanling pigs were used in a 35 d trial to evaluate the effects of a dietary acid and/or antibiotics in nursery pig diets. Pigs (18.3 d of age) were assigned to three dietary trts: 1) Basal control diet (NC); 2) Diet 1 + 55 ppm carbadox (CB); 3) Diet 1 + 38.6 ppm Tiamulin + 441 ppm Chlortetracycline (CTC) d 0-7 followed by 110 ppm CTC d 7-35 (TC). These three trts were factored with or without a diet acidification (DA); .4% organic acid based blend (fumaric, lactate, citric, propionic acid, benzoic acid) for d 0-7 followed by .2% inorganic acid based blend (phosphoric, fumaric, lactic, citric acid) for d 7-35. Pigs were allotted based on genetics, sex, and initial BW (Avg=5.6 kg) with 7 pigs/pen. Pen FI and individual BW was recorded weekly. Three diet phases were fed: d 0-7, 7-21, 21-35. Feces were collected on d 6, 20 and 33 (3 pigs/pen) for measurement of pH and *E.coli*. During phase 1, ADG, ADFI, G:F and d 7 BW for pigs fed CB and TC were greater than pigs fed NC (P<.04). During phase 2 pigs fed CB and TC had greater ADG and ADFI and d 21 BW (P<.01) than pigs fed NC. During phase 3, CB fed pigs had greater (P<.06) ADG and ADFI than NC fed pigs. Overall, pigs fed CB and TC had greater ADG (P<.004; 315 and 303 vs 270 g/d respectively), ADFI (P<.01) and d 35 BW (16.74 and 16.23 vs 15.08 kg, respectively; P<.002) than pigs fed NC. Pigs receiving DA tended to have greater G:F (P<.09) than pigs receiving no DA during phases 2 and 3. Overall ADG tended (P<.07) to improve with DA and NC or TC diets, but decreased when DA was added to the CB diets. Pigs fed CB shed lower counts of *E.coli* on d 33 compared with pigs fed TC or NC (P<.0001). Pigs fed CB and TC tended to have lower fecal pH on d 6 compared to pigs fed NC (P<.002). Feeding DA reduced fecal pH on d 6 and *E.coli* shedding on d 33 compared to pigs receiving no DA (P<.10). DA tended to increase growth performance above NC and TC diets alone. However, overall growth performance was greatest when CB was fed alone and not with DA.

Key Words: Pigs, Antibiotics, Diet Acidification

247 Use of δ-aminolevulinic acid in swine diet: effects on growth performance, behavioral characteristics and hematological/immune statuses in nursery pigs. R. D. Mateo*, F. Ji, and S. W. Kim, *Texas Tech University, Lubbock*.

Certain amino acids are essential precursors of a variety of important biomolecules in addition to their major function as protein building blocks. δ-aminolevulinic acid (ALA) is synthesized from the condensed form of succinyl-CoA with glycine after decarboxylation catalyzed by δ-aminolevulinate synthase. The objective of the study was to determine effects of ALA supplementation on growth performance, behavioral characteristics and hematological/immune statuses in nursery pigs. A total of 144 pigs weaned at 21 days of age were allotted to 3 dietary treatments representing (-) control (w/o antibiotics), (+) control (w/ Carbadox at 50 mg/kg as pure form or 1% as diluted form), and treatment group with ALA supplementation (0.05%). Each treatment had 6 pens (replicates) with 8 pigs per pen. Pigs were fed Phase 1 (21.86% CP, 1.4% Lys) and 2 (20.6% CP, 1.15% Lys) experimental diets for 3 and 2 wks, respectively. Feed intake and weight gain were measured weekly during Phase 1 and at the end of Phase 2. At the end of Phase 2, blood samples were taken and analyzed using an automated hematology analyzer. Skin color and activity of pigs (48 hrs) from all pens in each treatment were measured at the second week of Phase 2. Growth performance was not affected (P>0.05) by the dietary supplementation of ALA during nursery phases. Pigs in the ALA and (+) control groups had a higher (P<0.05) number of red blood cells than pigs in the (-) control group (6.46, 6.68, and 6.15 x 10^6 cell/μL, respectively). Pigs in the (+) control had a higher (P<0.05) hemoglobin level than pigs in the (-) control and ALA groups (12.16, 11.29, and 11.47, respectively) . Pigs in the ALA and (+) control groups had darker (P<0.05) and less (P<0.05) yellow skin color than pigs in the (-) control group. Pigs in the (+) control tended to be less active (P<0.10) than pigs in the other groups. There was no difference in behavioral characteristics between (-) control group and ALA group. The data suggest that ALA improves red blood cell counts which can be beneficial to pigs.

Key Words: Aminolevulinic Acid, Antibiotics, Nursery Pigs

248 The effect of dietary protein on growth performance and fecal consistency of 9 to 24 kg pigs following an enteric challenge with K88 E. coli. D. C. Kendall*[1], R. W. Fent[1], S. X. Fu[1], J. L. Usry[2], J. A. Carroll[3], and G. L. Allee[1], [1]*University of Missouri, Columbia,* [2]*Ajinimoto Heartland LLC, Chicago, IL,* [3]*ARS-USDA Animal Physiology Research Unit, Columbia, MO*.

Two experiments were conducted to determine the effect of dietary protein on growth performance and fecal consistency of 9 to 24 kg pigs following an enteric challenge with K88 E. coli. In Exp. 1, 96 barrows (10.2 kg; PIC C-23) were allotted by weight in a randomized complete block design and fed one of four dietary treatments with eight replicates of three pigs per pen. Diets contained 25.5, 23.6, 21.8, and 20.1% CP, achieved by decreasing the level of soybean meal inclusion and increasing crystalline amino acid use while maintaining 1.32% TID Lys. Diets contained no growth promoting antibiotics or copper sulfate. Following a 7d acclimation period, pigs were enterally dosed with 3.95 x 10^8 CFU K88 E. coli. Fecal consistency was measured daily with subjective fecal scores (0-3) where 0 = normal, 1 = mild, 2 = moderate, or 3 = severe diarrhea. In addition, fecal samples were collected on d 2, 3, 4, 6, and 8 for moisture determination. From d 2 to 8, fecal scores (P< .003) and fecal moisture (P< .05) declined linearly with decreasing dietary protein (.65, .45, .27, and .26 units; 74.3, 73.1, 72.6, and 72.3% moisture, respectively). For the 14 d following challenge, there was no effect of dietary treatment on growth performance. In Exp. 2, 188 barrows (9.0 kg; TR-4 X PIC C-22) were allotted by weight in a randomized complete block design and fed one of four dietary treatments with 10 replicates of four or five pigs per pen. Dietary treatments and procedures were the same as Exp. 1. Fecal consistency was measured on a subset of pigs (n = 96) on d 0, 2, 4, 6, 8, 10, 12, and 14. For the first 7 d following challenge, fecal scores (P< .001) and fecal DM (P< .001) declined linearly with decreasing dietary protein (1.36, 1.07, .86, and .53 units; 80.8, 79.0, 77.4, and 74.5% moisture, respectively). Similar to Exp. 1, dietary treatment did not influence post-challenge growth performance of pigs. These experiments clearly demonstrate that dietary protein negatively influences fecal consistency but does not affect growth performance during an enteric challenge.

Key Words: Pigs, E. Coli, Protein

249 The effect of lactose and inulin on intestinal morphology, microbiology and volatile fatty acids of the weanling pig. K. M. Pierce*[1], J. J Callan[1], P. O. Brophy[1], P. McCarthy[2], T. Sweeney[1], E. Fitzpatrick[1], C. Byrne[1], S. Ni Cheallaigh[1], and J. V. O'Doherty[1], *University College, Dublin University, Dublin, Ireland,* [2]*Volac International Ltd.*.

Twenty piglets (21 d, 8.0 kg BW) were used in a 2 x 2 factorial to investigate interactions between lactose and inulin on intestinal morphology, microbiology, and VFA production of the weanling pig. The piglets were fed the following diets for 6 d and sacrificed: (T1) 100 g/kg Lactofeed 70 (LF70; 860 g whey permeate and 140 g soy bean meal/kg; Volac International, UK), (T2) 100 g/kg LF70 + 15 g/kg inulin, (T3) 350 g/kg LF70, and (T4) 350 g/kg LF70 + 15 g/kg inulin. Tissue samples were taken from the duodenum (Duo), jejunum (Jej), and ileum for morphological measurements. Digesta samples were taken from the ileum, caecum, and

colon. There was an interaction ($P < 0.001$) between LF70 and inulin in villous height (VH) in the Duo, Jej, and the ileum. In the Duo and ileum, the inclusion of 350 g/kg LF70 increased VH compared to 100 g/kg LF70. However, there was no difference between 100 g/kg and 350 g/kg LF70 when the diets were supplemented with inulin. In the Jej, the inclusion of inulin at 100 g/kg LF70 increased VH compared to 100 g/kg LF70 without inulin. However, inulin had no effect on VH at 350 g/kg LF70. The inclusion of 350 g/kg LF70 increased lactobacilli (+15%) and reduced coliforms (-10%) in the caecum and colon. The inclusion of 350 g/kg increased ($P < 0.05$) total VFA compared to 100 g/kg LF70 (143.0 vs 105.6 mmol/L; SEM, 11.4) in the caecum. There was an interaction ($P < 0.05$) between LF70 and inulin for total VFA concentration in the colon. The pigs receiving 350 g/kg LF70 had a higher total VFA concentration compared to pigs on 100 g/kg LF70. However, there was no difference between 100 g/kg and 350 g/kg LF70 when the diets were supplemented with inulin. In conclusion, high levels of LF70 increased total VFA concentrations and improved gut morphology and gut microflora. Inulin inclusion resulted in improvements in these parameters at the low LF70 level.

Key Words: Pigs, Lactose and Inulin, Intestinal Morphology

250 Effects of lactic acid and lactose on the digestive tract of nursery pigs. M. F. Palacios*, E. A. Flickinger, C. M. Grieshop, C. T. Collier, and J. E. Pettigrew, *University of Illinois, Urbana*.

The objective of this study was to measure the effects of lactose (L) and (or) lactic acid (A), on gastrointestinal tract characteristics of pigs during a 4-wk experiment. A total of 96 pigs were weaned and blocked on the basis of litter. The experiment was carried out as a RCBD, with six blocks, and four diets. The experiment was conducted as a 2 x 2 factorial arrangement of treatments, with factors being L and A. Pigs were fed one the following diets: 1) Basal (B), 2) B + L, 3) B + A, or 4) B + L + A. A 3-phase feeding program was employed for this experiment with phases 1, 2 and 3, corresponding to week 1, week 2, and weeks 3 and 4 respectively. Each of the B diets contained corn starch, which was replaced or not by L and A according to the dietary treatment. The levels of L varied according to the phase: 21% for phase 1, 14% for phase 2, and 7% for phase 3. The A was added to provide 0.75%. Half of the pigs were euthanized for collection of gastrointestinal data, utilizing 24 pigs on each of days 7 and 28. The following characteristics were measured from the tract: wet weight of organs, pH, concentration of lactate, concentration of VFA, bacterial culture of Lactobacillus and total anaerobes, quantitative PCR for Lactobacillus rDNA and total bacterial rDNA. No differences among treatments were found in wet weight of organs at 7 or 28 days post-weaning. The pH measured in all gastrointestinal segments was reduced (P=0.01) at 7 days post-weaning by the incorporation of A. Concentrations of lactate along the tract were not affected by treatment. Concentrations of VFA were altered, most notably reductions in terminal ileum on day 7 and distal colon on day 28 with A. The number of total anaerobes was reduced by A in stomach, terminal ileum contents and mucosa on day 7 (P=0.01). Also on day 7, Lactobacillus rDNA concentration was reduced (P=0.02) when both L and A were added to the diet, and Lactobacillus rDNA as a proportion of total bacteria rDNA concentration was reduced (P=0.01) when L was added to the diet.

Key Words: Pig, Lactic Acid, pH

251 Effects of lactic acid on growth performance of nursery pigs. M. F. Palacios*, K. T. Soltwedel, G. R. Hollis, and J. E. Pettigrew, *University of Illinois, Urbana*.

A 6-wk experiment was conducted to evaluate the effect of increasing levels of lactic acid (A) to improve growth performance and health status of nursery pigs in a commercial farm. The experiment was carried out as a randomized complete block design with four treatments. Overall, four rooms were used, with 12 blocks, 48 pens, and 1584 pigs. Pigs were weaned at an average of 17.3 d of age and 5.42 kg BW. The feeding program was divided into four phases: Phase 1 (wk 1), Phase 2 (wk 2), Phase 3 (wks 3 and 4), and Phase 4 (wks 5 and 6). Diets contained corn, whey, oat groats, soybean meal, fish meal, blood plasma, and soy protein concentrate; and corn starch, which was replaced or not by a lactic acid product according to the dietary treatment. Pigs were fed one of the following dietary treatments: 1) Basal (B), 2)B+0.75% A (0.75A), 3)B+1.50% A (1.50A), and 4)B+2.25% A (2.25A). During the last two wks (Phase 4), all pigs received the same basal diet, with no addition of lactic acid to the diet. None of the diets contained antimicrobials. Performance criteria including ADG, ADFI, and G:F were measured for each phase of the experiment. In addition, medical treatments, and pig removals were recorded daily as measures of health status. The experimental treatments did not affect ADG, G:F or health status. Daily feed intake showed a quadratic response (P=0.04). The quadratic responses showed the greatest ADFI on the extreme treatments, and lower ADFI on the lower lactic acid inclusions. The results for this experiment did not show clear responses to increasing levels of lactic acid.

Diet	B	0.75A	1.50A	2.25A	SEM	Linear P-value	Quadratic P-value
ADG, g	366	355	367	365	4	0.61	0.37
ADFI, g	526	515	516	529	6	0.77	0.04
G:F	707	691	713	706	9	0.64	0.61
Removals, %	3.78	2.78	1.25	2.28	1.05	0.21	0.34
Treatments, %	1.35	1.44	1.40	1.58	0.13	0.37	0.66

Key Words: Pig, Lactic acid, Performance

252 Comparison of the effect of direct-fed microbials and antibiotic supplementation on the growth response of weanling pigs. M. S. Dirain*[1], M. E. Davis[1], D. C. Brown[1], C. V. Maxwell[1], Z. B. Johnson[1], and T. Rehberger[2], [1]*University of Arkansas, Fayetteville,* [2]*Agtech Products Inc., Waukesha, WI*.

Pigs (n=252) from 30 litters were used to compare the effect of direct-fed microbials and antibiotic supplementation on the growth of nursery pigs. Beginning at farrowing, pigs were provided milk supplementation with or without the addition of Lactobacillus brevis (1E-1) via an in-line system. These treatments were continued during the nursery period, in which pigs that were administered 1E-1 via milk supplementation continued to receive 1E-1 through the watering system. At the start of the nursery phase, pigs were fed a basal diet, the basal diet with Bacillus cultures, or the basal diet with antibiotics. These dietary treatments were administered during Phase 1 (d 0 to 14 after weaning), Phase 2 (d 14 to 28), and Phase 3 (d 28 to 38), in a 2 x 3 factorial design during the nursery period. Data were analyzed using the GLM procedure of SAS, and the effects of 1E-1 supplementation, dietary treatments, and their interaction were evaluated. No interaction was observed between 1E-1 supplementation and the dietary treatments ($P > 0.15$). Pigs supplemented with 1E-1 had greater ADG ($P < 0.05$) during Phase 2 and the overall nursery period (d 0 to 38), greater ADFI ($P < 0.05$) during Phase 3 and the overall nursery period, and tended to have improved gain:feed ($P < 0.10$) during Phase 3. Pigs supplemented with antibiotics during the nursery had greater ($P < 0.01$) ADG during Phase 2 and the overall nursery period, and greater ($P < 0.01$) ADFI during Phase 3 than pigs fed the basal diet or pigs fed Bacillus. Although pigs supplemented with antibiotics had greater ($P < 0.05$) gain:feed than pigs fed Bacillus during Phase 2, pigs fed Bacillus had greater ($P < 0.01$) gain:feed during Phase 3 than pigs fed the basal diet or those fed antibiotics. Pigs fed antibiotics during the nursery were 2 kg heavier at the end of the nursery than pigs fed the basal diet or Bacillus, whereas 1E-1 supplementation resulted in a 1.5 kg improvement ($P < 0.01$) in body weight at the end of the nursery period compared to pigs not receiving 1E-1. This study indicates that 1E-1 supplementation during lactation and the nursery phase improves the growth response of pigs during the nursery period.

Key Words: Swine, Lactobacillus, Feed Supplements

253 Efficacy of mannan oligosaccharides supplementation of both sows and piglet diets on the performance of weaned piglets. M. I. Gracia*[1], J. Morales[2], J. Pickard[3], J. Sánchez[1], and F. Baucells[1], [1]*Imasde Agropecuaria, S.L. Spain,* [2]*PigChamp Pro Europa Spain,* [3]*Alltech Inc., Ireland*.

A trial was conducted to study the effect of supplementing piglet diets with a source of mannan oligosaccharides (MOS, Bio-Mos®) on performance of weaned piglets from weaning at 28 d to 60 d of age. Five hundred and thirty two crossbred piglets (Large White × Large White∗Landrace), half male and half female, were allocated randomly to 28 replicates of 19 piglets each. A completely randomized block (room) design was applied using four experimental treatments arranged as a 2

× 2 factorial with main effects of piglet origin: 1) control sows, and 2) sows receiving 1 g/kg of MOS during lactation, and dietary treatment: 1) basal diet (control), and 2) basal diet with MOS at 2 g/kg in prestarter and 1 g/kg in starter diets. The experimental design was applied in both the prestarter (28 to 44 d of age) and the starter (44 to 60 d of age) periods. Nutritive value of the diets was 2.5 Mcal NE/kg and 14.8 g/kg lysine for prestarter, and 2.5 Mcal NE/kg and 13.3 g/kg lysine for starter, and were based on barley, corn, and wheat. Data were analyzed as a completely randomized block design with piglet origin and dietary treatment as main effects and weaning weight as a covariate. For the overall period (28 to 60 d of age), piglets coming from sows eating MOS during their lactation period grew more than piglets from control sows independently from their dietary treatment after weaning (339 *vs* 363 g/d; P<0.05). On the other hand, piglets supplemented with MOS tended to have better feed conversion ratio than control piglets independently from their origin (1.50 *vs* 1.39 g feed/g gain; P=0.059). No interactions were detected between main effects for any of the parameters studied. It was concluded that: i) the supplementation of lactation diets with MOS improved growth of piglets during the post-weaning period with independence of dietary treatment within this period, and ii) addition of MOS to post-weaning piglet diets improved feed efficiency.

Key Words: Mannan Oligosaccharides, Lactation, Piglets

254 Impact of spray-dried plasma with or without antimicrobials on nursery pig performance. P. Srichana*[1], A. M. Gaines[1], B. W. Ratliff[1], G. L. Allee[1], J. D. Crenshaw[2], J. M. Campbell[2], J. D. Quigley[2], and L. E. Russell[2], [1]*University of Missouri, Columbia,* [2]*APC Inc., Ankeny, IA.*

An experiment was conducted at a commercial research site to evaluate the impact of spray-dried plasma (SDP) with or without antimicrobials (AM) on nursery pig performance. A total of 792 pigs (TR-4 × C22; 5.66 ± 0.05 kg) were used in a completely randomized block design with 6 replicate pens/treatment and 22 pigs/pen. Growth performance was evaluated during four dietary phases: Phase 1 (d 0-7), Phase 2 (d 7-14), Phase 3 (d 14-28) and Phase 4 (d 28-50). Diets were formulated to contain 1.60% and 1.50% total lysine in phase 1 and 2, respectively and 1.42% and 1.32 % true digestible lysine in phase 3 and 4, respectively. Treatments were as follows: 1) 0% SDP without AM (d 0-50); 2) 0% SDP with AM (d 0-50); 3) SDP (6% Phase 1, 3% Phase 2, 1.5% Phase 3, 0.75% Phase 4) without AM; 4) same as treatment 3 with AM; 5) SDP (6% Phase 1, 3% Phase 2); 6) same as treatment 5 with AM. For diets containing AM, the Phase 1 and 2 diets contained 3000 ppm ZnO and 55 ppm Mecadox, while Phase 3 and 4 diets contained 27.5 ppm Mecadox and 100 ppm $CuSO_4$. In Phase 1, pigs fed SDP and (or) AM had improved ADG (P < 0.05) as compared to pigs not fed SDP. Improvements in ADG were due to improvements in ADFI (P < 0.05). In Phase 2 and 3, pigs fed AM had improved (P < 0.05) ADG, which was due to improvements in ADFI (P < 0.05). In Phase 4, SDP and (or) AM did not improve growth performance. For the combined phases, growth performance was improved only by AM (P < 0.05). Pigs fed AM were 9.5% heavier at the end of the nursery period as compared to pigs not fed AM. There were no differences among treatments for within-pen coefficient of variation for initial or final BW. Collectively, these data indicate that SDP dramatically improves feed intake and weight gain of pigs the first week postweaning, while AM inclusion improves overall nursery performance.

Key Words: Spray-Dried Plasma, Antimicrobial, Pigs

255 Effect of flaxseed fractions and sub-therapeutic antibiotic inclusion on microbial ecology in small intestine of growing pigs. L. F. Smith*[1], R. T. Zijlstra[2], M. D. Drew[1], and A. G. Van Kessel[1], [1]*Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada,* [2]*Prairie Swine Centre Inc., Saskatoon, SK, Canada.*

Increasing pressure to discontinue the feeding of growth-promoting antibiotics has prompted examination of novel feed ingredients and their effect on intestinal microbial ecology. The impact of antibiotic inclusion, flaxseed, or flaxseed fractions on small intestinal microbial profiles was investigated in growing pigs. Eighteen ileal-cannulated barrows (33.1±2.4 kg) were fed one of six diets (A, basal diet with wheat, peas and soybean meal, 3.40 Mcal/kg DE and 2.65 g dig. lysine/Mcal DE; B, basal diet plus 20% ground flaxseed; C, basal diet plus 18% ground hot-water extracted flaxseed; D, basal diet plus 4% ground flaxseed hulls; E, basal diet plus 8% flaxseed oil; F, basal diet plus 22 mg/kg tylosin phosphate) during each of three 18-d periods in a change-over design for a total of nine observations per treatment. Experimental periods included 16 d for diet acclimatization and ileal contents were collected on d 17 and 18. Diets were provided in a wet mash form at 2.8 x maintenance. Approximately 100 ml of ileal digesta was collected in plastic bags containing N_2 following the AM-feeding. Serial dilutions were prepared in sterile peptone and plated on selective media for enumeration of total aerobes and anaerobes, *Clostridium perfringens*, *Lactobaccillus* spp., *Bifidobacterium* spp., *Streptococcus* spp., and Enterobacteria. Data were analyzed using the repeated measures procedure in SPSS. *Lactobaccillus* spp. plate counts were 7.97, 8.13, 8.52, 7.95, 8.41, and 8.40 log cfu/g for diets A through F respectively, and were increased (*P*#88040.05) by flaxseed hulls, oil, and tylosin. Diet composition did not affect plate counts for any other growth media employed. Inclusion of tylosin increased the number of lactobacilli in pig ileum contents as reported by others. Flaxseed fractions also affected ileal bacterial colonization; however, precise identification of compositional changes will require molecular based analyses.

Key Words: Flaxseed, Antibiotic, Pigs

Production, Management and the Environment: Health and Miscellaneous

256 The use of statistical process control capability indices to estimate subclinical mastitis prevalence and new infection rates. J. Lukas*[1], M. L. Kinsel[2], and J. K. Reneau[1], [1]*University of Minnesota, St. Paul,* [2]*Agricultural Information Management, Ellensburg, WA.*

The objective of this study was to calculate a capability index (Cpk) measuring the capability of a herd to meet a desired SCC standard based on the BTSCC (bulk tank somatic cell count) and determine its correlation with subclinical mastitis prevalence (SM) and new infection rate (NIR) estimates. BTSCC data collected daily or every other day for 12 months (January until December 2003) from 694 Minnesota dairies were used to compute the linear score.The mean of individual values, and the average moving range was used to calculate four different Cpk indexes (Cpk400, Cpk500, Cpk600, Cpk750 based on the 400000, 500000, 600000, 750000 SCC standards, respectively) for each of the herds. The SM and NIR values of 272 herds on the Minnesota DHI program were transformed by natural log, merged by farm name with the Cpk indexes and used to examine the relationship between the calculated Cpk indexes and SM and NIR (dataset three, n=269). One hundred eighty herds from dataset three were randomly selected, linear regression models were developed and validated by taking the SM and NIR values observed for the remaining 89 herds and regressing them against the SMe (estimated subclinical mastitis values) and NIRe (estimated new infection rates) calculated from the four linear regression models that were developed. High R^2 values (0.70, 0.64, 0.58, 0.49 for SM vs Cpk400, Cpk500, Cpk600, Cpk750, respectively) indicated a strong correlation between the BTSCC and herds SM. According to models developed, SM in herds that are able to meet the SCC standard (Cpk ≥ 1), is less or equal to 26%, 30%, 34%, 38% for the 400000, 500000, 600000 and 750000 standard, respectively. The relatively low correlations between NIR and Cpk indexes (R^2=0.34, 0.31, 0.28, 0.24 for NIR vs Cpk400, Cpk500, Cpk600 and Cpk750, respectively) indicate that the single DHI test day estimate of NIR was insufficient to accurately describe NIR dynamics.

Key Words: BTSCC, Subclinical Mastitis Prevalence, Statistical Process Control

257 Evaluation of the DHI hot list as a tool to reduce bulk tank somatic cell counts. J. E. Belsito*, A. de Vries, and R. P. Natzke, *University of Florida, Gainesville.*

Many dairy producers in the Southeast find it difficult to keep their bulk tank somatic cell count (SCC) below the legal limit (750,000 cells/ml) throughout long periods of hot weather. DHI has developed a hot list to assist farmers in identifying high SCC cows in the herd. The hot list identifies the 20 cows that are the greatest contributors of SCC to the