SWINE UPDATE

Kansas State University Agricultural Experiment Station
and Cooperative Extension Service

Animal Sciences & Industry

October 1997 Vol. 19, No. 3

UPCOMING EVENTS

Colorado Swine Industry Days
November 5
Sterling, Colorado

November 6
Lamar, Colorado

◆

K-State Swine Industry Day
November 20
Manhattan, Kansas

◆

SE Area Swine Meeting
January 21
Neosho, Kansas

◆

Atchison–Jefferson Swine Meeting
January 28
Nortonville, Kansas

◆

K-State Swine Industry Day
February 3
Manhattan, Kansas

◆

Health Management Seminars
February 23
Newton, Kansas

February 24
Linn, Kansas

◆

SEW Pig Management Seminar
February 26
Seneca, Kansas

Pyridoxine, but Not Thiamin, Improves Weanling Pig Growth Performance

Thiamin and pyridoxine are two B-vitamins that are abundant in grain–soybean meal diets. For this reason, supplementation in starter pig diets has not been widely recommended. Recently, several breeding-stock companies and vitamin manufacturers have recommended the addition of thiamin (vitamin B_1) and pyridoxine (vitamin B_6) to diets to achieve maximum growth potential. Therefore, we conducted two trials to determine whether pyridoxine or thiamine needs to be added to the diet for weanling pigs.

Experiment 1. A total of 180 weanling pigs (initially 11.02 lb and 21 d of age) were used in a 35-d growth assay to determine the effects of added thiamin (vitamin B_1) or pyridoxine (vitamin B_6) on starter pig growth performance. Pigs were blocked by initial weight, equalized for sex and ancestry, and allotted randomly to each of five dietary treatments in a randomized complete block design. Each treatment had six pigs per pen and six replications (pens) per treatment.

All experimental diets were fed in meal form. Diets fed from d 0 to 14 after weaning were formulated to contain 1.6% lysine, .44% methionine, .90% Ca, and .80% P. Diets fed from d 14 to 35 were formulated to contain 1.35% lysine, .38% methionine, .85% Ca, and .75% P. The control diet contained a standard vitamin premix without added thiamin or pyridoxine. Experimental treatments were provided by adding either thiamin mononitrate (2.5 or 5.0 g/ton) or pyridoxine HCL (3.5 or 7.0 g/ton) to the control diet. Pigs were fed the same experimental vitamin concentrations throughout the 35-d study. Pigs were weighed and feed disappearance was determined weekly after weaning to calculate ADG, ADFI, and F/G.

From d 0 to 14 after weaning, ADG increased then decreased with increasing pyridoxine (quadratic, $P < .05$; Table 1). Pigs fed 3.5 g/ton of added pyridoxine had the greatest ADG. Surprisingly, for pigs fed thiamin, ADG decreased then increased (quadratic, $P < .05$). Average daily gain was decreased for pigs fed 2.5 g/ton of added thiamin but was identical between those fed the control diet and 5.0 g/ton of added thiamin. Average daily feed intake increased then decreased with increasing thiamin and pyridoxine (quadratic, $P < .10$ and .05, respectively). However, F/G decreased then increased (quadratic, $P < .05$) with increasing thiamin. This appeared to be a result of the high feed intake and poor growth of pigs fed 2.5 g/ton of added thiamin. Feed:gain ratio was unaffected by increasing pyridoxine.

From d 14 to 35 after weaning, added thiamin or pyridoxine had no effect on ADG or F/G; however, ADFI increased (linear, $P < .05$) with increasing pyridoxine.

Cumulative results (d 0 to 35) showed a quadratic ($P< .05$) response in ADG and F/G with increasing added thiamin. As for the period from d 0 to 14 after weaning, pigs fed 2.5 g/ton of added thiamin had decreased ADG, but pigs fed the 5.0 g/ton had similar ADG to those fed the control diet. Pigs fed increasing pyridoxine had increased ADFI (linear, $P < .05$) from d 0 to 35. Although

ADG and F/G were not significantly improved, ADG was numerically highest for pigs fed the diet containing 3.5 g/ton added pyridoxine, reflecting the response from d 0 to 14.

Experiment 2. Based on the results of Exp. 1, we conducted a second study to determine the pyridoxine requirement of weanling pigs. A total of 216 weanling pigs (initially 13.6 lb and 21 d of age) was used in a 35-d growth assay to determine the optimum level of pyridoxine to maximize growth performance. Pigs were blocked by initial weight, equalized for sex and ancestry, and allotted randomly to each of six dietary treatments. Each treatment had six pigs per pen and six replications (pens) per treatment.

The control diet was identical to that used in Exp. 1. The experimental treatments were formed by adding pyridoxine from pyridoxine HCL at 1, 2, 3, 4, or 5 g/ton. As in Exp. 1, pigs were weighed and feed disappearance was determined weekly after weaning to calculate ADG, ADFI, and F/G.

From d 0 to 14 after weaning, increasing pyridoxine increased then decreased (quadratic, P< .05) ADG and ADFI (Table 2). Pigs fed 3 g/ton of added pyridoxine had the maximum ADG and ADFI. The increases in ADG appeared to be a result of increased feed intake, because increasing pyridoxine had no affect on F/G.

From d 14 to 35 or 0 to 35, increasing pyridoxine had no effect (P > .05) on pig growth performance; however, ADG and ADFI tended to numerically increase with increasing pyridoxine.

In conclusion, our results suggest that adding thiamin had no positive effect on growth performance of weanling pigs. However, adding pyridoxine improved ADG and ADFI of pigs from d 0 to 14 after weaning. The data suggests a requirement of 2 to 3 g/ton of added pyridoxine in diets fed from d 0 to 14 after weaning. For practical applications of this research, the SEW and transition diets should contain 3 g/ton of added pyridoxine.

Jason C. Woodworth

Table 1. Effects of Added Thiamin and Pyridoxine on Starter Pig Performance (Exp. 1)[a]

		Added Thiamin, g/ton		Added Pyridoxine g/ton		
Item	Control	2.5	5.0	3.5	7.0	CV
d 0 to 14						
ADG, lb[bc]	.81	.66	.81	.91	.86	7.9
ADFI, lb[bd]	.96	1.00	.96	1.05	1.00	5.4
F/G[c]	1.18	1.52	1.18	1.15	1.16	5.4
d 14 to 35						
ADG, lb	1.34	1.36	1.40	1.40	1.42	5.1
ADFI, lb[e]	2.15	2.13	2.19	2.22	2.27	4.2
F/G	1.61	1.56	1.56	1.59	1.59	4.9
d 0 to 35						
ADG, lb[c]	1.13	1.08	1.16	1.20	1.19	4.7
ADFI, lb[e]	1.67	1.68	1.70	1.75	1.76	3.5
F/G[c]	1.49	1.56	1.47	1.45	1.47	3.9

[a] A total of 180 weanling pigs (initially 11.02 lb and 21 d of age), six pigs per pen and six pens per treatment.
[b] Quadratic effect of pyridoxine (P < .05).
[c] Quadratic effect of thiamin (P < .05).
[d] Quadratic effect of thiamin (P < .10).
[e] Linear effect of pyridoxine (P < .05).

Table 2. Effects of Added Pyridoxine on Starter Pig Performance (Exp. 2)A

	Added Pyridoxine (g/ton)							Probability (P<)	
Item	0	1	2	3	4	5	CV	Linear	Quadratic
d 0 to 14									
ADG, lb	.79	.80	.88	.93	.84	.85	9.8	.13	.05
ADFI, lb	.92	.94	1.00	1.01	.99	.93	8.8	.41	.03
F/G	1.16	1.18	1.14	1.09	1.19	1.10	6.3	.18	.99
d 0 to 35									
ADG, lb	1.10	1.08	1.16	1.17	1.13	1.14	5.6	.13	.21
ADFI, lb	1.66	1.63	1.74	1.72	1.73	1.71	4.9	.09	.30
F/G	1.52	1.52	1.49	1.47	1.52	1.49	4.1	.88	.69

[a] A total of 216 weanling pigs (initially 13.6 lb and 21 d of age), six pigs per pen and six pens per treatment.

The Interactions of Diet Complexity, Zinc Oxide, and Feed Grade Antibiotic for SEW Pigs

Zinc and medication are two feed additives commonly added to weanling pig diets to improve growth performance. Early-weaned (< 17 days of age) pigs might not respond to zinc or medication in the same manner as conventionally-weaned pigs because of their high-health status. Another possibility is that the response to zinc and (or) medication could be dependent on the complexity of the diets (i.e., more beneficial in a stressful environment). To this effect, an experiment was conducted to compare the interactive effects between diet complexity, added zinc oxide, and feed grade antibiotic on growth performance of SEW pigs.

A total of 320 barrows (initially 9.9 lb and 12 to 15 d of age) were used for the trial. Pigs were blocked on the basis of weight and randomly allotted to one of eight dietary treatments with five pigs per pen and eight replicate pens per treatment. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of diet complexity (simple or complex), added zinc oxide (165 or 3,000 ppm), and feed grade antibiotic (none or 50 g/ton).

All diets were fed in a meal form. The SEW diets were fed from d 0 to 5, followed by transition diets from d 5 to 10, then phase II diets from d 10 to 20, and finally a common phase III diet from d 20 to 27 postweaning. The common phase III diet did not contain zinc oxide, copper sulfate, or antibiotic. Zinc oxide and antibiotic replaced corn starch in diet formulation. Within each phase of diets, lysine, methionine, Ca, and P levels were kept constant. These levels were consistent with current K-State recommendations.

Pigs were housed in environmentally controlled nurseries in 4 × 4-foot pens with tri-bar flooring and were allowed ad libitum access to feed and water. Weight gain and feed intake were measured on d 5, 10, 20, and 27 postweaning to determine ADG, ADFI, and feed efficiency (F/G).

Data were analyzed as a 2 × 2 × 2 factorial in a randomized complete block design with pen as the experimental unit. Diet complexity, zinc oxide, and antibiotic were the main effects, with the model including the main effects and all interactions.

From d 0 to 10 postweaning, the presence of specialty proteins in the complex diets improved ADG, ADFI, and F/G ($P < .01$). Antibiotic had no effect ($P > .25$) on ADG, ADFI, or F/G from d 0 to 10 postweaning. Conversely, zinc oxide improved ADG, ADFI, and F/G ($P = .05$).

From d 10 to 20 postweaning, the presence of antibiotic improved ADG ($P < .01$) in both diet types and F/G ($P = .01$) in simple diets (complexity by antibiotic interaction ($P = .10$)).

From d 0 to 20 postweaning, zinc oxide, antibiotic, and complex diets all improved ($P < .01$) ADG, while zinc oxide ($P = .05$) and complex diets ($P < .01$) improved ADFI. Feed efficiency improved in response to antibiotic ($P = .02$) and complex diets ($P = .01$).

From d 20 to 27 postweaning, the prior presence of antibiotic improved ADFI

($P = .01$) and F/G ($P = .03$) while zinc oxide had no effect ($P > .15$) on ADG, ADFI, or F/G. As the common phase III diet was fed, pigs previously fed complex diets had improved ADFI ($P < .01$) but poorer F/G ($P < .01$). This was especially evident when pigs were changed from diets containing antibiotic and zinc oxide to the common diet containing neither.

From d 0 to 27 postweaning, complexity, antibiotic, and zinc oxide all improved ADG (P (.02). Complexity ($P < .01$), antibiotic ($P = .06$), and zinc oxide ($P = .07$) all improved ADFI, but F/G was not affected when measured over the total trial.

In this experiment, complex diets with zinc oxide and antibiotic or both were clearly superior. However, the complexity response was most dramatic in the early period (d 0 to 5) postweaning, but the complexity response was evident throughout the study. It is also clear that zinc oxide and antibiotic are beneficial in SEW diets

Patrick R. O'Quinn

Table 1. Growth Performance of Pigs Fed Simple or Complex Diets With or Without Zinc Oxide, Antibiotic, or Both[a]

	Simple				Complex				
	–Zinc Oxide		+Zinc Oxide		–Zinc Oxide		+Zinc Oxide		
	–Antibiotic	+Antibiotic	–Antibiotic	+Antibiotic	–Antibiotic	+Antibiotic	–Antibiotic	+Antibiotic	CV
<u>d 0–10:</u>									
ADG, lb	.13	.08	.18	.23	.26	.34	.38	.36	34.7
ADFI, lb	.27	.27	.33	.36	.41	.41	.47	.46	15.2
F/G	2.08	3.38	1.83	1.57	1.58	1.21	1.24	1.28	56.0
<u>d 0–27:</u>									
ADG, lb	.56	.60	.60	.68	.65	.73	.72	.71	10.8
ADFI, lb	.87	.91	.93	.94	.95	1.08	1.05	1.07	10.5
F/G	1.55	1.52	1.55	1.38	1.46	1.48	1.46	1.51	11.1

Probability Values (P <)

	C × A × Z[b]	A × Z	C × Z	C × A	Z	A	C
<u>d 0–10</u>							
ADG	.02	.96	.54	.67	< .01	.52	< .01
ADFI	.43	.74	.58	.45	< .01	.75	< .01
F/G	.09	.80	.22	.43	.05	.99	< .01
<u>d 0–27:</u>							
ADG	.07	.44	.33	.46	.02	.01	< .01
ADFI	.38	.17	.97	.31	.07	.06	< .01
F/G	.28	.52	.53	.15	.72	.50	.76

a Means represent a total of 320 pigs (initially 9.9 lb and 12–15 d of age) with 5 pigs per pen and 8 replicate pens per treatment.

b Abbreviations are C = diet complexity, A = antibiotic, and Z = zinc oxide.

COOPERATIVE EXTENSION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
KANSAS STATE UNIVERSITY
MANHATTAN, KANSAS 66506

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

SWINE UPDATE

Jim L. Nelssen
Extension Specialist
Swine

Robert D. Goodband
Extension Specialist
Swine

Mike D. Tokach
Extension Specialist
Livestock Production & Management, NE

Kansas State University
Cooperative Extension Service
Department of Animal Sciences & Industry
Weber Hall, Room 213
Kansas State University
Manhattan, Kansas 66506