THE INTERACTIVE EFFECTS OF ZINC SOURCE AND FEED GRADE MEDICATION ON WEANLING PIG GROWTH PERFORMANCE [1]

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Summary

Two hundred eight-eight weanling pigs (initially 12.3 lbs and 18 d of age) were used in a 27-d growth assay to determine the interactive effects of Zn source and feed grade medication on growth performance. Experimental treatments were arranged in a 2 × 3 factorial with main effects of medication (none or 50 g/ton of carbadox) and Zn source (none, 250 ppm of Zn from a Zn amino acid complex, or 3,000 ppm of Zn from ZnO). The results suggest that dietary Zn improved growth performance primarily from d 0 to 14 and feed grade medication improved growth performance from d 14 to 27. Pigs fed diets containing ZnO had better growth performance than pigs fed diets containing no additional Zn, and pigs fed diets containing ZnAA had intermediate responses.

(Key Words: Early-Weaned Pigs, Growth, Zinc, Medication.)

Introduction

The benefits to growth performance of newly weaned pigs from feeding high levels of Zn from ZnO are well known. The use of feed-grade medications for improving growth and feed efficiency of swine is also a common practice. A past trial conducted at Kansas State University evaluated the interactive effects of diet complexity, ZnO, and feed-grade medication on growth performance of segregated early-weaned pigs. Added ZnO improved growth performance for the first 10 days, whereas medications improved growth performance primarily from d 10 to 27. However, no medication × ZnO interactions occurred. Recent research also has shown that lower levels of organic Zn sources may improve growth performance similar to high levels of ZnO when added to diets containing feed-grade medication. However, a series of experiments conducted at Kansas State University did not report similar growth responses between diets containing high levels of ZnO and diets containing lower levels of an organic Zn source. Diets used in these trials did not contain feed-grade medications; consequently, we did not know if the beneficial response to lower levels of organic Zn sources was dependent on the presence of such medications. Therefore, the objective of this trial was to further test the effects of an organic Zn amino acid complex (ZnAA) versus an inorganic Zn source (ZnO) in the presence and absence of feed-grade medication (carbadox) on weanling pig growth performance.

Procedures

A total of 288 weanling pigs (initially 12.3 lb and 18 d of age; PIC) was blocked by initial weight and allotted randomly to each of six dietary treatments in a 27 d growth

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assay. Each treatment had six replications (pens) and eight pigs per pen.

The six experimental diets were arranged in a 2 × 3 factorial with main effects of feed-grade medication (none or 50 g/ton of carbadox) and Zn source (none, 250 ppm of Zn from a ZnAA, or 3,000 ppm of Zn from ZnO). The ZnAA used in this trial was AvailaZn, which is produced by the ZinPro Corporation, Eden Prairie MN, and contained 10% Zn.

All experimental diets were fed in meal form. Pigs were fed diets in three phases, with the first phase fed from d 0 to 7, the next from d 7 to 14, and the last fed from d 14 to 27. Diets were formulated to be similar to those fed in a commercial phase-feeding program. Zinc source and/or medication replaced cornstarch in the basal diets to form the experimental treatments, which were fed for the entire 27 d. All diets also contained 165 ppm of Zn from ZnO provided by the trace mineral premix.

Pigs were housed in an environmentally controlled nursery in 5 × 5 ft pens on a commercial farm in northeast Kansas. Pens contained one self-feeder and two nipple waters to provide ad libitum access to feed and water. Pigs were weighed and feed disappearance was measured on d 0, 7, 14, 21 and 27 to determine ADG, ADFI, and F/G.

Data were analyzed as a 2 × 3 factorial in a randomized complete block design using the general linear model (GLM) procedure of SAS. Data were analyzed for main effects (feed-grade medication and Zn source) and two-way interactions using pen as the experimental unit. Orthogonal contrasts were used to compare the Zn treatments.

Results and Discussion

From d 0 to 7, different Zn sources and/or medication had no effect (P>.10; Table 2) on ADG, ADFI, or F/G. From d 7 to 14, pigs fed diets containing ZnO had greater (P<.03) ADG and ADFI compared to pigs fed diets containing no additional Zn or ZnAA. Feed to gain ratio of pigs fed diets containing ZnO was better (P<.004) than that of pigs fed diets containing no additional Zn and tended to be better (P<.08) than that of pigs fed diets containing ZnAA. Pigs fed diets containing ZnAA had similar (P>.10) ADG, ADFI, and F/G compared to pigs fed diets containing no additional Zn. Feed medication had no effect (P>.10) on ADG, ADFI, or F/G.

From d 0 to 14, ADG of pigs fed diets containing ZnO was greater (P<.05) than that of pigs fed diets containing ZnAA or no additional Zn, and the ADG of pigs fed diets containing ZnAA tended to be greater (P<.07) than that of pigs fed diets containing no additional Zn. Average daily feed intake of pigs fed diets containing ZnO was greater (P<.007) than that of pigs fed diets containing no additional Zn and tended to be greater (P<.08) than that of pigs fed diets containing ZnAA. Feed to gain ratio was not different (P>.10) between pigs fed diets containing ZnO or ZnAA; however, both had better (P<.04) F/G than pigs fed diets containing no additional Zn. Feed medication did not influence (P>.10) growth performance.

From d 14 to 27, the different Zn sources did not affect (P>.10) ADG. Average daily feed intake of pigs fed diets containing ZnO was greater (P<.05) than that of pigs fed diets containing either ZnAA or no additional Zn; however, no difference (P>.10) occurred between these two sources. Feed to gain ratio of pigs fed diets containing ZnO was poorer (P<.04) than that of pigs fed diets containing no additional Zn, and tended to be poorer (P<.08) than that of pigs fed diets containing ZnAA. No difference (P>.10) in F/G occurred between pigs fed diets containing ZnAA and pigs fed diets containing no additional Zn. Pigs fed diets containing medication tended to have greater (P<.08) ADG and ADFI compared to pigs fed diets containing no medication; however, F/G was not affected (P>.10).

From d 0 to 27, pigs fed diets containing ZnO had greater (P<.04) ADG than pigs fed diets containing no additional Zn. Average daily gain of pigs fed diets containing ZnAA was similar (P>.10) to that of pigs fed diets containing no additional Zn or ZnO. Average daily feed intake was greater (P<.03) for pigs fed diets containing ZnO compared to pigs fed diets containing either ZnAA or no additional Zn, and no difference (P>.10) occurred between these two sources. Feed to gain ratio was not affected (P>.10) by the different Zn sources. Pigs fed diets containing medication had similar (P>.10) ADG, ADFI, and F/G compared to pigs fed diets containing no medication.

The results of this trial resembled those of the previous Kansas State University experiment showing a beneficial response to ZnO for the first 14 days followed by an increased response to dietary medication after d 14. The loss of an ADG response from feeding high levels of ZnO after approximately d 14 is similar to past research showing that growth performance can be depressed if high levels of ZnO are fed for extended periods of time. In this trial, pigs fed diets containing Zn from ZnO had improved growth performance compared to pigs fed diets containing no additional Zn. Pigs fed diets containing ZnAA had intermediate growth responses. Previous research at Kansas State University also has shown that pigs fed diets containing lower levels of Zn from ZnAA exhibited intermediate growth performance compared to pigs fed diets containing high concentrations of Zn from ZnO and pigs fed diets containing no added ZnO.

In conclusion, our data suggest that both added Zn and feed-grade medication are effective at improving growth performance of weanling pigs. The Zn responses were observed primarily for the first portion of the trial, whereas the medication response was observed at the end of the experiment. Our data also suggest that high levels of Zn from ZnO improved growth performance more than lower levels of Zn from a Zn amino acid complex.

Table 1. Diet Compositions (As-Fed Basis)

Ingredient, %	Day 0 to 7	Day 7 to 14	Day 14 to 27
Corn	37.81	44.78	51.07
Dried whey	25.00	20.00	10.00
Soybean meal (46.5% CP)	12.18	21.30	28.50
Spray-dried animal plasma	6.75	2.50	-
Select menhaden fish meal	6.00	2.50	-
Lactose	5.00	-	-
Soy oil	2.00	2.00	3.00
Spray-dried blood meal	1.75	2.50	2.50
Monocalcium phosphate	.69	1.26	1.59
Limestone	.50	.76	.99
Cornstarch[a]	1.40	1.40	1.40
Salt	.25	.30	.30
Vitamin premix	.25	.25	.25
L-Lysine HCL	.15	.15	.15
Trace mineral premix[b]	.15	.15	.15
DL-Methionine	.12	.15	.10
Total	100.00	100.00	100.00
Calculated analysis, %			
Lysine	1.70	1.55	1.40
Methionine	.48	.44	.39
Ca	.90	.90	.85
P	.80	.80	.75

[a]Medication, ZNAA, and ZnO replaced cornstarch to provide the experimental treatments.
[b]Provided per ton of complete feed: 36 g Mn; 150 g Fe; 150 g Zn from ZnO; 15 g Cu; 270 mg I; and 270 mg Se.

Table 2. Interactive Effects of Zinc Source and Feed Grade Medication on Growth Performance of Weanling Pigs[a]

		No Medication			Medication[c]				Main Effects, $P <$		Interaction, $P <$	Contrasts, $P <$		
Item	Zn Source[b]	Control	ZnAA	ZnO	Control	ZnAA	ZnO	SEM	Zn Source	Medication	Zn Source × Medication	1	2	3
Day 0 to 7														
ADG, lb		.25	.28	.27	.24	.31	.28	.029	.51	.87	.91	.24	.62	.48
ADFI, lb		.37	.39	.37	.33	.35	.39	.028	.66	.63	.74	.56	.73	.36
F/G		1.57	1.58	1.41	1.42	1.18	1.47	.109	.70	.15	.22	.42	.67	.71
Day 7 to 14														
ADG, lb		.54	.59	.73	.49	.59	.75	.044	.0001	.76	.66	.10	.001	.0001
ADFI, lb		.78	.81	.97	.80	.88	.95	.048	.009	.58	.71	.32	.03	.002
F/G		1.44	1.40	1.34	1.69	1.52	1.28	.081	.009	.10	.15	.21	.08	.004
Day 0 to 14														
ADG, lb		.40	.43	.50	.36	.45	.51	.030	.003	.92	.72	.07	.05	.0004
ADFI, lb		.57	.60	.67	.57	.62	.67	.033	.04	.89	.94	.32	.08	.007
F/G		1.44	1.40	1.35	1.59	1.39	1.31	.057	.007	.42	.18	.04	.28	.002
Day 14 to 27														
ADG, lb		1.02	.99	1.09	1.13	1.12	1.12	.040	.71	.06	.68	.80	.44	.60
ADFI, lb		1.40	1.37	1.54	1.49	1.51	1.66	.042	.07	.08	.96	.91	.04	.05
F/G		1.39	1.40	1.42	1.32	1.34	1.48	.047	.09	.62	.31	.77	.08	.04
Day 0 to 27														
ADG, lb		.70	.70	.78	.73	.77	.81	.026	.11	.17	.82	.54	.14	.04
ADFI, lb		.97	.97	1.09	1.01	1.04	1.15	.032	.03	.17	.95	.77	.03	.02
F/G		1.40	1.39	1.40	1.38	1.36	1.42	.037	.62	.70	.67	.58	.32	.65

[a]Values represent the means of 288 pigs (initially 12.3 lb and 18 d of age) with eight pigs per pen, and six pens per treatment.
[b]Zinc Source: Control = no additional Zn; ZNAA = 250 ppm of Zn from ZnAA; and ZnO = 3,000 ppm of Zn from ZnO.
[c]Medication represents 50 g/ton of carbadox.
[d]Contrasts were: 1) Control vs. ZnAA, 2) ZnAA vs. ZnO, and 3) Control vs. ZnO.