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Abstract

A 28-d growth assay was conducted to determine the effect of phytase dosage and source on growth performance of nursery pigs. The nine experimental treatments were control diets (0.13, 0.18, and 0.23% available phosphorus) and phytase (100, 225, or 350 FTU or FYT/kg) from either Natuphosï£¨ or Ronozymeï£ª P added to the 0.13% available P diet. The results of this experiment indicate that increasing available P or phytase level, through 0.23% available P and 350 FTU or FYT/kg, respectively, improves ADG and feed efficiency. Regression analysis of the ADG response indicated that, when adding less than 350 phytase units/kg, each 100 phytase units/kg will release 0.022 and 0.017% available P for Natuphosï£¨ and Ronozymeï£ª P, respectively.; Swine Day, Manhattan, KS, November 14, 2002

Keywords

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EFFECT OF PHYTASE DOSAGE AND SOURCE ON GROWTH PERFORMANCE OF NURSERY PIGS

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Summary

A 28-d growth assay was conducted to determine the effect of phytase dosage and source on growth performance of nursery pigs. The nine experimental treatments were control diets (0.13, 0.18, and 0.23% available phosphorus) and phytase (100, 225, or 350 FTU or FYT/kg) from either Natuphos® or Ronozyme™ P added to the 0.13% available P diet. The results of this experiment indicate that increasing available P or phytase level, through 0.23% available P and 350 FTU or FYT/kg, respectively, improves ADG and feed efficiency. Regression analysis of the ADG response indicated that, when adding less than 350 phytase units/kg, each 100 phytase units/kg will release 0.022 and 0.017% available P for Natuphos® and Ronozyme™ P, respectively.

(Key Words: Phytase, Phosphorus, Nursery Pigs.)

Introduction

Supplementing phytase in swine diets is becoming an increasingly common method to improve the availability of phosphorus in plant ingredients containing high levels of phytate phosphorus. The improved phosphorus availability lowers the amount of phosphorus in diets and thus contributes to a greater economic return. The addition of phytase to swine diets has also been shown to decrease phosphorus excretion by up to 30%. The environmental benefits associated with using phytase are becoming more important as many states are changing nutrient plans from a nitrogen to a phosphorus basis. Natuphos®, a product of *Aspergillus niger*, produced by BASF, has previously been the primary source of phytase in the United States. In 2000, Roche released a product called Ronozyme™ P (CT), a product of *Peniophoria lycii*. Data evaluating the efficacy of Ronozyme™ P compared to Natuphos® has been conflicting. Therefore, the objective of this experiment was to determine if Natuphos® and Ronozyme™ P have equal effects on growth performance and bone development of the growing pig.

Procedures

Initially, a pilot study was conducted with available phosphorus levels of 0.20, 0.30, and 0.40% to ensure a linear response to increasing available phosphorus. The pilot study response in ADG and F/G from 0.20 to 0.30% available phosphorus was not significant. Therefore, the basal diet in this experiment was corn-soybean meal based and was formulated to contain 5% added fat, 1.4% total lysine, and 0.13% available phosphorus as a negative control (Table 1).

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[2]BASF Corporation, Mount Olive, NJ.

A total of 342 pigs (PIC L42) were used in the 28-d growth assay. Pigs were fed a typical starter diet from d 0 to 10 post-weaning with 0.45% available phosphorus. From d 17 to 20 post-weaning pigs were fed a common diet without inorganic phosphorus (0.10% available phosphorus) to ensure a response to increasing phosphorus in the experiment. On d 20 post-weaning (23.4 lb BW) pigs were blocked by weight and allotted randomly to nine dietary treatments in a randomized complete block design. Each treatment had eight replications and four or five pigs per pen.

Monocalcium phosphate was substituted for sand to form the other control diets (0.18 and 0.23% available phosphorus). Phytase (100, 225, or 350 FTU or FYT/kg) from either Natuphos® or Ronozyme™ P was added to the 0.13% available phosphorus diet at the expense of sand. Calcium to total phosphorus ratio was maintained at 1.12:1 in all diets. All ingredients providing either calcium or phosphorus to the diet were analyzed for calcium and phosphorus concentration before diet formulation and analyzed values agreed with formulated values. Phytase from Natuphos® and Ronozyme™ P also was analyzed prior to diet formulation to equalize actual phytase level in the experimental treatments.

Pigs were housed in an environmentally controlled nursery. Each pen (4 × 4 ft) contained a stainless steel self-feeder and one nipple waterer to allow ad libitum access to feed and water. Pigs were weighed and feed disappearance measured every 7 d during the experiment.

Data were analyzed in randomized complete block design using the GLM procedures of SAS with pen as the experimental unit. Linear and quadratic polynomial contrasts were performed to determine the effects of increasing levels of available phosphorus and phytase. Contrasts were performed to compare phytase sources. A regression analysis of the average daily gain response was conducted by calculating the improvement in average daily gain with each incremental increase (0.05 and 0.10%) in available phosphorus over the negative control. This line was then used to calculate the percent available phosphorus that was released by comparing the average daily gain curve of each source of phytase with that of the controls.

Results and Discussion

Increasing available phosphorus linearly ($P<0.01$) improved ADG, ADFI, and feed efficiency throughout the experiment (Table 2). There were no phytase source × level interactions ($P>0.23$) or differences between phytase sources ($P>0.27$) observed. Increasing phytase linearly ($P<0.01$) increased ADG and feed efficiency. Feed intake increased (quadratic, $P<0.05$) with increasing phytase. Regression analysis of the ADG response (Figure 1) indicated that, when adding less than 350 phytase units/kg, each 100 phytase units/kg will release 0.022 and 0.017% available phosphorus for Natuphos® and Ronozyme™ P, respectively. Therefore, these values can be used in diet formulation when either of the products is added to adjust dietary phosphorus concentrations.

Table.1 Basal Diet Composition (As-Fed Basis)

	Available P, %		
Ingredient, %	0.13[a]	0.18	0.23
Corn	57.98	57.98	57.98
Soybean meal (46.5% CP)	34.15	34.15	34.15
Soybean oil	5.00	5.00	5.00
Sand	0.60	0.30	0.00
Limestone	0.52	0.56	0.60
Antimicrobial[b]	0.50	0.50	0.50
Salt	0.35	0.35	0.35
Monocalcium phosphate, 21% P	0.32	0.57	0.83
Vitamin premix	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15
L-Lysine·HCl	0.15	0.15	0.15
DL-Methionine	0.04	0.04	0.04
Calculated composition			
CP (N × 6.25), %	20.80	20.80	20.80
ME, kcal/lb	1,614	1,614	1,614
Cal, %	0.46	0.52	0.58
P, %	0.41	0.46	0.51
Available P, %	0.13	0.18	0.23
Lysine, %	1.30	1.30	1.30
Methionine, %	0.36	0.36	0.36
Threonine, %	0.81	0.81	0.81

[a]Phytase from either Natuphos® or Ronozyme™ P was added to provide 100, 225, or 350 FTU or FYT/kg at the expense of sand.
[b]Provided 25 g/ton carbadox.

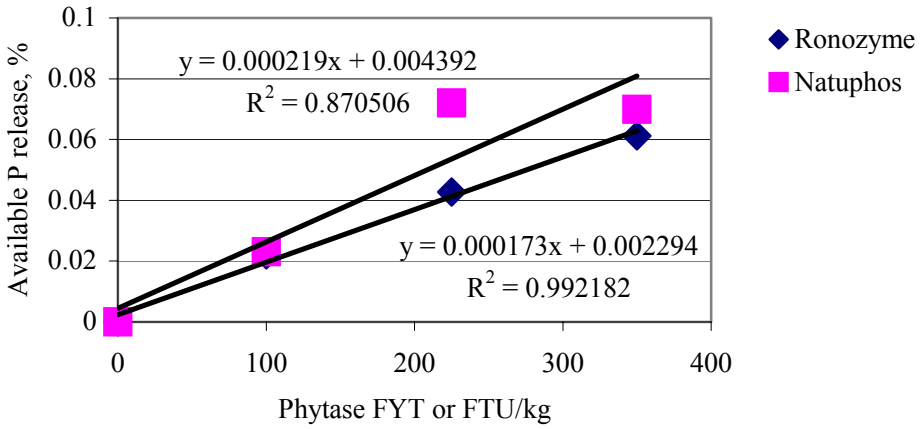

Figure 1. Regression of ADG to Determine Available P Release from Each Unit of Phytase.

Table 2. Effect of Available Phosphorus and Phytase Source on Growth Performance of Nursery Pigs[a]

				Phytase source [b,c]													
				Ronozyme™ P, FYT/kg			Natuphos®, FTU/kg				Probability (*P*<)					
	Available P, %												Available P, %		Phytase level	
Item	0.13	0.18	0.23	100	225	350	100	225	350	SEM	Trt	Source	Linear	Quad	Linear	Quad
Day 0 to 7																
ADG, lb	0.97	1.01	0.97	0.95	0.97	0.98	0.98	1.06	0.97	0.03	0.51	0.21	0.97	0.24	0.90	0.17
ADFI, lb [d]	1.39	1.39	1.30	1.30	1.33	1.33	1.40	1.44	1.31	0.04	0.10	0.07	0.09	0.25	0.51	0.17
Feed/gain	1.43	1.38	1.35	1.37	1.37	1.37	1.45	1.36	1.35	0.03	0.17	0.50	0.05	0.74	0.09	0.48
Day 7 to 14																
ADG, lb	1.36	1.40	1.56	1.34	1.39	1.40	1.35	1.45	1.48	0.04	0.01	0.13	0.01	0.31	0.02	0.41
ADFI, lb [d]	2.00	2.02	2.06	1.94	1.98	1.97	2.03	2.12	2.03	0.05	0.39	0.03	0.41	0.89	0.75	0.23
Feed/gain	1.47	1.46	1.32	1.45	1.42	1.41	1.51	1.47	1.37	0.03	0.01	0.42	0.01	0.11	0.01	0.60
Day 14 to 21																
ADG, lb	1.48	1.55	1.71	1.49	1.48	1.64	1.51	1.57	1.57	0.04	0.01	0.66	0.01	0.29	0.01	0.50
ADFI, lb	2.33	2.42	2.63	2.26	2.32	2.43	2.34	2.45	2.37	0.05	0.01	0.29	0.01	0.22	0.07	0.51
Feed/gain	1.58	1.57	1.53	1.52	1.57	1.49	1.55	1.55	1.52	0.03	0.21	0.32	0.22	0.70	0.10	0.02
Day 21 to 28																
ADG, lb	1.50	1.77	1.89	1.72	1.82	1.82	1.66	1.81	1.88	0.05	0.01	0.98	0.01	0.32	0.01	0.27
ADFI, lb	2.61	2.92	3.16	2.76	2.95	2.93	2.70	3.00	2.99	0.06	0.01	0.76	0.01	0.60	0.01	0.03
Feed/gain	1.75	1.65	1.68	1.61	1.62	1.61	1.62	1.66	1.59	0.03	0.04	0.63	0.26	0.19	0.58	0.25
Day 0 to 28																
ADG, lb	1.33	1.43	1.53	1.37	1.42	1.45	1.38	1.47	1.47	0.03	0.01	0.27	0.01	0.86	0.01	0.28
ADFI, lb [e]	2.08	2.19	2.27	2.06	2.15	2.16	2.12	2.25	2.17	0.04	0.01	0.09	0.01	0.81	0.08	0.05
Feed/gain	1.57	1.53	1.49	1.50	1.51	1.49	1.54	1.53	1.47	0.01	0.01	0.29	0.01	0.97	0.01	0.15

[a]Values are means of eight replications (pens) and four or five pigs per pen.

[b]Diets were identical to treatment containing 0.13% available phosphorus with exception of phytase.

[c]No phytase level × source interactions ($P>0.14$).

[d]Contrast Ronozyme ™ P vs Natuphos® ($P\leq0.04$).

[e]Contrast Ronozyme ™ P vs Natuphos® ($P\leq0.06$).