Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 1209

2013

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Recommended Citation

Goodband, Robert D.; Langbein, Kari Beth; Tokach, Michael D.; DeRouchey, Joel M.; and Dritz, Steven S. (2013) "Influence of a superdose of phytase (Optiphos) on finishing pig performance and carcass characteristics," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.7049

Influence of a superdose of phytase (Optiphos) on finishing pig performance and carcass characteristics

Abstract

A total of 1,188 finishing pigs (PIC 337 Ã— 1050, initially 80.1 lb) were used in a 92-d experiment to determine the influence of providing phytase above that needed to meet the P requirement for growth performance and carcass characteristics. There were 27 pigs per pen and 11 pens per treatment. Each pen contained a similar number of barrows and gilts. Pens were randomly assigned to treatment based on initial BW. Basal diets contained corn, soybean meal, dried distillers grains with solubles (DDGS), and bakery meal and were formulated to meet or exceed the nutrient requirements of the pigs in each of the four phases. The four dietary treatments were formed by adding increasing levels of phytase (Optiphos 2000, Enzyvia LLC) at 0.25 (control), 0.5, 1.0 and 2.0 lb/ton. Diets were formulated such that the addition of the first 0.25 lb/ton of phytase was needed to meet the P requirement of the pigs, with further additions exceeding the P requirement. Pigs were weighed and feed disappearance was determined approximately every 14 d to determine ADG, ADFI, and F/G. On d 92, pigs were tattooed by pen number and harvested to collect carcass data. Overall (d 0 to 92), increasing dietary phytase did not influence ADG but reduced (cubic, P < 0.01) ADFI, resulting in an improvement in F/G (cubic, P < 0.01). The cubic response occurred because F/G improved as phytase inclusion increased from 0.25 to 0.5 lb/ton, with no further improvement when phytase was increased to 1.0 or 2.0 lb/ton. Phytase addition to the diet did not influence carcass measurements. These results suggest that providing phytase at levels above that needed to meet the pigâ€™s requirement for P has the potential to improve feed efficiency.; Swine Day, Manhattan, KS, November 21, 2013

Keywords

Swine day, 2013; Kansas Agricultural Experiment Station contribution; no. 14-044-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1092; Finishing pig; Phosphorus; Phytase

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Influence of a Superdose of Phytase (Optiphos) on Finishing Pig Performance and Carcass Characteristics[1]

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Summary

A total of 1,188 finishing pigs (PIC 337 × 1050, initially 80.1 lb) were used in a 92-d experiment to determine the influence of providing phytase above that needed to meet the P requirement for growth performance and carcass characteristics. There were 27 pigs per pen and 11 pens per treatment. Each pen contained a similar number of barrows and gilts. Pens were randomly assigned to treatment based on initial BW. Basal diets contained corn, soybean meal, dried distillers grains with solubles (DDGS), and bakery meal and were formulated to meet or exceed the nutrient requirements of the pigs in each of the four phases. The four dietary treatments were formed by adding increasing levels of phytase (Optiphos 2000, Enzyvia LLC) at 0.25 (control), 0.5, 1.0 and 2.0 lb/ton. Diets were formulated such that the addition of the first 0.25 lb/ton of phytase was needed to meet the P requirement of the pigs, with further additions exceeding the P requirement. Pigs were weighed and feed disappearance was determined approximately every 14 d to determine ADG, ADFI, and F/G. On d 92, pigs were tattooed by pen number and harvested to collect carcass data.

Overall (d 0 to 92), increasing dietary phytase did not influence ADG but reduced (cubic, $P < 0.01$) ADFI, resulting in an improvement in F/G (cubic, $P < 0.01$). The cubic response occurred because F/G improved as phytase inclusion increased from 0.25 to 0.5 lb/ton, with no further improvement when phytase was increased to 1.0 or 2.0 lb/ton. Phytase addition to the diet did not influence carcass measurements. These results suggest that providing phytase at levels above that needed to meet the pig's requirement for P has the potential to improve feed efficiency.

Key words: finishing pig, phosphorus, phytase

Introduction

Phytase has been included in swine diets as a means of improving the digestibility of the P in the diet. Previous research illustrates that increasing the phytase dose results in a quadratic increase in P digestibility when diets are formulated to be at or below the requirement of the pig. Some recent research has also suggested that additions of phytase at levels much greater than that needed to meet pigs' P requirements may lead to improvements in the digestibility of other dietary nutrients, such as amino acids, trace minerals, and energy. Therefore, the objective of this experiment was to confirm if

[1] Appreciation is expressed to New Horizon Farms for use of pigs and facilities and to Richard Brobjorg, Scott Heidebrink, and Marty Heintz for technical assistance.

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providing a high dose (superdose) of phytase, above that needed to meet the P requirement, would influence pig growth performance and carcass characteristics.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in these experiments. The experiment was conducted in a commercial research-finishing barn in southwestern Minnesota. The barn was naturally ventilated and double-curtain-sided with completely slatted flooring and a deep pit for manure storage. Pens were equipped with a cup waterer and 4-hole stainless steel dry self-feeder (56 in. wide) manufactured by Thorp Equipment, Inc. (Thorp, WI) to provide ad libitum access to feed and water. Daily feed additions to each pen were accomplished through a robotic feeding system (FeedPro; Feedlogic Corp., Willmar, MN) capable of providing and measuring feed deliveries on an individual pen basis.

A total of 1,188 pigs (PIC 337 × 1050; initially 80.1 lb) were used in the 92-d study. There were 27 pigs per pen, with a similar number of barrows and gilts in each pen. Pens were randomly assigned to the 4 dietary treatments with 11 pens per treatment.

The 4 dietary treatments were increasing levels of phytase (Optiphos 2000, Enzyvia LLC) at 0.25, 0.5, 1.0, and 2.0 lb/ton (Table 1). Diets were formulated such that the addition of the first 0.25 lb/ton of phytase was needed to meet the pigs' P requirements, with further additions exceeding the phosphorus requirement. Corresponding phytase levels in the 4 diets were 113.5, 227, 454, and 908 phytase units (FTU)/lb (250, 500, 1,000, and 2,000 FTU/kg). The basal diet was corn-soybean meal–based and contained 15% bakery meal and decreasing levels of DDGS by phase and was formulated to meet or exceed the nutrient requirements of the pigs as defined by NRC (2012). Diets were fed in 4 phases from approximately 80 to 130, 130 to 180, 180 to 240, and 240 to 288 lb BW.

Pigs and feeders were weighed approximately every 14 d to determine ADG, ADFI, and F/G. On d 72, the 3 heaviest pigs from each pen (determined visually) were marketed following normal farm procedures. On d 92, the remaining pigs were harvested for carcass data collection. Pigs were tattooed by pen and transported to JBS Swift and Company (Worthington, MN) for processing and carcass data collection.

All data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Statistical significance was determined at $P < 0.05$, and P-values falling between $P > 0.05$ and $P < 0.10$ were considered trends. Contrast statements were used to test for linear, quadratic, and cubic effects. Polynomials for the unequally spaced treatments were determined and used in the contrast statements.

Results and Discussion

Overall (d 0 to 92), growth performance was excellent in this trial, with pigs gaining 2.3 lb/d; however, increasing added phytase did not influence ADG (Table 2). Increasing phytase dose reduced (cubic, $P < 0.01$) ADFI, resulting in an improvement in F/G (cubic, $P < 0.01$). The cubic response was a reflection of F/G improving as phytase inclusion increased from 0.25 to 0.5 lb/ton, with no further improvement

when phytase increased to 1.0 or 2.0 lb/ton. Quadratic responses are often observed when data respond in this manner, but in this study the unequally spaced treatments and lowest F/G for pigs fed the 0.5 lb/ton phytase level resulted in the cubic response. Phytase addition to the diet did not influence any of the carcass characteristics measured in this study.

The improvement in F/G as phytase level increased above that needed to meet the P requirement of the pigs demonstrates that providing a "superdose" of phytase can improve pig performance. The phytase used in this experiment is thought to provide a release of approximately 0.12% available P at 0.25 lb/ton. Providing additional phytase may release more P; however, with diets formulated to meet the P requirement at the 0.25 lb/ton inclusion, the additional phytase is thought to improve F/G through improved digestibility of the other nutrients in the diet, specifically amino acids and/or energy. Because diets should have met the amino acid requirements of the pigs, the extra energy availability is the most logical explanation for improved feed efficiency.

Table 1. Diet composition (as-fed basis)[1]

Item	Phase 1	Phase 2	Phase 3	Phase 4
Corn[2]	37.10	41.15	53.10	51.30
Soybean meal (46.5% CP)	15.50	11.50	9.75	16.40
Bakery meal	15.00	15.00	15.00	15.00
Corn DDGS, 9.6% oil[3]	30.00	30.00	20.00	15.00
Limestone	1.40	1.36	1.23	1.21
Salt	0.35	0.35	0.35	0.35
L-threonine	0.013	-	0.02	0.075
Biolys (lysine sulfate)	0.555	0.51	0.45	0.52
Methionine hydroxy analog	-	-	-	0.05
Ractopamine HCl[4]	-	-	-	0.025
Vitamin/trace mineral premix[5]	0.10	0.10	0.10	0.075
Total	100	100	100	100
Calculated analysis				
Standardized ileal digestible (SID) amino acids, %				
Lysine	0.97	0.85	0.74	0.92
Isoleucine:lysine	72	74	73	68
Methionine:lysine	32	35	35	34
Met & cys:lysine	60	65	65	61
Threonine:lysine	61	62	64	65
Tryptophan:lysine	18	18	18	18
Valine:lysine	83	87	86	77
Total lysine, %	1.16	1.03	0.89	1.07
CP, %	20.93	19.32	16.69	18.47
ME, kcal/lb	1,538	1,540	1,543	1,540
SID lysine:ME, g/Mcal	2.86	2.50	2.18	2.71
Ca, %	0.60	0.58	0.52	0.54
P, %	0.42	0.41	0.37	0.38
Available P, %	0.29	0.28	0.24	0.23

[1] Diets were fed in meal form during the experiment.
[2] The 4 dietary treatments were obtained by replacing corn in each diet with Optiphos 2000 (Enzyvia, Sheridan, IN) at a rate of 0.25, 0.50, 1.0, or 2.0 lb/ton.
[3] Dried distillers grains with solubles.
[4] Provided 9 g/lb (10 ppm) of Ractopamine HCl (Paylean; Elanco Animal Health, Greenfield, IN).
[5] Provided per pound of premix: 2,000,000 IU vitamin A; 250,000 IU vitamin D_3; 8,000 IU vitamin E; 800 mg vitamin K; 1,500 mg riboflavin; 5,000 mg pantothenic acid; 9,000 mg niacin; 7 mg vitamin B_{12}; 12 g Mn from manganese oxide; 50 g Fe from iron sulfate; 50 g Zn from zinc sulfate; 5 g Cu from copper sulfate; 90 mg I from calcium iodate; and 90 mg Se from sodium selenite.

Table 2. Effects of increasing levels of Optiphos 2000 in growth performance of finishing pigs[1]

	Phytase, lb/ton:					Probability, *P*<		
	0.25	0.50	1.00	2.00	SEM	Linear	Quadratic	Cubic
d 0 to 92								
ADG, lb	2.28	2.28	2.30	2.26	0.017	0.25	0.27	0.54
ADFI, lb	5.81[b]	5.59[a]	5.75[ab]	5.67[ab]	0.062	0.49	0.72	0.01
F/G	2.54[b]	2.45[a]	2.50[ab]	2.51[ab]	0.023	0.90	0.19	0.01
Wt, lb								
d 0	80.2	80.1	80.2	80.0	1.198	0.94	1.00	0.94
d 92	288.6	286.9	288.6	285.5	2.320	0.42	0.68	0.52
Carcass characteristics								
HCW, lb	210.7	211.0	212.2	207.9	1.566	0.16	0.18	0.76
Yield, %[2]	75.1	74.9	74.7	74.7	0.448	0.49	0.64	0.94
Backfat, in.[3]	0.67	0.66	0.65	0.67	0.011	0.75	0.16	0.92
Loin depth, in.[3]	2.59	2.60	2.57	2.57	0.018	0.33	0.89	0.42
Lean, %[3]	56.4	56.6	56.6	56.3	0.180	0.60	0.19	0.67
Fat-free lean index[3]	50.7	50.8	50.9	50.7	0.128	0.67	0.13	0.90

[a,b] Means with different superscripts differ ($P > 0.05$)

[1] A total of 1,188 finisher pigs (initially 80.1 lb) were used in a 92-d trial with 27 pigs per pen and 11 pens per treatment.

[2] Yield was determined by dividing carcass weight by live weight at the plant.

[3] HCW was used as a covariate.