Phosphorus Levels for Growing and Finishing Swine

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Summary

To determine the minimal level of supplemental phosphorus required by growing pigs, ninety pigs averaging 34 pounds were randomly assigned from outcome groups to 18 pens representing three replications of six dietary treatments. Graded levels of supplemental phosphorus (0, 0.05, 0.10, 0.15, and 0.20% of the diet) from dicalcium phosphate were added to a 16% protein milo-soybean meal basal diet containing 0.36% phosphorus. Additionally, meat and bone meal was also evaluated as a phosphorus source. For the first four weeks of the trial (Phase I), daily gains were maximized at 0.15% supplemental phosphorus, or a total phosphorus level of 0.51% of the diet. Similarly, during Phase II of the trial (pigs weighing 70 to 220 lbs.) daily gains were maximized at 0.15% supplemental phosphorus. Results suggest that growing and finishing pigs should be supplied at least 0.15% supplemental phosphorus from an available source, such as dicalcium phosphate and demonstrated that 5% meat and bone meal in the diet of the growing pig will supply the needed supplemental phosphorus.

Introduction

Dicalcium phosphate has been used as the major source of supplemental phosphorus for swine diets. A shortage of dicalcium phosphate has necessitated reexamination of our current phosphorus requirements for growing and finishing swine.

Procedure

Phase I. Ninety pigs averaging 34 pounds were assigned from outcome groups based on litter, sex, and initial weight to 18 pens representing three replications of six dietary treatments. Supplemental phosphorus (0, 0.05, 0.10, 0.15, and 0.20%) from dicalcium phosphate was added to a 16% protein milo-soybean meal basal diet containing 0.36% phosphorus (table 4.1). Additionally, meat and bone meal was evaluated as a phosphorus source. In all diets calcium was constant, 0.60%.

Phase II. Seventyfive pigs fed supplemental phosphorus at graded levels in Phase I were continued on their respective diet until pigs in each pen averaged 125 pounds; they then were switched to the finishing diets (table 4.1). The basal finishing diet contained 13% protein, 0.55% lysine, 0.34% phosphorus, and 0.55% calcium (constant in all diets). Performance data were summarized when pigs in each pen averaged approximately 220 pounds.

Results and Discussion

Performance of growing pigs fed supplemental phosphorus is shown in table 4.2. Daily gains for Phase I (0 to 4 weeks) were maximized at 0.15% supplemental phosphorus, or a total phosphorus level of 0.51% of the diet. Increasing phosphorus beyond that level had no beneficial effect on daily gain or feed efficiency, suggesting that 0.51% total phosphorus is adequate for maximum performance of growing pigs.

Data presented in table 4.2 also show that
5% meat and bone meal (50% protein, 3.54% phosphorus,
6.36% calcium) adequatley supply the phosphorus
needs of growing pigs. Meat and bone meal, substituted
on a pound-for-pound basis for 44% protein soybean
meal, supplied both supplementa protein and supplemental
phosphorus. Pigs fed the diet containing 5%
meat and bone meal as the sole source of supple-
mental phosphorus gained at the same rate and
used feed just as efficiently as did pigs fed
0.15 or 0.20% supplemental phosphorus from dicalcium
phosphate.

During Phase II (70-220 lbs.), daily gains of
pigs fed supplemental phosphorus increased linearly as
increased quantities of supplemental phosphorus were
added to the diet. Daily gains were maximized at
0.15% supplemental phosphorus or 0.49% total
phosphorus, suggesting that growing and finishing
pigs should be supplied at least 0.15% supplemental
phosphorus from an available source such as
dicalcium phosphate.

Table 4.1. Composition of Diets for Pigs Fed Supplemental Phosphorus at Graded Levels

Ingredients	Diets					
	A	B	C	D	E	F
Growing						
Milo	76.36	76.242	76.124	76.006	75.88	77.174
Soybean meal	21.0	21.0	21.0	21.0	21.0	16.0
Meat and bone meal [a]	0.0	0.0	0.0	0.0	0.0	5.0
Dicalcium phosphate[a]	0.0	0.238	0.476	0.714	0.952	0.0
Limestone	1.34	1.22	1.10	0.98	0.868	0.526
Salt	0.5					
Trace minerals	0.05	Same as Diet A				
Vitamin premix	0.50					
Antibiotic premix	0.25					
	100.0	100.0	100.0	100.0	100.0	100.0
Calculated Analysis						
Protein, %	16.0	16.0	16.0	16.0	16.0	16.2
Lysine, %	0.80	0.80	0.80	0.80	0.80	0.80
Calcium, %	0.60	0.60	0.60	0.60	0.60	0.60
Supplemental phosphorus, %	0.0	0.05	0.10	0.15	0.20	
Total phosphorus, %	0.36	0.41	0.46	0.51	0.56	0.51
Finishing						
Milo	85.22	85.102	84.984	84.861	84.744	
Soybean meal	12.22	12.22	12.22	12.22	12.22	
Dicalcium phosphate[a]	0.0	0.238	0.476	0.714	0.952	
Limestone	1.26	1.14	1.02	0.905	0.784	
Salt	0.50					
Trace minerals	0.05	Same as Diet A				
Vitamin premix	0.50					
Antibiotic premix	0.25					
	100.0	100.0	100.0	100.0	100.0	
Calculated Analysis						
Protein, %	13.0	13.0	13.0	13.0	13.0	
Lysine, %	0.55	0.55	0.55	0.55	0.55	
Calcium, %	0.55	0.55	0.55	0.55	0.55	
Supplemental phosphorus, %	0.0	0.05	0.10	0.15	0.20	
Total phosphorus, %	0.34	0.39	0.44	0.49	0.54	

[a]Dicalcium phosphate contained 21% phosphorus, 18% calcium.

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Table 4.2. Performance of Pigs Fed Supplemental Phosphorus at Graded Levels

| | Diets | | | | | |
	A	B	C	D	E	F
Supplemental phosphorus, %	0.0	0.05	0.10	0.15	0.20	
Phase I (0-4 weeks)						
No. of pigs	15	15	15	15	15	15
Pigs/pen	5	5	5	5	5	5
Initial wt. (lb.)	34.5	34.0	32.8	34.1	33.7	32.8
Final wt. (lb.)						
(Phase I - 4 weeks)	65.3	67.9	73.7	74.3	71.6	72.1
Daily gain (lb.)	1.05^c	1.21^b	1.32^a	1.40^a	1.35^a	1.40^a
Feed intake (lb.)	2.50	2.88	2.90	3.14	2.95	3.00
Feed/gain	2.37	2.36	2.17	2.23	2.17	2.12
Phase II (4 weeks to market)						
Initial wt. (lb.)	65.3	67.9	73.7	74.3	71.6	
Final wt. (lb.)	196.6	208.8	215.1	223.8	220.6	
Daily gain (lb.)	1.06^d	1.30^c	1.41^b	1.53^a	1.50^a	
Feed intake (lb.)	4.45_a	4.84_b	5.12_b	5.34_c	5.07_c	
Feed/gain	4.20^a	3.72^b	3.63^b	3.49^c	3.38^c	

[abcd]Means with different superscripts differ significantly (P<.05).