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Comparison of protein sources for phase II starter diets

Abstract

A total of 432 weanling pigs (initially 15.3 lb and 21 d of age) was used in a growth trial to compare various protein sources in the Phase II starter diet. During Phase I (0 to 7 d post-weaning), all pigs were fed a common high nutrient density diet containing 1.5% lysine, 10% porcine plasma, 10% lactose, and 20% dried whey. During Phase II (7 to 28 d post-weaning), pigs were fed one of six experimental diets. All Phase II diets contained 10% dried whey and were formulated to 1.18% lysine. The positive control diet contained 4% menhaden fish meal (FISH). Synthetic amino acids were used to replace fish meal to form an ideal protein, negative control diet (AA). Spray-dried porcine plasma (SDPP), spray-dried blood meal (SDBM), soy protein concentrate (SPC), and extruded soy protein concentrate (ESPC) replaced fish meal on a lysine basis to form the other four diets. During the grower phase (28 to 56 d postweaning), all pigs were fed a common 1.1% lysine, milo-soybean meal diet. Average daily gain (lb), ADFI (lb), and F/G during Phase I were .39, .53, and 1.41, respectively. During Phase II, SPC and ESPC effectively replaced fish meal as a protein source; however, pigs fed diets containing the spray-dried blood products (SDPP or SDBM) gained faster than pigs fed the other four diets. Pigs fed the diet containing synthetic amino acids had poorer feed conversion than pigs fed diets containing the intact protein sources. Pigs fed the diet containing SDBM during Phase II gained faster during the subsequent grower phase than pigs fed the other diets. Based on these results and earlier research, optimal staging of starter diets includes using SDPP in Phase I and SDPP or SDBM in Phase II.; Swine Day, Manhattan, KS, November 21. 1991

Keywords

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COMPARISON OF PROTEIN SOURCES FOR PHASE II STARTER DIETS[1]

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Summary

A total of 432 weanling pigs (initially 15.3 lb and 21 d of age) was used in a growth trial to compare various protein sources in the Phase II starter diet. During Phase I (0 to 7 d postweaning), all pigs were fed a common high nutrient density diet containing 1.5% lysine, 10% porcine plasma, 10% lactose, and 20% dried whey. During Phase II (7 to 28 d postweaning), pigs were fed one of six experimental diets. All Phase II diets contained 10% dried whey and were formulated to 1.18% lysine. The positive control diet contained 4% menhaden fish meal (FISH). Synthetic amino acids were used to replace fish meal to form an ideal protein, negative control diet (AA). Spray-dried porcine plasma (SDPP), spray-dried blood meal (SDBM), soy protein concentrate (SPC), and extruded soy protein concentrate (ESPC) replaced fish meal on a lysine basis to form the other four diets. During the grower phase (28 to 56 d postweaning), all pigs were fed a common 1.1% lysine, milo-soybean meal diet. Average daily gain (lb), ADFI (lb), and F/G during Phase I were .39, .53, and 1.41, respectively. During Phase II, SPC and ESPC effectively replaced fish meal as a protein source; however, pigs fed diets containing the spray-dried blood products (SDPP or SDBM) gained faster than pigs fed the other four diets. Pigs fed the diet containing synthetic amino acids had poorer feed conversion than pigs fed diets containing the intact protein sources. Pigs fed the diet containing SDBM during Phase II gained faster during the subsequent grower phase than pigs fed the other diets. Based on these results and earlier research, optimal staging of starter diets includes using SDPP in Phase I and SDPP or SDBM in Phase II.

(Key Works: Starter, Performance, By-products, Protein, Sources.)

Introduction

Previous research at Kansas State University has concentrated on the utilization of SDPP, SDBM, and further processed soybean products (SPC and ESPC) in high nutrient density diets for the early-weaned pig. This research indicated that SDPP was superior to the other protein sources for the Phase I diet. Throughout this research, the Phase II diet has received little attention. A typical Phase II diet recommended by Kansas State University contains 10% dried whey and 3 to 5% menhaden fish meal. This trial was conducted to compare alternative protein sources in a Phase II starter diet.

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[2]Extension Specialist, Livestock Production and Management, Northeast; Northeast Area Extension Office, 1515 College Ave., Manhattan, KS 66502.

Procedures

A growth trial utilizing 432 weaned pigs (initially 15.3 lb and 21 d of age) was conducted to compare protein sources in a Phase II diet. At weaning, pigs were blocked by weight and allotted by litter and sex to the six experimental treatments. During Phases I (0 to 7 d postweaning) and II (7 to 28 d postweaning), pigs were housed 12 per pen (6 pens per treatment) in an environmentally controlled nursery with woven wire flooring and allowed ad libitum access to feed and water. Feed consumption and individual pig weights were recorded weekly to determine ADG, ADFI, and F/G. On d 28 postweaning, pigs were moved to an environmentally controlled grower room with slatted concrete floors. Pigs were weighed at the completion of the grower phase (d 56) to determine ADG during the grower phase (28 to 56 d postweaning).

During Phase I (0 to 7 d postweaning), all pigs were fed a common high nutrient density starter diet containing 10% SDPP, 10% lactose, and 20% dried whey (Table 1). The Phase I diet was formulated to contain 1.5% lysine, .9% calcium, and .8% phosphorus. Pigs were switched to Phase II diets on d 7 postweaning. All Phase II diets (Table 1) contained 10% dried whey and were formulated to 1.18% lysine, .9% calcium, and .8% phosphorus. The positive control diet contained 5% menhaden fish meal (FISH). Synthetic amino acids (L-lysine HCL and DL-methionine) replaced fish meal to form an ideal protein, negative control diet (AA). Spray-dried porcine plasma (SDPP), spray-dried blood meal (SDBM), soy protein concentrate (SPC), and extruded soy protein concentrate (ESPC) replaced fish meal on a lysine basis to form the other four diets. A constant level of soybean meal was maintained in all Phase II diets. Diets were fed as 1/8 in. pellets. During the grower phase, all pigs were fed a common, milo-soybean meal diet that was formulated to 1.1% lysine and provided in a meal form.

Results and Discussion

Starter Phases I and II. During Phase I, pigs gained .39 lb/d consumed .53 lb of feed per d and had a feed conversion (F/G) of 1.41. During the first wk after pigs were switched to Phase II diets (7 to 14 d postweaning), pigs fed the diets containing blood products (plasma or blood meal) gained faster and consumed more feed than pigs fed the other four diets ($P < .01$; Table 2). The advantage in gain was maintained throughout Phase II (7 to 28 d postweaning), resulting in more total gain ($P < .06$) for pigs fed the diets containing blood products than pigs fed the other diets. The improved response to diets containing spray-dried blood products appears to be due to their ability to increase feed intake. The reason that spray-dried blood products increase feed intake in early-weaned pigs is unknown.

Extrusion processing of SPC improved daily gain and feed conversion only during the first wk of Phase II ($P < .08$). Cumulatively, pigs fed diets containing SPC and ESPC had similar daily gain and feed efficiency. Their performance also was similar to that of pigs fed the diet containing fish meal. Replacing fish meal with synthetic amino acids on an ideal protein basis resulted in similar cumulative daily gain; however, pigs fed the diet containing fish meal had improved feed efficiency as compared to pigs fed the AA diet.

Grower Phase. Pigs fed the diet containing SDBM during Phase II gained faster ($P < .03$) during the subsequent grower phase than pigs fed the diets containing the other protein sources. As a result, pigs fed the diet containing SDBM during Phase II were heavier ($P < .03$) at the end of the grower phase than pigs fed the other diets.

Conclusion. These results indicate that SDPP, SDBM, SPC, or ESPC can effectively replace fish meal on an equal lysine basis in Phase II diets. Maximal performance in Phase II was obtained when the diet contained SDPP

or SDBM. Staging of protein sources such that SDPP was present in the Phase I diet and the Phase II diet contained SDBM resulted in improved subsequent performance in the grower phase. Based on these results and earlier research, optimal staging of starter diets includes using SDPP in Phase I and SDPP or SDBM in Phase II.

Table 1. Composition of Diets

Item, %	Phase I[a]	Phase II Treatment[b] AA	Fish	SDPP	SDBM	SPC	ESPC
Corn	32.63	56.43	52.74	52.85	54.27	51.12	51.12
Soybean meal (47% CP)	19.34						
Soybean meal (44% CP)		25.23	25.23	25.23	25.23	25.23	25.23
Menhaden fishmeal			5.00				
Plasma protein	10.28			3.88			
Blood meal					2.49		
Soy protein concentrate (SPC)						5.74	
Extruded SPC							5.74
Dried whey	20.00	10.00	10.00	10.00	10.00	10.00	10.00
Lactose	10.00						
Soybean oil	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Monocalcium phosphate (18% P)	2.47						
Dicalcium phosphate (21% P)		1.93	1.29	1.95	1.92	1.77	1.77
Limestone	.65	.83	.46	.81	.81	.86	.86
FOA 390	1.00						
Mecadox		.50	.50	.50	.50	.50	.50
Salt		.25	.25	.25	.25	.25	.25
Vitamin premix	.25	.25	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15	.15	.15
Copper Sulfate	.10	.08	.08	.08	.08	.08	.08
Selenium premix	.05	.05	.05	.05	.05	.05	.05
L-lysine		.29					
DL-Methionine	.08	.02					
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis, %							
Crude protein	20.1	17.5	19.9	19.5	19.2	20.5	20.5
Lysine	1.50	1.18	1.18	1.18	1.18	1.18	1.18
Methionine	.39	.27	.33	.27	.27	.29	.29

[a]All pigs were fed the Phase I diet from d 0 to 7 postweaning then switched to their experimental Phase II diets from d 7 to 28 postweaning.

[b]AA = amino acids, Fish = fish meal; SDPP = spray-dried porcine plasma, SDBM = spray-dried blood meal, SPC = soy protein concentrate, ESPC = extruded soy protein concentrate.

Table 2. Influence of Phase II Protein Source on Pig Performance[a]

Item	Phase II Treatment[b]						
	AA	Fish	SDPP	SDBM	SPC	ESPC	CV
d 7-14							
ADG, lb[cde]	.45	.56	.67	.63	.47	.57	17.1
ADFI, lb[cf]	.83	.82	.98	.91	.87	.87	9.2
F/G	2.00	1.64	1.55	1.59	2.14	1.67	24.6
d 7-28							
ADG, lb[g]	.87	.87	.94	.92	.87	.89	7.4
ADFI, lb[h]	1.39	1.32	1.41	1.40	1.35	1.36	6.3
F/G[e]	1.61	1.52	1.51	1.53	1.56	1.53	4.4
Phase II							
Total Gain, lb[g]	18.3	18.3	19.7	19.3	18.2	18.7	7.4
Grower phase							
ADG, lb[i]	1.21	1.20	1.23	1.33	1.25	1.22	7.0
Total gain, lb[i]	33.9	33.7	34.6	37.3	34.9	34.3	7.0
Pig wt, lb							
d 28[g]	36.3	36.4	37.8	37.4	36.3	36.8	3.8
d 56[gi]	70.1	70.3	72.4	74.7	71.3	71.0	3.5

[a]All pigs were fed a common diet from d 0 to 7 postweaning. Values are means of six pens containing 12 pigs per pen.
[b]See Table 1.
[c]Blood products vs others, ($P < .01$).
[d]SPC vs ESPC, ($P < .08$).
[e]Amino Acids (AA) vs others, ($P < .02$).
[f]Fish meal vs others, ($P < .07$).
[g]Blood products vs others, ($P < .06$).
[h]Blood products vs others, ($P < .14$).
[i]SDBM vs others, ($P < .03$).