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Comparison of avian and bovine spray-dried blood meal and whey levels in starter pig diets

Abstract

A total of 420 weanling pigs was used in a growth trial having two objectives. Objective 1 was to compare spray-dried avian blood meal and spray-dried bovine blood meal as protein sources in the phase II diet (d 7-21 postweaning). Objective 2 was to determine the appropriate level of dried whey for a phase II diet containing 2.5% spray-dried bovine blood meal. During phase I (d 0-7 postweaning), all pigs were fed a common high nutrient density pelletized diet containing 1.5% lysine, 20% dried edible grade whey, 7.5% spray-dried porcine plasma, and 1.75% spray-dried bovine blood meal. All phase II diets were formulated to 1.25% lysine, .9% Ca, and .8% P. In the comparison of avian and bovine spray-dried blood meals, the diets contained 2.5% blood meal and 10% whey. No significant differences occurred in average daily gain (ADG), average daily feed intake (ADFI), or feed to gain ratio (FIG) with use of avian and bovine spray-dried blood meal. The phase II diets comparing different whey levels contained 2.5% spray-dried bovine blood meal and whey levels of 5, 10, 15, or 20% substituted for corn and soybean meal on a protein basis. Linear and quadratic improvements occurred in performance with increasing whey levels for the 21 d growth period. However, linear and quadratic increases in the cost per pound of gain also occurred. In conclusion, avian and bovine blood meal appear to be comparable sources of protein for the phase II diet. Current economics indicate that approximately 10% whey is the optimal inclusion rate in phase II starter pig diets containing 2.5% spray-dried blood meal.; Swine Day, Manhattan, KS, November 19, 1992

Keywords

Swine day, 1992; Kansas Agricultural Experiment Station contribution; no. 93-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 667; Swine; Starter pigs; Whey; Spray-dried blood meal

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K COMPARISON OF AVIAN AND BOVINE SPRAY-DRIED BLOOD MEAL AND WHEY LEVELS IN STARTER PIG DIETS

S

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Summary

A total of 420 weanling pigs was used in a growth trial having two objectives. Objective 1 was to compare spray-dried avian blood meal and spray-dried bovine blood meal as protein sources in the phase II diet (d 7-21 postweaning). Objective 2 was to determine the appropriate level of dried whey for a phase II diet containing 2.5% spray-dried bovine blood meal. During phase I (d 0-7 postweaning), all pigs were fed a common high nutrient density pelletized diet containing 1.5% lysine, 20% dried edible grade whey, 7.5% spray-dried porcine plasma, and 1.75% spray-dried bovine blood meal. All phase II diets were formulated to 1.25% lysine, .9% Ca, and .8% P. In the comparison of avian and bovine spray-dried blood meals, the diets contained 2.5% blood meal and 10% whey. No significant differences occurred in average daily gain (ADG), average daily feed intake (ADFI), or feed to gain ratio (F/G) with use of avian and bovine spray-dried blood meal. The phase II diets comparing different whey levels contained 2.5% spray-dried bovine blood meal and whey levels of 5, 10, 15, or 20% substituted for corn and soybean meal on a protein basis. Linear and quadratic improvements occurred in performance with increasing whey levels for the 21 d growth period. However, linear and quadratic increases in the cost per pound of gain also occurred. In conclusion, avian

and bovine blood meal appear to be comparable sources of protein for the phase II diet. Current economics indicate that approximately 10% whey is the optimal inclusion rate in phase II starter pig diets containing 2.5% spray-dried blood meal.

(Key Words: Starter Pigs, Whey, Spray-Dried Blood Meal.)

Introduction

Previous research at Kansas State University has shown spray-dried blood meal to be the protein source of choice for the phase II starter pig diet. Since changing the recommended protein source to spray-dried blood meal, there have been questions as to the appropriate level of whey to include in the phase II diet for starter pigs. Previous research at Kansas State University also has compared bovine and porcine spray-dried blood meal as a protein source for the phase II diet. Results indicated that porcine and bovine spray-dried blood meal were comparable. Therefore, the two objectives of this experiment were to determine the optimal level of dried whey inclusion in the phase II diet and to compare avian and bovine spray-dried blood meal as protein sources for the phase II diet.

¹Appreciation is expressed to California Spray Dry Inc., Modesto, California to partial financial support and donation of spray-dried blood meal. The authors also wish to thank Dale Keesecker and the employees of Keesecker Agribusiness, Washington, KS for use of facilities and animals.

Procedure

A growth trial utilizing 420 weaned pigs (initially 13.7 lb and 21 d of age) was conducted. At weaning, pigs were blocked by weight and sex to the five experimental treatments with 13 or 15 pigs per pen (6 pens per treatment). During phases I (0 to 7 d postweaning) and II (7 to 28 d postweaning), pigs were housed 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 on d 0, 7, 14, and 28 to determine ADG, ADFI and F/G. Pigs were reallocated after day 7 postweaning within replicates to equalize pen weights.

During phase I (0 to 7 d postweaning), all pigs were fed a common high nutrient density diet (Table 1). The phase I diet was formulated to contain 1.5% lysine, .9% calcium, and .8% phosphorus and was in the pellet (1/8 inch) form. Pigs were switched to phase II diets on d 7 postweaning. All phase II diets were formulated to contain 1.25% lysine, .9% calcium, and .8% phosphorus and were fed in the meal form. In the comparison of avian and bovine spray-dried blood meal, both diets contained 10% whey. For the comparison of whey levels, increasing levels of whey were substituted for corn and soybean meal on a protein basis (Table 1).

Results and Discussion

Phase I. During phase I, pigs gained .33 lb/d, consumed .42 lb feed/day, and had a feed to gain ratio of 1.29.

Phase II avian vs bovine spray-dried blood meal. No statistical differences in

ADG, ADFI, or F/G occurred between the diets containing either avian or bovine spray-dried blood meal for either the 7 to 14 d postweaning or 7 to 28 d postweaning periods (Table 2). However, numeric differences occurred in ADG, ADFI, and F/G for the 7 to 14 d period. Therefore, a follow-up trial was conducted comparing avian and bovine spray-dried blood meal beginning at d 0 postweaning. This trial indicated no significant differences between spray-dried bovine and avian blood meals as protein sources for phase II. In conclusion, research at Kansas State University indicates that porcine, bovine and avian blood meal are interchangeable as protein sources in the phase II diet, as long as they are spray-dried.

Phase II whey levels. For the 7 to 14 d postweaning period, linear ($P < .001$) and quadratic ($P < .05$) improvements occurred in ADG and ADFI, and a linear ($P < .05$) improvement in F/G (Table 3). For the entire 7 to 28 d postweaning period, linear ($P < .001$) and quadratic ($P < .001$) improvements occurred in ADG, ADFI, and F/G. However, linear ($P < .001$) and quadratic ($P < .001$) increases in cost per pound of gain also occurred. Maximum ADG and ADFI occurred with inclusion of 20% whey in the phase II diet, but cost per pound of gain was minimized using a 10% whey inclusion rate. Prices used for the cost per pound of gain analysis were corn, \$2.18 per bushel; soybean meal, \$180 per ton; and spray-dried edible grade whey, \$.33 per pound. Although performance was maximized with 20% dried whey inclusion in the diets, current economics dictate 10% whey as the optimal inclusion rate in phase II starter pig diets containing 2.5% spray-dried blood meal.

Table 1. Composition of Diets, %

Item	Phase II treatment						
	Phase I	Blood meal		Dried whey %			
		Avian	Bovine ^a	5	10 ^a	15	20
Corn	45.47	58.06	58.06	61.66	58.06	54.46	50.86
Soybean meal (46.5%)	16.00	21.87	21.87	23.14	21.87	20.61	19.35
Dried whey, edible grade	20.00	10.00	10.00	5.00	10.00	15.00	20.00
Spray-dried porcine plasma	7.50						
Spray-dried avian blood meal		2.50					
Spray-dried bovine blood meal	1.75		2.50	2.50	2.50	2.50	2.50
Soybean oil	5.00	3.00	3.00	3.00	3.00	3.00	3.00
Monocalcium phosphate (18%P)	1.91	1.96	1.96	2.06	1.96	1.87	1.77
Limestone	.69	.82	.82	.88	.82	.78	.73
Mecadox	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Vitamin premix ^b	.25	.25	.25	.25	.25	.25	.25
Trace mineral premix ^c	.15	.15	.15	.15	.15	.15	.15
L-lysine	.10	.15	.15	.15	.15	.15	.15
DL-methionine	.10	.05	.05	.05	.05	.05	.05
Copper sulfate	.08	.08	.08	.08	.08	.08	.08
Vitamin E premix ^d		.05	.05	.05	.05	.05	.05
Selenium premix ^e		.05	.05	.05	.05	.05	.05
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

^aThe 10% whey and bovine spray-dried blood meal diets were the same treatment.

^bPhase I each pound contains vitamin A, 2,000,000 IU; vitamin D₃, 200,000 IU; vitamin E, 8,000 IU; menadione, 800 mg; vitamin B₁₂, 6 mg; riboflavin, 1,500 mg; pantothenic acid, 5,200 mg; niacin, 9,000 mg; choline, 30,000 mg. Phase II each pound contains vitamin A, 1,000,000 IU; vitamin D₃, 100,000 IU; vitamin E, 4,000 IU; menadione, 400 mg; vitamin B₁₂, 5 mg; riboflavin, 1,000 mg; pantothenic acid, 2,500 mg; niacin, 5,500 mg; choline, 100,000 mg.

^cIn phase I each pound contains Zn, 50 g; Fe, 50 g; Mn, 12 g; Cu, 5 g; I, 90 mg; Se, 90 mg. In phase II each pound contains Zn, 45 g; Fe, 45 g; Mn, 45 g; Cu, 4.5 g; I 90 mg.

^dEach pound contains 20,000 IU vitamin E.

^eEach pound contains 272.4 mg Se.

Table 2. Comparison of Spray-dried Blood Meal Sources in the Phase II Starter Pig Diet^{a,b}

Item	Spray-Dried Blood Meal Source		CV, %
	Avian	Bovine	
<u>d 7 to 14</u>			
ADG, lb	.39	.44	17.5
ADFI, lb	.74	.78	7.0
F/G	2.18	1.87	19.6
<u>d 7 to 28</u>			
ADG, lb	.81	.82	4.9
ADFI, lb	1.26	1.28	4.4
F/G	1.55	1.54	3.0

^aAll pigs were fed a common diet from day 0 to 7 (phase I) postweaning. Each value is the mean of six pens containing 13 or 15 pigs per pen.

^bNo significant treatment effects.

Table 3. Comparison of Dried Whey Levels for the Phase II Starter Pig Diet Containing 2.5% Spray-dried Blood Meal^a

Item	Spray-dried Whey %				CV, %
	5	10	15	20	
<u>d 7 to 14</u>					
ADG, lb ^{b,c}	.38	.44	.46	.55	17.5
ADFI, lb ^{b,c}	.70	.78	.79	.84	7.0
F/G ^d	2.01	1.87	1.71	1.58	19.6
<u>d 7 to 28</u>					
ADG, lb ^{b,e}	.66	.82	.85	.90	4.9
ADFI, lb ^{b,e}	1.17	1.28	1.26	1.35	4.4
F/G ^{b,e}	1.76	1.56	1.50	1.50	3.0
Diet Cost/Ton, \$ ^f	209	235	260	286	
Cost/lb gain, \$ ^{b,e}	.184	.184	.192	.215	3.1

^aAll pigs were fed a common diet from day 0 to 7 postweaning. Each value is the mean of six pens containing 13 or 15 pigs per pen.

^{b,d}Linear effect $P < .001$ and $P < .05$, respectively.

^{c,e}Quadratic effect $P < .05$ and $P < .001$, respectively.

^fIngredient costs used were corn, \$2.18 per bushel; soybean meal, \$180 per ton; spray-dried edible whey, \$.33 per pound.