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Abstract

Using a 50:50 blend of spray-dried plasma protein (SDPP):spray-dried wheat gluten (WG) (i.e., with each as approximately 4% of the diet) gave the greatest ADG and ADFI, while reducing diet costs compared to the control diet (i.e., 8% SDPP). Even with a slight decrease in efficiency of gain, the marked decrease in diet cost will yield better cost of gain with a 50:50 blend versus using only SDPP.; Swine Day, Manhattan, KS, November 16, 1995

Keywords

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WHEAT GLUTEN AND SPRAY-DRIED PLASMA PROTEIN BLENDS FOR NURSERY PIGS

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Summary

Using a 50:50 blend of spray-dried plasma protein (SDPP):spray-dried wheat gluten (WG) (i.e., with each as approximately 4% of the diet) gave the greatest ADG and ADFI, while reducing diet costs compared to the control diet (i.e., 8% SDPP). Even with a slight decrease in efficiency of gain, the marked decrease in diet cost will yield better cost of gain with a 50:50 blend versus using only SDPP.

(Key Words: Nursery, Wheat Gluten, Plasma Protein.)

Introduction

Until recently, milk or milk products were considered essential components of diets for maximum growth and health of early-weaned pigs. Blood products (e.g., plasma protein and blood meal) have been used successfully to replace milk products in nursery diets and typically give greater feed consumption in early-weaned pigs. However, blood products (like milk products) are expensive compared to refined protein products of plant origin.

In previous KSU Swine Day Reports, we suggested that spray-dried wheat gluten (WG) supported greater ADG and ADFI in nursery pigs than did dried skim milk or soy protein isolate. Also, in last year's report, we suggested that a 50:50 blend of wheat gluten (WG) and spray-dried plasma protein (SDPP) gave better overall performance than when either protein source was used individually.

Thus, the experiment reported herein was designed to determine the appropriate ratio of WG and SDPP to minimize diet costs without adversely affecting growth performance of nursery pigs.

Procedures

A total of 150 crossbred (Duroc × Yorkshire × Hampshire × Chester White) weanling pigs (avg initial wt of 12.3 lb) was used in a 32-d growth assay to determine the optimal blend of spray-dried WG and SDPP in diets for nursery pigs. The WG was substituted on a protein basis to yield the desired SDPP:WG blends: 1) SDPP; 2) 75% SDPP and 25% WG; 3) 50% SDPP and 50% WG; 4) 25% SDPP and 75% WG; and 5) WG. The actual amounts (%) SDPP and WG in the diets were 8 and 0, 6 and 1.82, 4 and 3.64, 2 and 5.45, and 0 and 7.25 for the 100:0, 75:25, 50:50, 25:75, and 0:100 ratios, respectively. As WG was added as a greater percentage of the diets, so was crystalline lysine (up to .55% for the 0:100 ratio of SDPP and WG), such that diets for d 0 to 14 were formulated to 1.5% lysine, .42% methionine, .9% Ca, and .8% P, with all other nutrients in excess of NRC (1988) suggestions. For d 14 to 32, the pigs were fed the same corn-soybean meal-whey-based diet formulated to 1.2% lysine, .8% Ca, and .7% P. The pigs were housed in an environmentally controlled nursery room with five pigs per pen and six pens per treatment. Pigs and feeders were weighed on d 0, 14, and 32 to allow for calculation of ADG, ADFI, and F/G. Feces were collected on d 13 from four pigs per pen; pooled; dried; and analyzed for concentrations of DM, N, and Cr.

Data were analyzed as a randomized complete block design with initial wt as the blocking criterion and pen as the experimental unit. Response criteria were ADG, ADFI, F/G, and digestibilities of DM and N. Polynomial regression was used to describe the shape of the response (i.e., linear, quadratic, cubic, and quartic effects) as WG was added in increasingly greater concentrations.

Results and Discussion

For d 0 to 14, ADG and ADFI increased with up to 50% replacement of the SDPP and decreased when more SDPP was removed from the diet (quadratic effects, P<.004 and .02, respectively). For d 14 to 32, pigs fed the 50:50 blend had the greatest ADFI (quadratic effect, P<.04), resulting in the numerically greatest ADG but poorest (quadratic effect, P<.03) F/G. Overall (d 0 to 32), ADG and ADFI increased as WG was used to replace up to 50% of the SDPP (quadratic effects, P<.04 and .02, respectively). However, the increased ADFI outpaced the increases in ADG, resulting in a trend for a quadratic decrease (P<.06) in efficiency of gain.

No differences occurred in digestibilities of DM or N at d 13 (P>.18). Thus, it seems unlikely that any effects on growth performance for SDPP or WG can be attributed to improved digestibility of nutrients.

In conclusion, using the 50:50 blend of SDPP:WG (i.e., with each as approximately 4% of the diet) gave the greatest ADG and ADFI, while reducing diet costs compared to the 8% SDPP control treatment.

Table 1. Diet Composition, %

	Plasma protein:wheat gluten ratio (d 0 to 14)[ab]					
Item	100:0	75:25	50:50	25:75	0:100	Diet for 14 to 32[c]
Corn	34.45	34.55	34.55	34.65	34.67	49.50
Whey	20.00	20.00	20.00	20.00	20.00	20.00
WG	-	1.82	3.64	5.45	7.25	-
SDPP	8.00	6.00	4.00	2.00	-	-
Lactose	10.00	10.00	10.00	10.00	10.00	-
Soybean meal (48% CP)	18.54	18.54	18.54	18.54	18.54	22.22
Blood meal	1.50	1.50	1.50	1.50	1.50	1.50
Soybean oil	3.00	3.00	3.00	3.00	3.00	3.00
Monocalcium phosphate	1.98	1.96	1.95	1.93	1.91	1.24
Limestone	.65	.66	.67	.69	.69	.70
Vitamins	.25	.25	.25	.25	.25	.25
Minerals	.15	.15	.15	.15	.15	.15
Salt	-	-	.10	.10	.20	.20
Copper sulfate	.08	.08	.08	.08	.08	.08
Chromic oxide[d]	.20	.20	.20	.20	.20	-
Lysine-HCl	.05	.18	.30	.43	.55	.10
DL-methionine	.15	.12	.08	.05	.01	.05
Antibiotic[e]	1.00	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00	100.00

[a]Diets for d 0 to 14 were formulated to 1.5% lysine, .9% Ca, and .8% P.
[b]WG=spray-dried wheat gluten and SDPP=spray-dried plasma protein.
[c]The diet for d 14 to 32 was formulated to 1.2% lysine, .8% Ca, and .7% P.
[d]Used as an indigestible marker.
[e]Antibiotic supplied 150 g of apramycin per ton of diet for d 0 to 14 and 50 g/ton of carbadox for d 14 to 32.

Table 2. Chemical Composition of the Protein Sources

Item	Spray-dried wheat gluten[a]	Spray-dried porcine plasma[b]
CP, %	74.3	72.0
Amino acids, % of sample		
Arginine	2.6	4.3
Histidine	1.4	2.4
Isoleucine	2.2	2.8
Leucine	4.7	7.3
Lysine	1.3	6.5
Methionine	2.5	.7
Phenylalanine	3.4	4.1
Threonine	2.4	5.2
Tryptophan	.6	1.5
Valine	2.2	4.7
Amino acids, % of CP		
Arginine	3.5	5.6
Histidine	1.9	3.1
Isoleucine	3.0	3.6
Leucine	6.3	9.4
Lysine	1.8	8.5
Methionine	3.4	1.0
Phenylalanine	4.6	5.3
Threonine	3.2	6.8
Tryptophan	.8	1.9
Valine	3.0	6.1

[a]Amino acids analyzed using AOAC (1990) procedures.
[b]Amino acid profile courtesy of Merrick's, Inc.

Table 3. Spray-Dried Wheat Gluten and Porcine Plasma Protein Blends for Nursery Pigs[a]

	Plasma protein:WG ratio (d 0 to 14)[b]						Contrasts			
Item	100:0	75:25	50:50	25:75	~~100:0~~ 0:100	SE	Linear	Quad-ratic	Cubic	Quartic
d 0 to 14										
ADG, lb	.91	.94	.94	.87	.79	.02	.001	.004	-[c]	-
ADFI, lb	.96	1.01	1.01	.96	.87	.03	.05	.02	-	-
F/G	1.05	1.07	1.07	1.10	1.10	.04	.05	-	-	-
d 14 to 32										
ADG, lb	1.21	1.26	1.27	1.21	1.21	.04	-	-	-	-
ADFI, lb	1.77	1.86	1.94	1.86	1.78	.06	-	.04	-	-
F/G	1.46	1.48	1.53	1.54	1.47	.02	-	.03	.09	-
d 0 to 32										
ADG, lb	1.08	1.12	1.13	1.06	1.02	.03	.06	.04	-	-
ADFI, lb	1.42	1.49	1.53	1.46	1.38	.04	-	.02	-	-
F/G	1.32	1.33	1.35	1.38	1.35	.02	.06	.06	.11	-
Apparent digestibility (d 13), %										
DM	88.4	90.5	89.5	89.6	89.5	1.0	-	-	-	-
N	84.0	87.6	86.8	86.8	87.6	1.4	-	-	-	-

[a]A total of 150 weanling pigs (avg initial wt of 12.3 lb) were allotted with five pigs per pen and six pens per treatment.
[b]WG=spray-dried wheat gluten and SDPP=spray-dried plasma protein. Note that the same corn-soybean meal-whey-based diet was fed for d 14 to 32.
[c]Dash indicates P>.15.