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Evaluation of specialty soy protein sources on nursery pig performance

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Evaluation of Specialty Soy Protein Sources on Nursery Pig Performance¹

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Summary

A 35-d growth trial was conducted to evaluate the effects of a new soy protein source, Nutrivance (TechMix, Stewart, MN), on nursery pig growth performance. Nutrivance is a modified soy protein produced via a proprietary process combining extraction and enzymatic treatment of soybeans. Pigs ($n = 1,188$, PIC 337 $\times$ 1050; initially 9.8 lb BW) were weaned at 21 d of age and allotted by weight to pens with 27 pigs per pen. Pigs were fed a common diet for 15 d before the start of the study. Pens of pigs (13.5 lb BW) were then allotted to 1 of 4 dietary treatments fed for 14 d followed by a common diet fed for 21 d. The 4 experimental treatments were a corn-soybean meal–based control diet, or a corn-soybean meal–based diet with either 8% Nutrivance, 8.65% HP-300 (Hamlet Protein, Findlay, OH), or 6.85% Soycomil P (SPC; Archer Daniels Midland Co., Decatur, IL). The diets were formulated to the same standardized ileal digestible lysine level with specialty soy protein products replacing a portion of soybean meal in the control diet to form the experimental treatments.

From d 0 to 14, there were no differences in ADG or F/G; however, pigs fed the diets containing Nutrivance or HP-300 had decreased ADFI ($P < 0.02$) compared with those fed the control diet, with pigs fed diets containing SPC intermediate. From d 14 to 35 when a common diet was fed, pigs previously fed the diet with the HP-300 had lower ADFI ($P < 0.03$) compared with pigs fed the control diet, with pigs previously fed diets containing Nutrivance or SPC intermediate. From d 0 to 35, pigs fed diets containing Nutrivance or HP-300 had decreased ADG and ADFI ($P < 0.02$) compared with pigs fed the control diet, with pigs fed diets containing SPC intermediate. Final weight (d 35) was greatest ($P < 0.04$) for pigs fed the control diet and lowest for pigs fed the diet with Nutrivance, and pigs fed the diets with HP-300 or SPC were intermediate. In conclusion, differences exist between alternative specialty soy protein sources, but, the corn-soybean meal control diet elicited the greatest growth performance in this study.

Key words: growth performance, nursery pig, soy protein sources

Introduction

Providing high-quality sources of amino acids to weanling pigs is known to improve performance and aid in transitioning pigs to dry feed. However, increasing prices of some of the most common protein sources has encouraged the industry to search for alternative ingredients capable of replacing these expensive ingredients without negatively affecting performance.

¹ Appreciation is expressed to TechMix, LLC (Stewart, MN) for partial financial support and providing the specialty soy protein sources and to New Horizon Farms for use of pigs and facilities.

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Nutrivance (TechMix, Stewart, MN) is a new specialty soybean protein ingredient that was developed from a proprietary process that combines extraction and enzymatic treatment of soybeans to create a modified soy protein for animal feeds. The enzymatic treatment reduces anti-nutritional factors found in soybean meal that are known to negatively affect pig performance. Little research has been conducted to determine how this new soy protein replacement product will affect nursery pig performance. Thus, the objective of this study was to evaluate the effects of different soy protein sources on growth performance of nursery pigs.

Procedures

The protocol for this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. This experiment was conducted at a commercial research-nursery site in southwest Minnesota. One room with 44 pens was used, with each pen (12 × 7.5 ft) equipped with a 6-hole stainless steel dry self-feeder (SDI Industries, Alexandria, SD) and a pan waterer for ad libitum access to feed and water. The nursery is equipped with a robotic feeding system that is capable of feeding each individual pen any of the individual diets as well as a pen scale to obtain pig weight on a pen basis.

At weaning, 1,188 pigs (PIC 337 × 1050; 9.8 lb BW) were used in a 5-d study. Pigs were allotted to 1 of 44 pens, with 27 pigs per pen and all pigs fed the same common diets for 15 d after weaning. At that point, pens of pigs (13.5 lb BW) were weighed and randomly allotted within weight blocks to 1 of the 4 dietary treatments with 11 pens per treatment. Experimental diets were fed for 14 d and consisted of: (1) a corn-soybean meal-based control diet, or a corn-soybean meal-based diet with either (2) 8% Nutrivance, (3.47% standardized ileal digestible lysine [SID Lys] as-fed), (3) 8.65% HP-300 (Hamlet Protein, Findlay, OH; 3.25% SID Lys as-fed), or (4) 6.85% Soycomil P (Archer Daniels Midland Co., Decatur, IL; 3.85% SID Lys as-fed) (Table 1). The diets were formulated to the same SID Lys concentration, with specialty soy protein product replacing 10.85% of the soybean meal in the control diet to form the experimental treatments. After the 14-d experimental treatment phase, a common diet was fed for 21 d. Pig weight and feed disappearance were measured on d 0, 7, 14, 28, and 35 of the trial to determine ADG, ADFI, and F/G.

Samples of each diet were collected during feed manufacturing and from a minimum of 6 feeders on each weigh day, combined, and subsampled to form a composite sample for each weigh day. These samples were submitted to Ward Laboratories, Inc. (Kearney, NE) for analysis of DM, CP, Ca, and P.

Data were analyzed as a randomized complete block design using PROC MIXED in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Weight block was included in the model as a random effect. The effects of soy protein sources on performance criteria were determined by a pairwise comparison. Results were considered significant at $P \leq 0.05$ and tendencies from $P > 0.05$ to $P \leq 0.10$.

Results and Discussion

The chemical analyses of the dietary treatments were similar to expectations from diet formulation (Table 2).

Growth performance of pigs prior to the initiation of study was similar to expectations (Table 3). From d 0 to 14, there were no differences in ADG or F/G; however, pigs fed the diets containing Nutrivance or HP-300 had decreased ADFI ($P < 0.02$) compared with those fed the control diet, with pigs fed diets containing SPC intermediate. From d 14 to 35 when a common diet was fed, pigs previously fed the diet with the HP-300 had decreased ADFI ($P < 0.03$) compared with pigs fed the control diet, with pigs previously fed diets containing Nutrivance or Soycomil intermediate. From d 0 to 35, pigs fed diets containing Nutrivance or HP-300 had decreased ADG and ADFI ($P < 0.02$) compared with pigs fed the control diet; pigs fed diets containing SPC were intermediate. Final weight (d 35) was greatest ($P < 0.04$) for pigs fed the control diet and lowest for pigs fed the diet with Nutrivance, whereas pigs fed the diets with HP-300 or SPC were intermediate.

These data suggest that the specialty soybean protein sources tested in this study were not able to elicit the same growth performance as pigs fed the corn-soybean meal control diet. This was evident because pigs fed the control diet had the greatest numerical ADG and ADFI throughout the study. Because ADFI was the primary growth criteria negatively influenced by the specialty soybean source treatments HP 300 and Nutrivance, we speculate that diet palatability might have been adversely affected by the products. Furthermore, our data suggest that the other specialty soy protein sources tested in this study did not have the same impact on feed intake. Additional research should be conducted to further compare how different specialty soy protein products influence nursery pig growth performance.

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

Item	Control	Nutrivance ²	HP 300 ³	Soycomil P ⁴
Ingredient, %				
Corn	41.73	44.54	43.90	45.69
Soybean meal (47.5% CP)	33.60	22.75	22.75	22.75
Dried distillers grains with solubles	10.00	10.00	10.00	10.00
Dried whey	10.00	10.00	10.00	10.00
Corn oil	1.00	1.00	1.00	1.00
Dicalcium P (18.5% P)	1.00	1.05	1.00	1.03
Limestone	1.10	1.08	1.13	1.10
Salt	0.30	0.30	0.30	0.30
DL-methionine	0.14	0.15	0.14	0.15
L-threonine	0.12	0.12	0.12	0.12
Biolys	0.50	0.50	0.50	0.50
Optiphos 2000	0.03	0.03	0.03	0.03
Zinc oxide	0.25	0.25	0.25	0.25
Trace mineral premix	0.10	0.10	0.10	0.10
Vitamin premix	0.13	0.13	0.13	0.13
Nutrivance	--	8.00	--	--
HP-300	--	--	8.65	---
Soycomil P	--	--	----	6.85
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Standardized ileal digestible (SID) amino acids, %				
Lysine	1.30	1.30	1.30	1.30
Isoleucine:lysine	63	63	63	64
Methionine:lysine	34	35	34	35
Met & Cys:lysine	58	58	58	58
Threonine:lysine	65	65	65	65
Tryptophan:lysine	19.6	19.2	19.5	18.3
Valine:lysine	66	67	68	68
Total lysine, %	1.46	1.46	1.45	1.46
ME, kcal/lb	1,508	1,517	1,525	1,525
NE, kcal/lb ⁵	1,099	1,108	1,115	1,118
SID lysine:ME, g/Mcal	3.91	3.89	3.87	3.87
CP, %	23.0	22.9	23.1	22.8
Ca, %	0.80	0.80	0.80	0.80
P, %	0.66	0.66	0.66	0.65
Available P, %	0.50	0.51	0.50	0.50

¹ Experimental diets were fed from d 15 to 29 after weaning.

² Nutrivance, TechMix, LLC, Stewart, MN, formulated with 3.47% SID lysine.

³ HP-300, Hamlet Protein, Findlay, OH, formulated with 3.25% SID lysine.

⁴ Soycomil P, Archer Daniels Midland Co., Decatur, IL, formulated with 3.85% SID lysine.

⁵ NRC, 2012.

Table 2. Chemical analysis of experimental diets¹

Item	Control	Nutrivance ²	HP-300 ³	Soycomil P ⁴
DM, %	90.63	90.89	90.89	90.92
CP, %	25.3	24.8	25.0	24.2
Ca, %	1.00	1.07	0.96	1.06
P, %	0.59	0.64	0.62	0.63

¹ Values represent a single subsample of a homogenized group of a minimum of 12 samples per treatment analyzed at Ward Laboratories, Inc. (Kearney, NE).

² Nutrivance, TechMix, LLC, Stewart, MN.

³ HP-300, Hamlet Protein, Findlay, OH.

⁴ Soycomil P, Archer Daniels Midland Co., Decatur, IL.

Table 3. Effects of specialty soy protein sources on nursery pig performance¹

Item	Control	Nutrivance ²	HP-300 ³	Soycomil ⁴	SEM	<i>P</i> <
d 0 to 14						
ADG, lb	0.71	0.65	0.65	0.70	0.03	0.14
ADFI, lb	0.98 ^b	0.89 ^a	0.89 ^a	0.95 ^{ab}	0.03	0.02
F/G	1.40	1.40	1.37	1.35	0.03	0.78
d 14 to 35						
ADG, lb	1.25	1.21	1.21	1.23	0.02	0.13
ADFI, lb	1.82 ^b	1.77 ^{ab}	1.73 ^a	1.77 ^{ab}	0.03	0.03
F/G	1.46	1.46	1.42	1.44	0.02	0.27
d 0 to 35						
ADG, lb	1.03 ^b	0.98 ^a	0.99 ^a	1.02 ^{ab}	0.02	0.02
ADFI, lb	1.49 ^b	1.41 ^a	1.39 ^a	1.44 ^{ab}	0.03	0.02
F/G	1.44	1.44	1.41	1.41	0.01	0.16
BW, lb						
d 0	13.5	13.5	13.6	13.6	0.44	0.97
d 14	23.4	22.5	22.6	23.2	0.66	0.23
d 35	49.9 ^c	48.2 ^a	48.3 ^{ab}	49.6 ^{bc}	0.93	0.04

^{a,b,c} Means within the same row with different superscripts differ ($P \leq 0.05$).

¹ A total of 1,188 nursery pigs (PIC 337 × 1050, initially 13.5 lb BW) were used in a 35-d growth trial with 27 pigs per pen and 11 pens per treatment. Treatment diets were fed from d 15 after weaning, then a common diet was fed from d 21 to 35.

² Nutrivance, TechMix, LLC, Stewart, MN.

³ HP-300, Hamlet Protein, Findlay, OH.

⁴ Soycomil P, Archer Daniels Midland Co., Decatur, IL.