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Abstract

Three experiments were conducted to determine the effects of a sorghum-specific enzyme supplementation on growth performance of finishing pigs. Although positive trends occurred, the sorghum-specific enzymes used in our experiments did not yield large and(or) consistent improvements in growth performance or nutrient digestibility in finishing pigs.; Swine Day, Manhattan, KS, November 19, 1998

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ENZYME ADDITIONS TO SORGHUM-BASED DIETS FOR FINISHING PIGS[1]

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Summary

Three experiments were conducted to determine the effects of a sorghum-specific enzyme supplementation on growth performance of finishing pigs. Although positive trends occurred, the sorghum-specific enzymes used in our experiments did not yield large and(or) consistent improvements in growth performance or nutrient digestibility in finishing pigs.

(Key Words: Sorghum, Enzyme, Finishing Pigs.)

Introduction

The hardy nature of sorghum makes it appealing to farmers and livestock producers in the High Plains of the U.S., throughout Mexico, and in relatively arid regions in the most of world. Yet the feeding value of sorghum grain on average is 3 to 5% less than that of corn. Thus, a means of improving nutrient utilization from sorghum grain would be of great benefit. Some researchers have suggested that enzyme supplementation of swine and poultry diets (e.g., beta glucanase in barley-based diets and phytase *in most* cereal-based diets) can improve nutrient utilization and(or) growth performance. Thus, the objective of this experiment was to determine the effects of sorghum-specific enzyme supplementation on growth performance and nutrient utilization in finishing pigs.

Procedures

For Exp. 1, 192 pigs (PIC line 326 boars × C15 and C22 sows) were blocked by weight (average initial BW of 100 lb) and allotted to pen based on sex and ancestry. There were 12 gilts in eight pens and 12 barrows in eight pens. Treatments were the sorghum-soybean meal-based diets with none and 12 oz of enzyme derived from *A. niger* and *B. subtilis* fermentation extract (carbohydrase; 50.000 BA unit/oz + cellulase; 100 F unit/oz.) per ton of sorghum. Water was added with the enzyme system so that all diets had 12 oz of supplemental liquid. The enzyme system and(or) water were mixed with the sorghum for 5 min before other dietary ingredients were added to the mixer. The pigs were housed in a modified open-front building with 50% solid concrete and 50% concrete slat flooring. Each pen (6 ft × 16 ft) had a three-hole self-feeder and nipple waterer to allow ad libitum consumption of feed and water.

At approximately midexperiment (d 39), chromic oxide (.25%) was added to the diets as an indigestible marker. After a 4-d adjustment period, fecal samples were collected from four pigs per pen, pooled within pen, and frozen. Later, the feces were oven-dried at 122°F for 24 hr and ground. Feed and feces were analyzed for concentrations of DM, N, and Cr to allow calculation of apparent digestibilities of DM and N.

The pigs were slaughtered when those in the heaviest pen in a weight block reached an

[1]Appreciation is expressed to Charles Cobb of Loveland Industries, Inc., for funding this project.

average BW of 250 lb. Dressing percentage (hot carcass weight / final live weight × 100) and tenth rib backfat thickness (measured on the midline of the split carcass) for each pig were adjusted (using regression analysis) to the average final BW before being pooled within pen. Also, fat-free lean index for each pen was calculated using the equation proposed by the National Pork Producers Council (1994). Response criteria were ADG, ADFI, F/G, dressing percentage, last rib backfat thickness, fat-free lean index, and apparent digestibilities of DM and N. All data were analyzed as a randomized complete block design (with BW as the blocking criterion) using the GLM procedures of SAS.

For Exp. 2, 168 pigs (same genetics as for Exp. 1 with an average initial BW of 129 lb) were blocked by weight and allotted to pen based on sex and ancestry. There were 11 gilts in eight pens and 10 barrows in eight pens. Pig and feeder management and housing were the same as in Exp.1.

Treatments were a sorghum-soybean meal-based diet with no enzyme or 5, 10, and 15 oz of the enzyme supplementation added to each ton of sorghum. Water was added with the enzyme system so that all diets had 15 oz of supplemental liquid. The diets (Table 1) were formulated to .90% lysine for d 0 to 29 and .70 % lysine for d 29 to 63 and fed in meal form. Fecal sample collection, preparation, and analyses were the same as in Exp. 1. All data were analyzed as a randomized complete block design using the GLM procedures of SAS. Polynomial regression was used to characterize the shape of the response curve, and pen was the experimental unit. Response criteria were the same as in Exp. 1 (e.g., growth performance, nutrient digestibility, and routine carcass measurements).

For Exp. 3, 176 pigs (same genetics as for Exp. 1 with average initial BW of 103 lb) were blocked by weight and allotted to pen based on sex and ancestry. There were 11 gilts in eight pens and 11 barrows in eight pens. Treatments were the same sorghum-soybean meal-based diets used in Exps. 1 and 2, with no enzyme or 15, 30, and 40 oz of enzyme supplementation per ton of sorghum. Pig and feeder managements were the same as in the previous experiments. Collecting of carcass data was slightly different (i.e., a different slaughter plant), with fat thickness measured off-midline, at the tenth rib, using a Fat-O-Meter probe. Also hot carcass weights were "head on". Response criteria and data analyses were the same as in Exp. 2.

Table 1. Basal Diets[a]

Ingredient, %	Period 1[b]	Period 2[c]
Sorghum	82.57	90.00
Soybean meal (46.5% CP)	13.40	6.52
Soybean oil	.50	.50
Lysine HCL	.39	.38
Threonine	.18	.15
DL-methionine	.17	.14
Monocalcium phosphate	1.10	1.00
Limestone	1.02	.73
Salt	.30	.30
Vitamin premix	.15	.15
Trace mineral premix	.10	.10
Antibiotic[d]	.12	.12
Total	100.00	100.00

[a]All diets were fed in mash form.
[b]Formulated to .90% lysine, .65% Ca, and .55% P, and fed from d 0 to 29, d 0 to 35, and d 0 to 39 in Exp.1, 2, and 3, respectively.
[c]Formulated to .70% lysine, .55% Ca, and .45% P, and fed from d 29 to 63, d 35 to 71, and d 39 to 74 in Exp.1, 2, and 3, respectively.
[d]Supplied 100g/ton tylosin.

Results and Discussion

For Exp. 1, F/G for d 0 to 39 was improved (P<.03) by enzyme supplementation. However, other measurements of growth performance were not affected (P>.15) for d 0 to 39, d 39 to 74, or overall. Digestibility of DM tended (P<.13) to be greater in pigs fed diet with enzymes, but digestibility of N was not affected (P>.15). Pigs fed the diet with enzymes had greater dressing percentage (P<.03), but BF and FFLI were not affected (P>.24).

For Exp. 2, adding as much as 15 oz/ton of the enzyme supplementation did not affect (P>.15) ADG, ADFI, or F/G for d 0 to 29. During d 29 to 63, the linear effect of enzyme concentration on F/G approached significance (P<.11), with an 8.5% advance as enzyme concentration was increased from none to 15 oz/ton of sorghum. However, for the overall period (d 0 to 63), growth performance; digestibilities of DM and N; and carcass characteristics (dressing percentage, backfat thickness, and fat-free lean index) were not affected (P>.15) by addition of the enzyme system.

For Exp. 3, enzyme supplementation had no effect on ADG, ADFI, F/G, or digestibilities of DM and N (d 39), and carcass characteristics (dressing percentage, backfat thickness, and fat free lean index) were similar among treatments (P>.15) when up to 45 oz/ton of enzyme was added.

In conclusion, positive trends occurred, but enzyme supplementation to sorghum-based diets showed no consistent advantages. Still, the feeding value of sorghum is less than that of corn, so the search for a cost-effective enzyme supplement will continue.

Table 2. Effects of Sorghum-Specific Enzyme on Growth Performance of Finishing Pigs (Exp.1)[a]

Item	Enzyme Concentration, oz/ton of Sorghum		SE	P- value
	0	12		
Day 0 to 39				
ADG, lb	2.12	2.16	.05	-[c]
ADFI, lb	4.87	4.79	.13	-
F/G	2.29	2.21	.03	.03
Day 39 to 74				
ADG, lb	1.90	1.94	.06	-
ADFI, lb	5.66	5.96	.17	-
F/G	2.98	3.07	.07	-
Overall				
ADG, lb	2.01	2.05	.05	-
ADFI, lb	5.44	5.50	.19	-
F/G	2.70	2.68	.05	-
Nutrient digestibility (d 43), %				
DM	84.4	85.4	.9	.13
N	66.0	67.1	1.9	-
Carcass measurements [b]				
DP, %	72.3	73.1	.4	.03
BF, in	.89	1.02	.14	-
FFLI, %	47.2	45.4	2.1	-

[a]A total of 192 finishing pigs was fed from an average initial BW of 100 lb to an average final BW of 248 lb.
[b]DP = dressing percentage, BF = tenth rib backfat thickness, and FFLI = fat free lean index (NPPC, 1994).
[c]Dash indicates P>.15.

Table 3. Effects of Sorghum-Specific Enzyme on Growth Performance of Finishing Pigs (Exp.2)[a]

	Enzyme Concentration, oz/ton of Sorghum					P-Value		
Item	0	5	10	15	SE	Lin	Quad	Cubic
Day 0 to 29								
ADG, lb	2.15	2.16	2.13	2.14	.09	-[c]	-	-
ADFI, lb	4.70	4.80	4.73	4.65	.12	-	-	-
F/G	2.19	2.22	2.22	2.17	.02	-	-	-
Day 29 to 63								
ADG, lb	1.87	2.00	1.98	2.08	.10	-	-	-
ADFI, lb	5.90	6.09	6.00	6.00	.23	-	-	-
F/G	3.16	3.05	3.03	2.88	.01	.11	-	-
Overall								
ADG, lb	1.99	2.08	2.05	2.11	.09	-	-	-
ADFI, lb	5.55	5.68	5.59	5.56	.22	-	-	-
F/G	2.79	2.73	2.73	2.64	.01	-	-	-
Nutrient digestibility (d32),%								
DM	83.4	84.5	84.0	84.7	.7	-	-	-
N	62.4	62.7	61.6	63.3	.1	-	-	-
Carcass measurements [b]								
DP, %	72.6	74.5	72.9	73.1	.7	-	-	-
BF, in	1.00	.97	1.00	.99	.02	-	-	-
FFLI, %	45.6	46.3	45.8	46.0	.4	-	-	-

[a]A total of 168 finishing pigs was fed from an average initial BW of 129 lb to an average final BW of 256 lb. [b]DP = dressing percentage, BF = tenth rib backfat thickness, and FFLI = fat free lean index (NPPC, 1994). [c]Dash indicates P>.15.

Table 4. Effects of Sorghum-Specific Enzyme on Growth Performance of Finishing Pigs (Exp.3)[a]

	Enzyme Concentration, oz/ton of Sorghum					P-Value		
Item	0	15	30	45	SE	Lin	Quad	Cubic
Day 0 to 36								
ADG, lb	2.12	2.08	2.10	2.15	.09	-[c]	-	-
ADFI, lb	5.60	5.40	5.48	5.54	.21	-	-	-
F/G	2.64	2.59	2.60	2.58	.13	-	-	-
Day 36 to 71								
ADG, lb	2.10	2.09	2.11	2.06	.11	-	-	-
ADFI, lb	6.99	6.95	6.94	6.87	.26	-	-	-
F/G	3.32	3.33	3.28	3.33	.13	-	-	-
Overall								
ADG, lb	2.10	2.09	2.11	2.11	.07	-	-	-
ADFI, lb	6.55	6.47	6.44	6.51	.18	-	-	-
F/G	3.11	3.09	3.05	3.08	.10	-	-	-
Nutrient digestibility (d39), %								
DM	83.6	83.7	83.8	84.2	.4	-	-	-
N	62.7	64.4	63.7	64.2	1.1	-	-	-
Carcass measurements [b]								
DP, %	76.5	76.1	74.3	76.5	2.4	-	-	-
BF, in	.72	.71	.69	.70	.04	-	-	-
FFLI, %	49.4	49.5	49.7	49.7	.5	-	-	-

[a]A total of 176 finishing pigs was fed from an average initial BW of 103 lb to an average final BW of 252 lb. [b]DP = dressing percentage (head-on), BF = tenth rib backfat thickness, and FFLI = fat free lean index (NPPC, 1994). [c]Dash indicates P>.15.