Effect of Turbozyme 160 on Performance of Early-Weaned Pigs

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Story in Brief

Two trials were conducted to determine the efficacy of an enzyme product (Turbozyme 160) in improving gain and efficiency during the nursery phase in early-weaned pigs. Pigs fed Turbozyme 160 consistently grew more rapidly and were more efficient than pigs fed the control diet. During both trials, the greatest magnitude of improvment was observed during the period when diets were changed from a complex, high nutrient phase 1 diet containing plasma protein to a simpler phase 2 diet. By the completion of the starter I period, pig weight was improved in pigs fed Turbozyme 160 by 2.57 lb and 2.55 lb in Trials 1 and 2, respectively when compared to those fed the control diet.

(Key Words: Early-weaned Pigs, Enzymes, Feed Additive.)

Introduction

Adding enzymes to animal feed has been attempted for a number of years with limited success. However, more recently, a number of enzyme preparations have been shown to improve performance in pigs. Two trials were conducted to determine the efficacy of an enzyme product (Turbozyme 160) in improving gain and efficiency of gain in pigs.

Materials and Methods

Trial 1

Seventy-two Hampshire and Yorkshire pigs were group weaned when the oldest pigs were approximately 24 days old and the youngest pigs approximately 19 days of age (average age = 21.5 days). Pigs were blocked by age group (36 pigs in each of 2 groups) and stratified by litter, weight, and

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sex (boars and gilts) into 6 pens with 6 pigs per pen in each weight group (total of 12 pens). Three pens from each weight group were randomly allotted to one of two treatments (6 pens/treatment) consisting of a basal prestarter diet (Treatment 1, Table 1) or the basal prestarter diet plus Turbozyme 160. The prestarter and starter diets were formulated to contain 1.46 and 1.15% lysine, 0.90 and 0.88% calcium and 0.85 and 0.74% phosphorous, respectively. The prestarter diet was fed for a two week period (Period 1) when the diets were changed to a basal starter diet (Table 1, Treatment 1) or the basal starter diet plus Turbozyme 160 (Treatment 2). Starter diets (Period 2) were continued until pigs reach approximately 61 lb. Periods 1 and 2 were conducted in an environmentally controlled nursery with temperatures initially maintained at 86°F and decreased 2°F weekly until the temperature reached 78°F. Both feed and water were available on an ad libitum basis. Interim gain, feed intake, and efficiency of gain measurements were obtained weekly.

Table 1. Composition of experimental diets (Trial 1).

	Diet			
	Prestarter		Starter I	
	Control (1)	T 160 (2)	Control (1)	T 160 (2)
Dried skim milk	10.0	10.0	-	-
Whey, dehy	20.0	20.0	-	-
Steam rolled oats	10.0	10.0	-	
AP-820[a]	5.0	5.0	-	
Soybean meal	-	-	28.50	28.50
Corn, ground	37.915	37.475	66.65	66.21
Soybean oil	4.0	4.0	-	-
Pro-88[b]	5.0	5.0	-	-
Fishmeal[c]	5.0	5.0	-	-
Lysine, HCl	.24	.24	.15	.15
Ethoxyquin	.025	.025	-	-
FOA 390	1.0	1.0	1.0	1.0
Flavor	.1	.1	-	-
$CuSO_4$	.1	.1	.075	.075
$CaCO_3$	-	-	.9	.9
Dical phosphate	1.1	1.1	1.95	1.95
DL-Methionine	.02	.02	-	-
Vit-Min-Mix	.50	.50	.375	.375
Salt	-	-	.4	.4
Turbozyme 160[e]	-	.44	-	.44

[a] See footnote a,b,c and e in Table 2.

Trial 2

Experimental preocedures were similar to those in Trial 1 with some modification in the diets fed and initial age was 23.2 days. Three pens from each weight group were randomly allotted to one of two treatments (6 pens/treatment) consisting of a basal complex prestarter diet (Treatment 1, Table 2) or the basal prestarter diet plus Turbozyme 160. The prestarter diet was fed for a two week period (Phase 1) when the diets were changed to a basal semi-complex starter I diet (Table 2, Treatment 1) or the basal starter I diet plus Turbozyme 160 (Treatment 2). The starter I diet was continued for a two week period (Phase 2) when the diets were changed to a basal starter II corn-soybean meal diet (Table 2, Treatment 1) or the starter II diet plus Turbozyme 160 (Treatment 2). The starter II diet was fed for a two week Period (Phase 3).

Results and Discussion

Trial 1

The effect of Turbozyme 160 on average daily gain, average daily feed intake, gain/feed ratio and pig weight during the prestarter and starter phase in Trial 1 are presented in Table 3. Data from the two age groups were combined since no age x diet interaction was observed ($P>.10$). Pigs fed Turbozyme 160 consistently grew more rapidly and were more efficient than pigs fed the control diet. During the first two weeks postweaning (Period 1) when pigs were fed the prestarter diets, the effect of Turbozyme 160 was most evident in week 2 where pigs fed Turbozyme 160 tended to grow more rapidly ($P<.13$) and tended to be more efficient ($P<.09$) than pigs fed the control diet. During week three, when the diet was changed to a less complex corn-soybean meal diet, pigs fed Turbozyme 160 grew 25% faster ($P<.05$) and were 19.6% ($P<.01$) more efficient than those fed the control diet. This improved gain and efficiency in pigs fed Turbozyme 160 was observed for the entire five week starter period, although the magnitude of response was not as great as observed during week 3. During the overall five week starter phase, gain was improved by 5.9% ($P<.13$) and feed efficiency was improved by 9.6% ($P<.01$) in pigs fed Turbozyme 160. Average daily feed intake was not affected by inclusion of Turbozyme 160 in the diet. The consistant improvement in daily gain throughout the prestarter and starter period resulted in an increase in pig weight at the completion of the starter phase of 2.57 lb when compared to pigs fed the control diet.

Trial 2

The effect of Turbozyme 160 on average daily gain, average daily feed intake, gain/feed ratio and pig weight during the prestarter and starter periods in Trial 2 are presented in Table 4. Results of this trial were similar to those

Table 2. Composition of experimental diets (Trial 2).

	Diet					
	Prestarter 0-2 Weeks		Starter I 2 wk - 4 wk		Starter II 4 wk - 6 wk	
	Control 1	T 160 2	Control 1	T 160 2	Control 1	T 160 2
Dried skim milk	10.0	10.0	-	-	-	-
Whey, dehy	20.0	20.0	5.0	5.0	-	-
Steam Rolled Oats	10.0	10.0	-	-	-	-
AP-820[a]	7.5	7.5	-	-	-	-
Soybean Meal	-	-	23.40	23.40	28.60	28.60
Corn, Ground	36.275	36.055	60.305	60.085	67.425	67.205
Soybean oil	4.0	4.0	3.0	3.0	-	-
Pro-88[b]	5.0	5.0	-	-	-	-
Fishmeal[c]	5.0	5.0	5.0	5.0	-	-
Lysine, HCl	.22	.22	.28	.28	.28	.28
Ethoxyquin	.025	.025	.025	.025	-	-
CTC-50[d]	.20	.20	.20	.20	.20	.20
Flavor	.10	.10	.10	.10	-	-
$CuSO_4$	.10	.10	.075	.075	-	-
$CaCO_3$	.10	.10	.19	.19	.66	.66
Dical Phosphate	.96	.96	1.65	1.65	2.06	2.06
DL-Methionine	.02	.02	-	-	-	-
Vit-Min-Mix	.50	.50	.375	.375	.375	.375
Salt	-	-	.4	.4	.4	.4
Turbozyme-160[e]	-	.22	-	.22	-	.22
Calculated composition						
Lysine	1.60	1.60	1.33	1.33	1.22	1.22
Ca	.95	.95	.90	.90	.90	.90
P	.80	.80	.80	.80	.75	.75

[a] Plasma protein - American Protein Corporation, Ames, IA.
[b] Morgan Manufacturing Co., Inc. Paris, IL.
[c] Select Grade.
[d] 110 g chlortetracycline per kg.
[e] JEFO Import Export, Inc., Quebec, Canada.

Table 3. The effect of T-160 on performance of early weaned pigs (Trial 1)[a]

Item	Treatment		SE
	Control	Turbozyme-160	
Average daily gain, lb			
Week 1	.31	.31	.02
Week 2	.84[b]	.90[c]	.02
Period 1(WK 1-2)	.57	.62	.02
WK 3	.70[g]	.88[h]	.04
WK 4	1.06	1.10	.04
WK 5	1.21	1.28	.04
WK 6	1.32	1.34	.04
WK 7	1.36	1.34	.09
Period 2(WK 3-7)	1.12[b]	1.19[c]	.02
Average daily feed intake, lb			
Period 1(WK 1- 2)	.64	.64	.02
Period 2(WK 3-7)[f]	2.22	2.13	.04
Feed efficiency (Feed/Gain)			
Period 1(WK 1-2)	1.09[d]	1.04[e]	.02
WK 3	1.96[i]	1.64[j]	.03
WK 4	1.82	1.75	.03
WK 5	1.72[g]	1.51[h]	.03
WK 6	2.04[i]	1.92[j]	.05
WK 7	2.17[d]	2.04[e]	.05
Period 2(WK 3-7)	1.92[i]	1.75[j]	.05
Pig weight, lb			
Initial	13.86	13.84	.07
WK 1	16.10	16.04	.22
WK 2	21.93	22.42	.42
WK 3	26.84[d]	28.56[e]	.53
WK 4	34.05[d]	36.28[e]	.81
WK 5	42.61[b]	45.08[c]	.99
WK 6	51.88[d]	54.58[e]	.88
WK 7	61.31[b]	63.89[c]	1.01

[a] Least squares means.
[b,c] Means in the same row with different superscripts differ ($P < .13$).
[d,e] Means in the same row with different superscripts differ ($P < .09$).
[g,h] Means in the same row with different superscripts differ ($P < .05$).
[i,j] Means in the same row with different superscripts differ ($P < .01$).

Table 4. Effect of Turbozyme-160 on performance of early-weaned pigs (Trial 2)[a].

Item	Age x treatment subclass means				Treatment main effect means		SE
	Control		Turbozyme-160		Control	Turbozyme-160	
	Old	Young	Old	Young			
Average daily gain, lb							
WK 1	.77[b]	.57[c]	.79[b]	.62[c]	.66	.70	.02
WK 2[k]	.73[b]	.79[bc]	.88[c]	.73[b]	.75	.81	.02
Phase 1(WK1-2)[l]	.75[d]	.68[df]	.84[e]	.66[f]	.70[i]	.79[j]	.02
WK 3	.73[de]	.55[d]	.88[e]	.70[de]	.64[i]	.79	.07
WK 4	.90	.95	1.08	1.01	.92	1.08	.07
Phase 2(WK3-4)	.81	.75	.97	.90	.79	.94	.09
WK 5[k]	1.29[de]	1.54[d]	1.47[e]	1.19[de]	1.43[g]	1.34[h]	.04
WK 6	1.30[de]	1.12[e]	1.25[de]	1.17[d]	1.21	1.21	.09
Phase 3(WK5-6)	1.30	1.32	1.36	1.17	1.32	1.28	.09
Ave. daily feed intake, lb							
Phase 1(WK1-2)	.99[d]	.81[e]	.97[d]	.81[e]	.90	.90	.02
Phase 2(WK3-4)	1.58[de]	1.32[e]	1.67[d]	1.50[de]	1.45	1.58	.09
Phase 3(WK5-6)	2.75[d]	2.46[e]	2.60[de]	2.22[f]	2.62[g]	2.45[h]	.07
FCR(Feed/Gain)							
WK 1	1.05[d]	1.20[d]	.97[e]	1.05[d]	1.12[i]	1.01[j]	.06
WK 2[k]	1.64[d]	1.21[e]	1.35[e]	1.35[e]	1.42	1.35	.08
Phase 1(WK1-2)	1.35[d]	1.20[e]	1.16[e]	1.20[e]	1.27[g]	1.18[h]	.03
WK 3	1.91[d]	1.83[de]	1.65[e]	1.69[e]	1.86[g]	1.67[h]	.06

Table 4. (Continued).

Item	Age x treatment subclass means				Treatment main effect means		SE
	Control		Turbozyme-160		Control	Turbozyme-160	
	Old	Young	Old	Young			
WK 4	1.93	1.71	1.79	1.64	1.82[g]	1.71[h]	.10
Phase 2(WK3-4)	1.92[d]	1.77[de]	1.72[e]	1.66[e]	1.84[g]	1.69[h]	.06
WK 5[k]	1.70[d]	1.11[f]	1.44[e]	1.45[e]	1.41	1.45	.07
WK 6	2.50	2.93	2.43	2.41	2.76	2.42	.22
Phase 3(WK5-6)[k]	2.15	2.02	1.94	1.93	2.08	1.93	.10
Pig weight, lb							
Initial	14.50	14.12	14.48	14.15	14.32	14.30	
WK 1	19.82[b]	18.06[c]	19.65[b]	18.35[c]	18.94	19.01	.24
WK 2	24.84[d]	23.54[e]	25.78[d]	23.47[e]	24.18	24.64	.35
WK 3	29.94[de]	27.43[f]	31.92[d]	28.45[ef]	28.69[i]	30.18[j]	.68
WK 4	36.32[d]	34.12[d]	39.45[e]	36.08[d]	35.22[g]	37.77[h]	.92
WK 5[k]	45.45[d]	44.92[d]	49.76[e]	44.44[d]	45.19[g]	47.10[h]	.64
WK 6[l]	54.56[d]	52.69[d]	58.56[e]	52.51[d]	53.64	55.55	1.14

[a] Least squares means.
[b,c] Subclass means in the same row with different superscripts differ ($P < .01$).
[d,e,f] Subclass means in the same row with different superscripts differ ($P < .05$).
[g,h] Main effect means in the same row with different superscripts differ ($P < .05$).
[i,j] Main effect means in the same row with different superscripts differ ($P < .1$).
[k] Treatment x age interactions ($P < .05$).
[l] Treatment x age interactions ($P < .1$).

observed in the initial study. Pigs fed Turbozyme 160 consistently grew faster and were more efficient than pigs fed the control diet. The response to feeding Turbozyme was also greater in older pigs than in younger pigs. Therefore, both the subclass means and main effect means are presented.

During the first two weeks postweaning (prestarter phase), Turbozyme 160 improved overall gain by 6% ($P<.1$) and feed efficiency by 7% ($P<.05$). The greatest magnitude of improvement during the prestarter period was observed in older pigs with older pigs fed Turbozyme 160 exhibiting a 11.7% improvement in gain ($P<.05$) and a 14% improvement ($P<.05$) in efficiency during phase 1, whereas, little change in performance was observed in younger pigs. This resulted in an age by treatment interaction for gain ($P<.05$) and feed efficiency ($P<.05$) during week 2 and for gain during the overall phase 1 period (wk 1 and 2, $P<.05$).

The magnitude of response to Turbozyme 160 was greatest during the first two weeks of the starter I period (Phase 2; wks 3 and 4) when pigs were switched to a less complex diet. During week 3, pigs fed Turbozyme 160 grew 24% faster ($P<.1$) and were 10% more efficient ($P<.05$) than pigs fed the control diet. A similar response was observed during week 4. The overall response for the phase 2 period (wks 3 and 4) was a 19% increase in gain ($P<.05$) and an 8.1% improvement ($P<.05$) in feed efficiency. This magnitude of response in week 3 is consistent with the observations in the initial study where pigs fed Turbozyme 160 during week 3 grew 25% faster and were 19.6% more efficient than pigs fed the control diet. It should be noted that both age groups of pigs responded to Turbozyme 160 during the phase 2 period and no age x treatment interaction was observed. In fact, gain was improved by 20% in young pigs and 19% in older pigs fed Turbozyme 160 during the overall phase 2 period (wks 3 and 4). Improvement in feed efficiency was also observed in both age groups. During weeks 5 and 6 (Phase 3), performance of pigs fed Turbozyme 160 was similar to that observed in pigs fed the control diet.

Average daily feed intake was either not affected by the inclusion of Turbozyme 160 in the diet or feed intake was reduced. This suggests that the improved gain occurred as a result of improved efficiency at similar intakes and in cases where reduced intakes occurred, gain was similar.

The consistent improvement in daily gain in pigs fed Turbozyme 160 during phase 1 and phase 2 resulted in an increase in pig weight at the completion of phase 2 (week 4) of 2.55 lb. ($P<.05$) when compared to pigs fed the control diet. This study confirms results of the initial trial with Turbozyme 160.