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EFFECTS OF DIET PROCESSING METHOD ON GROWTH PERFORMANCE OF SEGREGATED EARLY-WEANED PIGS[1]

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Summary

A 28-d growth trial was conducted to evaluate the effects of different diet processing methods on growth performance of segregated early-weaned pigs. From d 0 to 14, pigs were fed diets processed by one of four different methods: meal, universal pellet cooker (UPC), expanded, or pelleted. Pigs fed pelleted or UPC diets had improved ADG and F/G, and pigs fed meal diets had the poorest ADG and F/G. From d 14 to 28, pigs were fed one of six diets consisting of complex meal and expanded diets and two (least cost and complex) UPC and pelleted diets. From d 14 to 28, pigs fed the complex pelleted diet had numerically the highest ADG and best F/G compared to pigs in the other treatments; however, ADG and F/G were not significantly different from those of pigs fed the meal diet. Complex pelleted or UPC diets improved growth performance compared to least cost diets. Thermal-processed, least-cost diets will not elicit similar or improved growth performance compared to complex diets. These data suggest that processing techniques influence growth performance more in the early nursery phases than in later phases, and that pigs fed UPC or pelleted diets have the best growth performance.

(Key Words: Weanling Pigs, Diet Processing, Growth.)

Introduction

Diet processing, such as pelleting, has been shown consistently to improve feed efficiency of pigs. Other thermal processing techniques, such as extruding or expanding, have been shown to improve growth performance in some trials; however, no benefits were observed in others. The Universal Pellet Cooker (UPC), a new diet processing technique developed by Wenger®, combines thermal processing technology with the benefits of pelleting. This technology should result in a diet form that could elicit growth performance responses similar to or exceeding those observed from pelleting.

Complex diets containing high levels of milk products or specialty protein sources have been shown to significantly improve growth performance compared to simple diets that contained no milk or specialty protein products; however, the complex diets are considerably more expensive. If further processing of simple diets could result in growth performance similar to that obtained from feeding complex diets to pigs, dietary cost could be reduced significantly. Thus, this trial was designed to compare the effects of different diet processing techniques (meal, UPC, pelleting, or expanding) on weanling pig growth performance. Secondly, we wanted to determine if simple diets processed by a standard pelleting technique or by UPC technology could elicit growth

[1]The authors thank Wenger®, Sabetha, KS, for partial funding and assistance and Eichmann Bros., St. George, KS, for the use of pigs and facilities for this experiment.

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performance similar to that of pigs fed complex diets in meal form.

Procedures

A total of 384 pigs (initially 12.0 lbs and 14 d of age) was used in a 28-d growth trial. Pigs were blocked on the basis of initial weight and randomly allotted to one of four dietary treatments with eight pigs per pen and eight (meal and expanded) or 16 (UPC and pelleted) replications (pens) per treatment. The diets were fed as meal, universal pellet cooker-conditioned pellets (UPC), standard-conditioned pellets, and expander-not pelleted forms. On d 14, pigs fed UPC or pelleted diets were used to further test the influence of diet complexity on processing technique. Pens of pigs fed these diets were allotted randomly to complex or least-cost formulations. Pigs previously fed meal or expanded diets were maintained on complex diets processed by the same method. Consequently, from d 14 to 28, there were eight replications of six treatments. Diet compositions are shown in Table 1.

Pigs were housed in an environmentally controlled nursery on a farm in northeast Kansas. Pens were 4 × 6 ft with tribar flooring, and pigs were allowed ad libitum access to feed through a five-hole self-feeder and water through a single water nipple. Weight gain and feed disappearance were determined on d 7, 14, 21, and 28 postweaning and were used to determine ADG, ADFI, and feed efficiency (F/G).

The standard-conditioned pelleted diet was steam preconditioned to 130°F with a cone pressure of 110 for the d 0 to 7 diet, 145°F and cone pressure of 110 for the d 7 to 14 diet, and 170°F for the diet fed from d 14 to 28. The standard-conditioned pellets were prepared with a 30 horsepower pellet mill (California Pellet Mill 1000 Series, Master H.D. Model). The expanded diet was steam conditioned to 140°F for the d 0 to 7 diet and 170°F thereafter. The expander cone pressure was computer monitored so that the expander energy input (net energy) was held constant at 12 kWh/t.

The data were analyzed as a randomized complete block design with pen as the experimental unit using the general linear model (GLM) procedures of SAS. An LSD test was used to test treatment means.

Results and Discussion

From d 0 to 7 (Table 2), pigs fed the meal diet had lower ($P<.05$) ADG compared to pigs fed UPC, pelleted, or expanded diets. Processing technique had no effect ($P>.05$) on ADFI. Feed to gain ratio was poorest ($P<.05$) for pigs fed the meal diet compared to all other diets.

From d 7 to 14, processing technique had no effect ($P>.05$) on ADG. Average daily feed intake was highest ($P<.05$) for pigs fed meal diets and lowest ($P<.05$) for pigs fed pelleted diets; pigs fed expanded and UPC-processed diets had similar but intermediate responses. Feed to gain ratio was best ($P<.05$) for pigs fed pelleted diets compared to all other diets. Pigs fed meal diets had poorer ($P<.05$) F/G than pigs fed UPC diets; however, F/G of pigs fed expanded diets was similar to that of pigs fed both meal and UPC diets.

From d 0 to 14, pigs fed meal diets had similar ($P>.05$) ADG compared to pigs fed expanded diets, but lower ($P<.05$) ADG than pigs fed UPC and pelleted diets. Pelleted diets elicited similar ($P>.05$) ADG compared to UPC diets, but higher ($P<.05$) ADG compared to expanded. No difference ($P>.05$) occurred in ADFI for different processing techniques. Feed to gain ratio was poorest ($P<.05$) for pigs fed meal diets compared to pigs in all other treatments. Pigs fed pelleted diets had better ($P<.05$) F/G compared to pigs fed expanded diets. Diets processed by UPC elicited similar ($P>.05$) F/G compared to pelleted and expanded diets.

From d 14 to 21 (Table 3), pigs fed meal, UPC complex, and pelleted complex diets had similar and higher ($P<.05$) ADG compared to pigs fed UPC least-cost diets, and pigs fed pelleted least-cost and expanded diets had intermediate responses. Average daily feed intake was highest ($P<.05$) for pigs

fed meal diets compared to pigs fed pelleted complex and expanded diets, and pigs fed UPC least-cost and complex and pelleted, least-cost diets had intermediate responses. Feed to gain ratio was poorest (P<.05) for pigs fed UPC least-cost diets compared to UPC complex, both pelleted diets, and expanded diets, but similar (P>.05) to F/G for pigs fed meal diets. Pigs fed pelleted complex diets had the lowest (P<.05) F/G compared to pigs fed meal or UPC least-cost diets, and all other diets resulted in intermediate responses.

From d 21 to 28, ADG was highest (P<.05) for pelleted complex diets compared to UPC least cost diets, and all other diets elicited similar and intermediate responses. Processing technique had no effect (P>.05) on ADFI and F/G.

From d 14 to 28, pigs fed pelleted complex diets had higher (P<.05) ADG compared to those fed both UPC diets, the pelleted least-cost diet, and the expanded diet. Average daily gain was lowest (P<.05) for pigs fed UPC least-cost diets compared to pigs fed meal and pelleted complex diets; those fed all other diets had intermediate responses. Average daily feed intake was highest (P<.05) for pigs fed meal diets compared to pig fed UPC and pelleted, least-cost diets and expanded diets. Feed to gain ratio was not different (P>.05) among diets.

In this trial, processing technique elicited the greatest response from d 0 to 14. Pigs fed UPC or pelleted diets had similar growth performance from d 0 to 14, but both processing techniques improved ADG and F/G compared to meal diets. From d 14 to 28, processing technique did not improve growth performance compared to pigs fed meal diets. Pigs fed complex UPC or pelleted diets had improved growth performance compared to those fed the UPC and pelleted, least-cost formulations. This suggests that increased diet processing can not replace diet complexity to support maximum growth performance of pigs.

Table 1. Diet Compositions (As-Fed Basis)

Ingredient, %	SEW Diet[a]	Transition Diet[b]	Complex II[c]	Least Cost Phase II[d]
Corn	34.59	41.59	51.49	53.89
Dried whey	25.00	20.00	10.00	-
SBM, 46.5%	12.39	21.39	28.00	37.79
Plasma protein	6.69	2.50	-	-
Fish meal	6.00	2.50	-	-
Lactose	5.00	-	-	-
Choice white grease	5.00	5.00	3.00	3.00
Blood meal	1.75	2.50	2.50	-
Monocalcium phosphate	.76	1.35	1.69	2.0
Limestone	.47	.75	1.10	1.10
Zinc oxide	.37	.37	.25	.25
Vitamin premix	.25	.25	.25	.25
Salt	.20	.20	.35	.35
L lysine-HCl	.15	.15	.15	.15
Trace mineral premix	.15	.15	.15	.15
DL-methionine	.15	.13	.10	.10
Sow pack	.05	.05	-	-
Antibiotic	1.00	1.00	1.00	1.00
Total	100	100	100	100

[a]Diets were formulated to contain 1.70% lysine, .48% methionine, .90% Ca, .80% P and were fed from d 0 to 7. [b]Diets were formulated to contain 1.55% lysine, .46% methionine, .90% Ca, .80% P and were fed from d 7 to 14. [c]Diets were formulated to contain 1.40% lysine, .43% methionine, .85% Ca, .75% P and were fed from d 14 to 21. [d]Diets were formulated to contain 1.40% lysine, .43% methionine, .85% Ca, .75% P and were fed from d 21 to 28.

Table 2. The Effects of Diet Processing on Growth Performance of Segregated Early-Weaned Pigs[a]

	Processing Technique				
Item	Meal	UPC	Pellet	Expanded	SEM
Day 0 to 7					
ADG, lb	.29[b]	.39[c]	.40[c]	.34[c]	.027
ADFI, lb	.37	.39	.40	.3[6]	.020
F/G	1.29[b]	1.00[c]	1.03[c]	1.08[c]	.055
Day 7 to 14					
ADG, lb	.81	.83	.85	.80	.023
ADFI, lb	.91[b]	.85[bc]	.81[c]	.85[bc]	.031
F/G	1.11[b]	1.02[c]	.96[d]	1.06[bc]	.026
Day 0 to 14					
ADG, lb	.55[b]	.61[cd]	.62[c]	.57[bd]	.020
ADFI, lb	.64	.62	.61	.60	.021
F/G	1.16[b]	1.01[cd]	.97[d]	1.06[c]	.022

[a]A total of 384 pigs (initially 12.0 lbs and 14 d of age), eight pigs per pen and eight (meal and expanded) or sixteen (UPC and pellet) replications per treatment.
[b,c,d]Values with in the same row lacking a common superscript differ (P<.05).

Table 3. The Effects of Diet Processing Method on Growth Performance of Segregated Early-Weaned Pigs[a]

	Processing Technique						
	Meal	UPC		Pellet		Expanded	
Item	CX[b]	LC	CX	LC	CX	CX	SEM
Day 14 to 21							
ADG, lb	.90[c]	.73[d]	.89[c]	.84[cd]	.96[c]	.83[cd]	.047
ADFI, lb	1.68[c]	1.55[cd]	1.58[cd]	1.52[cd]	1.47[d]	1.42[d]	.060
F/G	1.95[cd]	2.30[d]	1.85[ce]	1.88[ce]	1.57[ef]	1.73[cf]	.127
Day 21 to 28							
ADG, lb	1.33[cd]	1.24[d]	1.27[cd]	1.29[cd]	1.44[c]	1.26[cd]	.065
ADFI, lb	1.83	1.59	1.64	1.61	1.70	1.63	.090
F/G	1.38	1.30	1.29	1.26	1.19	1.30	.068
Day 14 to 28							
ADG, lb	1.11[ce]	.96[d]	1.07[cd]	1.06[cd]	1.20[e]	1.04[cd]	.039
ADFI, lb	1.76[eh]	1.57[cd]	1.61[defi]	1.57[dfgi]	1.59[dghi]	1.52[ci]	.062

[a]A total of 384 pigs (initially 12.0 lb and 14 d of age), eight pigs per pen and eight pens per treatment.
[b]Diet: CX = complex and LC = least cost.
[c,d,e,f,g,h,i]Values within the same row lacking a common superscript differ (P<.05).