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Effect of Percent Fines in Pelleted Diets on Growth Performance of Grow-Finish Pigs During Three Phases of Production

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Summary

Swine feed is commonly pelleted to improve F/G, feed handling characteristics, and bulk density. However, the degree of improvement in F/G of pigs depends on pellet quality or the percent fines at the feeder. The objective of this study was to determine if the response to pellet quality was dependent on the BW range of grow-finish pigs. Therefore, a total of 350 pigs (initially 80 lb; line 600 × 241, DNA) were randomly placed in 35 pens with 10 pigs per pen (5 barrows and 5 gilts per pen). All pigs were fed a common diet until the onset of the first experiment. At this time, pens of pigs were weighed to determine average pig weight per pen and split into 7 blocks based on average pen weight. Treatments were randomly assigned to pens within block. There was a total of 5 treatments with 7 replications per treatment. For Exp. 1, 2, and 3, pigs were fed treatments for 20 days from 96 to 150 lb, 21 days from 179 to 234 lb, and 20 days from 260 to 317 lb, respectively. Between each experiment, a 10-day washout period was utilized to mitigate any residual effects from the previous experiment and pens were rerandomized to treatment before the start of each experiment. Treatments consisted of 10% fines (screened pellets), pellets with increasing fines inclusions (45, 65, and 85% fines), and mashed feed. Experiment 1 (96 to 150 lb) treatments contained 90.4, 67.6, 46.4, and 12.5% fines at the feeder. There was no evidence of differences in ADG or ADFI in pigs fed the mash diet compared to those fed any of the pelleted treatments. However, pigs fed pellets with 12.5% fines had improved ($P < 0.05$) F/G compared to those fed mash diets. Pig ADFI and total feed cost increased (linear, $P > 0.006$) in those fed pelleted diets with an increasing percentage of fines. Pigs fed pelleted diets with increasing percentage of fines (linear, $P = 0.002$) had poorer F/G. Experiment 2 (179 to 235 lb) treatments consisted of 86.0, 60.5, 43.6, and 15.5% fines at the feeder. There was no evidence of differences in ADG. Pigs fed 86.0% fines had a tendency for increased ($P < 0.1$) ADFI and poorer F/G when compared to the mash diet. Therefore, total feed cost increased ($P < 0.05$) for pigs fed pellets with 86.0% fines when compared to pigs fed the mash diet. However, pigs fed pellets with 15.5% fines had improved ($P < 0.05$) F/G compared to those fed mash diets. For pigs fed pelleted diets, increasing percentage of fines increased (linear, $P = 0.016$) ADFI which resulted in poorer (linear, $P < 0.02$) F/G, total feed cost, and income over feed cost (IOFC). Experiment 3 (260 to 317 lb) pelleted diets contained 83.6, 65.1, 41.8, and 9.6% fines

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at the feeder. There was no evidence of differences in ADG or ADFI for pigs fed pellets with 65.1, 41.8, or 9.6% fines compared to those fed the mash diet. Pigs fed 83.6% fines had increased ($P < 0.05$) total feed cost per pig and a tendency for increased ($P < 0.1$) ADFI when compared to pigs fed the mash diet. Pig F/G improved ($P < 0.05$) when fed 9.6 and 41.8% fines compared to those fed mash diets. Pigs fed 65.1% fines had a tendency for improved ($P < 0.1$) F/G when compared to pigs fed the mash diet. Income over feed cost improved ($P < 0.05$) in pigs fed pellets with 9.6% fines when compared to those fed the mash diet. Pig F/G became poorer (linear, $P = 0.0056$) as percent fines increased in the pelleted diets. Pelleted diets with fines increasing from 9.6 to 83.6% tended to increase (linear, $P = 0.0874$) total feed cost. In conclusion, feeding pigs 12.5, 15.5, and 9.6% fines in Exp. 1, 2, and 3 improved F/G by 4.1, 4.5, and 6.7%, respectively, compared to pigs fed mashed diets. Increasing the percent fines from 12.5 to 90.4%, 15.5 to 86.0%, and 9.6 to 83.6% reduced F/G of pigs by 5.9, 8.6, and 6.4% for Exp. 1, 2, and 3, respectively.

Introduction

The pelleting of feed provides many benefits from improved palatability and flowability, to decreased feed wastage, reduced ingredient segregation, and the destruction of pathogens. While pelleting feed comes at an additional cost, the benefits can offset these costs through improved animal performance. These improvements are largely attributed to improvements in F/G due to a reduction in feed wastage. However, the degree of these improvements in F/G will be determined by the percentage of fines at the feeder.

Pelleting properties of mash feed can be influenced by a range of variables, some better understood than others. However, it is typically accepted that improving pellet quality leads to an increase in pelleting cost or reduction in production rate. Depending on the production schedule, feed mills may not be able to accommodate the appropriate pelleting parameters to optimize pellet quality. Therefore, it is important to understand the feeding behavior of pigs throughout the grow-finish cycle to determine if pellet quality may be more important at different stages of production. When pigs are placed in pens during the grow-finish phases, the useable square footage per pig is typically the greatest. As pigs grow within the pens, competition for useable living and feeding space increases. Therefore, it is important to consider opportunities to influence feeding behavior as competition at the feeder increases. Feed form (mash or pelleted diets) is one factor to consider; however, it is unclear if the response to pelleted diets and percentage of fines at the feeder depends on the phase of production throughout the grow-finish period. Therefore, the objective of this study was to determine if the response to pellet quality was dependent on the BW range of grow-finish pigs.

Materials and Methods

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. The study was conducted at the Kansas State University Swine Teaching and Research Center (Manhattan, KS). Pigs were housed in 8 ft × 10 ft pens with a two-hole dry self-feeder and one nipple pan waterer allowing *ad libitum* access to feed and water.

Pigs (initially 80 lb; line 600 × 241, DNA) were randomly placed in 35 pens with 10 pigs per pen (5 barrows and 5 gilts per pen). All pigs were fed a common diet until the onset of the first experiment. At this time, pens were weighed to determine average pig weight per pen, and split into 7 blocks based on average pen weight. Treatments were then randomly assigned to pens within weight block. There was a total of 5 treatments with 7 replications per treatment.

Diets were formulated to meet or exceed the NRC recommended requirements for pigs from 96 to 150 lb, 179 to 234 lb, and 260 to 317 lb for Exp. 1, 2, and 3, respectively (Table 1). Pigs were fed for 20, 21, and 20 days for experiments 1, 2, and 3, respectively. Between each experiment, a common diet was fed for 10 days. For each weight range, 1 experimental diet was ordered and manufactured by Hubbard Feeds' mill in Beloit, KS. Target corn particle size was 600-µm. Diets were then transported to the Kansas State University O.H. Kruse Feed Technology Innovation Center for further processing. Pelleted treatments were steam conditioned (twin staff pre-conditioner, Model 150, Wenger, Sabetha, KS) to a target conditioning temperature of 185°F for 30 seconds and subsequently pelleted using a 30-horsepower pellet mill (1012-2 HD Master Model, California Pellet Mill, Crawfordsville, IN) to target a high-quality pellet. Actual pelleting parameters were achieved for Exp. 1 using a 3⁄16 × 1 ¼ in. die (L:D 6.67) with a conditioning temperature of 180.8°F, hot pellet temperature of 192.4°F, and a production rate of 33.7 lb per min. The same pellet die and mill were used in Exp. 2 with parameters of 170.4°F for conditioning temperature, 185.4°F hot pellet temperature, and a production rate of 34.4 lb per min. Initially, diets for Exp. 3 were pelleted using the same pelleting parameters as Exp. 1 and 2. However, the resulting pellet quality for experiment 3 was poor while using the 3⁄16 × 1 ¼ inch die (L:D 6.67) and would not achieve the target percent fines at the feeder. Therefore, a 3⁄16 × 2 ¼ inch die (L:D 12) was used to improve pellet quality. Experiment 3 pellet production parameters were a conditioning temperature of 152.6°F, hot pellet temperature of 177.8°F, and a production rate of 25.8 lb per minute. For all experiments, after cooling (OP-FLO Air Cooler, Bliss Industries, Ponca City, OK) pellets were passed through a No. 5 screen on a Gentle Roll (EBM Manufacturing, Inc., Norfolk, NE) to separate fines from pellets. For all experiments, pellet fines were created by passing pellets through a Colorado Mill Equipment single pair crumble roll (Eco Roll 7, Cañon City, CO) twice to create fines similar in particle size to those created during the pelleting process.

Screened pellets, pellet fines, and mash feed were blended, distributed, and documented by the automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN) at the Kansas State University Swine Teaching and Research Center. The treatments were blended at ratios of 0, 25, 50, and 75% fines to pellets, which resulted in approximately 12, 45, 65, and 85% fines at the feeder. Each treatment had 3 feed samples collected using a grain probe at the feeder to determine the approximate fines percentage. At the conclusion of each phase, representative samples were sent to Ward Laboratories, Inc. (Kearney, NE) for proximate analysis of DM (dry matter), CP (crude protein), crude fiber, crude fat, and ash. Pigs were weighed prior to allotment (considered day 0) with final experiment weights collected on day 20, 21, and 20 for experiments 1, 2, and 3, respectively. Pigs were weighed weekly between day 0 and 20 or 21 to monitor growth performances. Data from days 0 and 20 or 21 were used to calculate ADG, ADFI, and F/G.

For economic evaluation, diet cost, total feed cost, cost per total pound of gain, revenue, and income over feed cost were calculated. Ingredient costs used were $261.43 per ton for corn, soybean meal at $413.40 per ton, soy oil at $1,717.00 per ton, limestone at $40.00 per ton, dicalcium phosphate at $1,070.00 per ton, salt at $306.00 per ton, L-lysine at $2,720.00 per ton, DL-methionine at $3,900.00 per ton, L-threonine at $2,840.00 per ton, L-valine at $6,000.00 per ton, choline chloride at $1,786.00 per ton, trace mineral premix at $1,308.00 per ton, and vitamin premix at $1,758.00 per ton. The cost for pelleting was fixed at $6.00 per ton. Diet costs were calculated by multiplying diet cost per pound by 2,000 pounds. Total feed costs were calculated by multiplying overall feed intake by diet cost per pound. Cost per pound of gain was calculated by multiplying F/G by diet cost per pound, and total revenue was calculated by multiplying the total pounds gained by the assumed price per pound of live weight. Price per pound of live weight was calculated with a carcass price of $122.45 per CWT (National Daily Hog and Pork Summary on June 22, 2022) and an assumed dressing percentage of 75%. Income over feed cost was calculated by subtracting the cost of total gain from revenue.

Statistical Analysis

Data were analyzed as a randomized complete block design using the PROC-GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, NC). The experimental unit was pen with weight block as the blocking factor. A Dunnett's test was performed for all phases to compare the pelleted treatments to the mash control. Single degree-of-freedom contrasts were constructed to test the linear and quadratic effects of increasing pellet fines. Contrasts for unequally spaced treatments were determined using the actual percentage fines at the feeder values in PROC ILM. Results were considered significant if $P \leq 0.05$ and a trend if $P \leq 0.10$.

Results and Discussion

Diets were within analytical variation according to AAFCO standards for moisture, DM (dry matter), CP (crude protein), crude fiber, crude fat, and ash (Table 2). The proximate analyses were similar across all treatments within each experiment.

Experiment 1 and 2 diets were pelleted at an approximate production rate of 33.7 and 34.4 lb per min with conditioning temperatures of 180.8 and 170.4°F, respectively (Table 3). These temperatures yielded an approximate hot pellet temperature of 192.4 and 185.4°F for grower diets 1 and 2 while using a 3⁄16 × 1 ¼ die (L:D 6.67). For Exp. 3, the pellet mill die was switched to a 3⁄16 × 2 ¼ inch die (L:D 12) to achieve higher quality pellets and meet the percentage of fines goal at the feeder. This led to a decrease in pellet mill production rate to approximately 25.8 lb per min with a conditioning temperature of 152.6 and hot pellet temperature of 177.8°F.

For Exp. 1, diets (96 to 150 lb pigs) resulted in 90.4, 67.6, 46.4, and 12.5% fines at the feeder. There was no evidence of difference in ADG or ADFI between pigs fed the mash diet and those fed any of the pelleted treatments. Pigs fed pelleted diets with increasing percentage of fines had increased (linear, $P = 0.006$) ADFI. Pigs fed pellets with 12.5% fines had improved ($P < 0.05$) F/G compared to those fed the mash diets. All other pelleted diets had no evidence of difference in F/G when compared to pigs fed the mash diet. Pigs fed pelleted diets with increasing percentage fines had poorer (linear, $P = 0.002$) F/G. There was no evidence of difference in total feed cost, revenue or IOFC between pigs fed the pelleted diets when compared to pigs fed the mash diet for the 20-d period. Total feed cost increased (linear, $P < 0.006$) as percentage of fines increased at the feeder.

The Exp. 2 grower diet (179 to 235 lb) resulted in 86.0, 60.5, 43.6, and 15.5% fines at the feeder. There was no evidence of difference in ADG for pigs fed mash, 15.5% fines, or diets with 43 to 86% fines. There was no evidence of difference in ADFI between pigs fed the mash diet and those fed 60.5, 43.6, and 15.5% fines. Pigs fed 86.0% fines had a tendency for increased ($P < 0.1$) ADFI when compared to pigs fed the mash diets. Pig ADFI increased when fed pellets with increasing percentage of fines (linear, $P = 0.016$) from 15.5 to 86.0% fines. Pigs fed pellets with 15.5% fines had improved ($P < 0.05$) F/G compared to the pigs fed the mash diets. Pigs fed 86.0% fines had a tendency for poorer ($P < 0.1$) F/G when compared to pigs fed the mash diet. Pigs fed the pellet diet with increasing percentage of fines had poorer (linear, $P = 0.0001$) F/G. Total feed cost for pigs fed 86.0% fines increased ($P < 0.05$) compared to those fed the mash diet. There was no evidence of a difference for revenue or IOFC for pigs fed pelleted diets when compared to those fed the mashed diet. Total feed cost increased (linear, $P = 0.016$) and IOFC decreased (linear, $P = 0.006$) as percent fines at the feeder increased.

For Exp. 3, diets (260 to 317 lb) resulted in 83.6, 65.1, 41.8, and 9.6% fines at the feeder. There was no evidence of difference in ADG for pigs fed mash, 9.6% fines, or 41 to 84% fines. There was no evidence of difference in ADFI between pigs fed the mash diet and those fed 65.1, 41.8, and 9.6% fines. Pigs fed the 83.6% fines had a tendency for increased ($P < 0.1$) ADFI compared to those fed the mash diets. Pigs fed pellets with 9.6 and 41.8% fines had improved ($P < 0.05$) F/G when compared to those fed the mash diet. Pigs fed pellets with 65.1% fines had a tendency for improved ($P < 0.1$) F/G when compared to those fed the mash diet. Pig F/G became poorer (linear, $P = 0.0056$) as percent fines increased in the pelleted diets. Pigs fed 83.6% fines had increased ($P < 0.05$) total feed cost when compared to pigs fed mash diets. There was no evidence of difference in revenue for pigs fed pelleted diets when compared to pigs fed the mash diet. Pigs fed pellets with 9.6% fines had increased ($P < 0.05$) IOFC when compared to those fed the mash diet. Total feed costs tended to increase (linear, $P = 0.0874$) as percent fines increased from 9.6 to 83.6% in pigs fed pelleted diets.

In conclusion, pelleting the diets improved F/G of finishing pigs. However, the benefits of pelleting the feed diminished in a linear fashion as the percentage of fines increased. For the 96 to 150 lb, 179 to 235 lb, and 260 to 317 lb, pigs fed pellets with the 12.5, 15.5, and 9.6% fines had 4.1, 4.5, and 6.7% improvement in F/G compared to those fed the mash control. Increasing the percentage of fines from 12.5 to 90.4%, 15.5 to 86.0%, and 9.6 to 83.6% reduced F/G of pigs by 5.9, 8.6, and 6.4% for Exp. 1, 2, and 3, respectively. Therefore, an improvement in F/G resulting from pelleting was only observed in the 12.5 and 15.5% fines treatments for 96 to 150 lb and 179 to 235 lb pigs, and the 9.6% fines and 41.8% fines treatments for 260 to 317 lb pigs.

Table 1. Ingredient composition of experimental diets, as-fed basis[1]

Ingredient, %	Experiment 1	Experiment 2	Experiment 3
Corn	73.54	81.08	81.65
Soybean meal, dehull, sol extr[2]	21.23	14.15	13.8
Corn oil	1.5	1.5	1.5
Calcium carbonate	0.75	0.65	0.6
Calcium phosphate (monocalcium)	0.5	0.28	0.1
Sodium chloride	0.5	0.55	0.5
L-Lys-HCl	0.45	0.39	0.38
DL-Met	0.11	0.06	0.09
L-Thr	0.14	0.12	0.16
L-Trp	0.04	0.04	0.04
L-Val	0.09	0.05	0.04
Vitamin premix with phytase[3]	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15
Ameri-Bond 2X[4]	0.75	0.75	0.75
TOTAL	100	100	100
Diet cost, $/ton	329.28	313.09	312.93
Calculated analysis			
Standardized ileal digestible (SID) AA %			
Lysine	1.05	0.83	0.81
Ile:Lys	55	55	56
Leu:Lys	123	136	138
Met:Lys	33	31	36
Met and Cys:Lys	55	56	62
Thr:Lys	60	62	68
Trp:Lys	19.2	19.1	19.3
Val:Lys	69	69	69
His:Lys	37	39	40
Total lysine, %	1.17	0.93	0.91
ME, kcal/lb	1,525	1,532	1,536
NE, kcal/lb	1,157	1,178	1,163
SID Lys:NE, g/Mcal	4.12	3.2	3.11
CP, %	16.9	14	13.9
Ca, %	0.54	0.37	0.38
P, %	0.45	0.37	0.33
Available P, %	0.3	0.25	0.21

[1]Experimental diets were mixed at Hubbard Feeds (Beloit, KS) and shipped to the Kansas State University O.H. Kruse Feed Technology and Innovation Center for pelleting. All treatments within experiments were fed the same formulation diet with respects to weight ranges (Exp. 1 from 96 to 150, Exp. 2 from 179 to 234, Exp. 3 from 260 to 317 lb).

[2]Dehulled soybean meal was cracked, heated, flaked, then mixed with hexane to separate oil from the product.

[3]Vitamin premix contains a minimum: 75,000 IU/lb, vitamin D_3 300,000 IU/lb, vitamin E 8,000 IU/lb, vitamin B_{12} 6.0 mg/lb, menadione 600 mg/lb, riboflavin 1,500 mg/lb, d-pantothenic acid 5,000 mg/lb, niacin 9,000 mg/lb, Ronozyme HiPhos GT 20000, 556 FYT/lb.

[4]Borregaard, Sarpsborg, Norway.

Table 2. Chemical analysis of experimental diets (as-fed basis)[1]

	Chemical analysis				
Treatment	**MC[2]**	**83–91[3]**	**60–68[3]**	**41–47[3]**	**9–13[3]**
Experiment 1					
Moisture	11.48	12.17	11.66	11.91	11.47
Dry matter	88.52	87.83	88.34	88.09	88.53
Crude protein	16.4	16.1	16.7	16.9	16.5
Crude fiber	2.9	2.7	2.7	2.5	2.8
Crude fat	3.4	3.4	3.5	3.1	3.4
Ash	3.76	3.61	3.85	3.86	3.75
Experiment 2					
Moisture	10.68	11.01	11.26	11.5	11.7
Dry matter	89.32	88.99	88.74	88.5	88.3
Crude protein	13.4	12.7	12.5	13	12.7
Crude fiber	0.3	0.7	0.5	0.6	0.6
Crude fat	3.9	3.5	3.6	3.7	3.8
Ash	2.99	3.09	2.98	3.04	2.86
Experiment 3					
Moisture	12.79	12.86	13.45	12.77	12.96
Dry matter	87.21	87.14	86.55	87.23	87.04
Crude protein	13.7	13.2	13.1	13.2	13.3
Crude fiber	2.2	2.5	2.3	2.3	2.2
Crude fat	5.3	5.2	5.2	5	5
Ash	2.98	2.89	2.88	2.95	2.92

[1]Treatment samples were analyzed by Ward Laboratories, INC, in Kearney, KE.
[2]Mash control diet.
[3]Range of percent fines collected at the feeder.

Table 3. Production records for pelleting experimental diets[1]

Screened pellets	**Experiment 1[2]**	**Experiment 2[2]**	**Experiment 3[3]**
Production rate, lb/min	33.7	34.4	25.8
Conditioning temp., °F	180.8	170.4	152.6
Hot pellet temp., °F	192.4	185.4	177.8

[1]Pellets were manufactured by a 30-horsepower pellet mill (1012-2 HD Master Model, California Pellet Mill, Crawfordsville, IN).
[2]Phases 1 and 2 were pelleted with a 3⁄16 × 1 ¼ in. die to accomplish a L/D ratio of 6.67.
[3]Phase 3 was pelleted with 3⁄16 × 2 ¼ in. die for a L:D of 6.67.

Table 4. Effects of increasing pellet fines on growth performance of finishing pigs[1]

		Fines, %					Probability, *P* <[3]	
Diet form	**MC[4]**	**84–91[4]**	**60–68[4]**	**41–47[4]**	**9–13[4]**	**SEM**	**Linear**	**Quadratic**
Experiment 1								
Percent fines[2]	---	90.4	67.6	46.4	12.5			
BW, lb								
d 0	96.1	96.1	96.2	96.0	96.1	1.35	0.829	0.970
d 20	149.4	150.3	149.3	150.4	149.3	1.71	0.627	0.895
d 0 to 20								
ADG, lb	2.67	2.71	2.65	2.70	2.66	0.047	0.641	0.919
ADFI, lb	5.23	5.40	5.12	5.20	5.00	0.085	0.006	0.558
F/G	1.96	1.99	1.93	1.93	1.88*	0.022	0.002	0.544
Economics, $								
Total feed cost/pig[6]	17.23	18.09	17.16	17.43	16.77	0.283	0.006	0.557
Revenue/pig[7]	48.95	49.72	48.70	49.60	48.86	0.864	0.641	0.919
IOFC[8]	31.72	31.63	31.54	32.18	32.09	0.668	0.524	0.906
Experiment 2								
Percent fines[2]	---	86.0	60.5	43.6	15.5			
BW, lb								
d 0	179.9	179.8	179.7	179.8	179.7	1.85	0.942	0.978
d 20	232.3	233.8	233.2	232.5	234.7	2.48	0.682	0.279
d 0 to 20								
ADG, lb	2.49	2.57	2.54	2.51	2.62	0.053	0.608	0.199
ADFI, lb	6.70	7.19†	7.03	6.64	6.72	0.158	0.016	0.388
F/G	2.69	2.79†	2.76	2.65	2.57*	0.031	<0.001	0.505
Economics, $								
Total feed cost/pig[6]	22.04	24.09*	23.56	22.26	22.51	0.527	0.016	0.387
Revenue/pig[7]	48.11	49.61	49.07	48.37	50.49	1.013	0.608	0.199
IOFC[8]	26.07	25.52	25.51	26.11	27.99	0.616	0.006	0.158

continued

Table 4. Effects of increasing pellet fines on growth performance of finishing pigs[1]

		Fines, %					Probability, *P* <[3]	
Diet form	**MC[4]**	**84–91[4]**	**60–68[4]**	**41–47[4]**	**9–13[4]**	**SEM**	**Linear**	**Quadratic**
Experiment 3								
Percent fines[2]	---	83.6	65.1	41.8	9.6			
BW, lb								
d 0	261.1	260.9	261.0	261.0	261.1	2.85	0.876	0.975
d 20	311.0	317.1[†]	314.8	315.1	316.0	3.40	0.802	0.370
d 0 to 20								
ADG, lb	2.51	2.73	2.69	2.70	2.75	0.075	0.800	0.626
ADFI, lb	7.52	8.12[†]	7.68	7.66	7.66	0.184	0.120	0.182
F/G	3.00	2.98	2.86[†]	2.84*	2.80*	0.040	0.006	0.246
Economics, $								
Total feed cost/pig[6]	23.55	25.91*	24.48	24.42	24.43	0.585	0.087	0.203
Revenue/pig[7]	46.14	50.13	49.41	49.68	50.43	1.382	0.846	0.596
IOFC[8]	22.59	24.22	24.93	25.26	26.00*	0.925	0.178	0.987

[1]A 3-phased experiment was conducted on finishing age pigs, phase 1 (approximately 96 pounds) lasting 20 days, phase 2 (approximately 180 pounds) lasting 21 days, phase 3 (approximately 261 pounds) lasting 20 days.
[2]Feed samples were collected at the feeder and sifted using a #5 sieve. The weights (grams) were then divided by the total sample weights to determine the percentage of pellets and fines.
[3]Dunnet's test in SAS (SAS Institute, Inc., Cary, NC) was used to compare pelleted treatments to mash diets and linear and quadratic contrasts were created for unequally spaced treatments with fines percentages at the feeder using the PROC-ILM function for each experiment.
[4]Treatments were composed of the mash control (MC) and the range of fines determined at the feeder across all 3 experiments.
[5]Feed cost per pound of gain per pig.
[6]Total feed cost/pig = total feed cost divided by total gain per pig.
[7]Total revenue/pig = total gain per pig × price per pound of gain.
[8]Income over feed cost = total revenue/pig - total feed cost/pig.
*Denotes a significant difference of $P < 0.05$ when treatments are compared to MC.
[†]Denotes a trend $P < 0.1$ when treatments are compared to MC.