EFFECTS OF FEEDER DESIGN ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING PIGS[1]

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Summary

Two experiments were conducted to compare the effects of feeder design (conventional dry vs. wet-dry feeder) on finishing pig performance. In Exp. 1, 1,186 pigs (PIC 337 × 1050) were used in a 69-d experiment. Pigs were weighed (avg. 70.8 lb) and allotted to 1 of 2 feeder types in a completely randomized design. There were 22 pens per feeder type with 26 to 28 pigs per pen. All pigs were fed the same dietary sequence in 4 phases (d 0 to 10, 10 to 28, 28 to 50, and 50 to 69). Overall (d 0 to 69), pigs using the wet-dry feeder had greater ($P < 0.001$) ADG, ADFI, and final weight compared with pigs using the conventional dry feeder. In Exp. 2, 1,236 pigs (PIC 337 × 1050) were used in a 104-d experiment. Pigs were weighed (avg. 63.2 lb) and allotted to 1 of the 2 feeder types in a completely randomized design. There were 23 pens per feeder type with 25 to 28 pigs per pen. All pigs were fed the same feed budget (diet 1 = 59 lb/pig, diet 2 = 88 lb/pig, diet 3 = 121 lb/pig, and diet 4 = 130 lb/pig). On d 84, the 3 largest pigs per pen were marketed. Afterward, all remaining pigs were fed a fifth dietary phase containing Paylean until d 104. Carcass measurements were obtained after pigs were transported to a commercial abattoir on d 104. Overall (d 0 to 104), pigs using the wet-dry feeder had greater ($P < 0.001$) ADG, ADFI, and final weight compared with those using the conventional dry feeder. However, pigs using the wet-dry feeder had poorer F/G and increased feed cost per pig ($P < 0.002$) than pigs using the conventional dry feeder. Carcass yield, fat free lean index, premium per pig, and live value/cwt were increased, whereas average back fat depth was decreased ($P < 0.03$) for pigs using the conventional dry feeder compared with pigs using the wet-dry feeder. The combination of these effects resulted in a numerically lower net income per pig for pigs fed with the wet-dry feeder. These experiments demonstrate that growth performance of finishing pigs was improved with a wet-dry feeder compared with a conventional dry feeder. However, because carcasses of pigs fed with a wet-dry feeder yielded less and were fatter, more research is required to understand the dynamics among feeder design, feed intake, and economic return.

Key words: feeders, pig

Introduction

Because finishing feed costs represent roughly 50% of the cost of production, swine

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producers are continually evaluating technologies that may improve the growth performance of finishing pigs and reduce feed cost per pound of gain. Additionally, increasing costs associated with waste handling provide an incentive to reduce water usage (slurry volume). Previous research at Kansas State University (KSU) has demonstrated that using a wet-dry feeder may improve the growth rate and feed efficiency and reduce water disappearance of finishing pigs. These previous studies evaluated the differences between a wet-dry feeder and a conventional dry feeder with water provided separately via a nipple waterer. However, studies comparing the effects of various feeder designs on the growth performance of finishing pigs in a modern, commercial finishing facility are scarce. Many barns are now equipped with feeders that present dry feed to the pigs with some sort of cup or trough located in close (horizontal) proximity as a water source. With a wet-dry feeder, the water is provided by a nipple in the feed pan. Therefore, the objective of this research was to determine whether use of a wet-dry feeder would improve performance and profitability of finishing pigs housed in commercial conditions.

Procedures

Procedures used in the experiment were approved by the KSU Institutional Animal Care and Use Committee. The experiment was conducted in a commercial research finishing facility in southwest Minnesota. The facility was double curtain sided with pit fans for minimum ventilation and completely slatted flooring over a deep pit for manure storage. Individual pens were 10 × 18 ft. Half of the pens were equipped with a single 60-in.-wide, 5-hole conventional dry feeder (STACO, Inc., Schaefferstown, PA) and 1 cup waterer in each pen (Figure 1). The remaining pens were each equipped with a double-sided wet-dry feeder (Crystal Springs, GroMaster, Inc., Omaha, NE) with a 15-in. feeder opening on both sides that provided access to feed and water (Figure 2).

Although the pens equipped with a wet-dry feeder contained a cup waterer (Figure 2), waterers were shut off during the experiments. Therefore, the only source of water for pigs in these pens was through the wet-dry feeder. In addition, water was delivered to all of the pens of each feeder type independently, and each of the 2 water lines was equipped with a single water meter to monitor total daily water disappearance for each feeder type.

In Exp. 1, 1,186 pigs were weighed and allotted to the 2 feeder types. There were 22 pens per treatment. Each pen contained 26 to 28 pigs with the average number of gilts and barrows per pen and initial weight (70.8 lb) balanced across treatments. All pigs were fed the same sequence of diets with 4 dietary phases (d 0 to 10, 10 to 28, 28 to 50, and 50 to 69; Table 1). On d 14, 28, 42, 56, and 69, pigs were weighed and feed disappearance was measured to determine ADG, ADFI, and F/G. This experiment was conducted from December 20, 2007, to February 27, 2008.

In Exp. 2, 1,236 pigs were weighed and allotted to the 2 feeder types. There were 23 pens per treatment. Each pen contained 25 to 28 pigs with the average number of gilts and barrows per pen and initial weight (63.2 lb) balanced across treatments. Unlike Exp. 1, all pigs were fed by using a feed budget (diet 1 = 59 lb/pig, diet 2 = 88 lb/pig, diet 3 = 121 lb/pig, and diet 4 = 130 lb/pig; Table 2). On d 84, the 3 largest pigs per pen were marketed. Afterward, all the remaining pigs were fed a fifth diet containing Paylean (Elanco Animal Health, Indianapolis IN) until d 104. On d 0, 14, 28, 42, 56, 70, 84, and 104, pigs were weighed and feed disappearance was measured to determine ADG, ADFI, and F/G. After transportation to a commercial abattoir on d 104, carcass measurements were obtained from 494 of the remaining pigs (11 pens per feeder type). Total feed cost per pig and total revenue per pig were determined, and an initial pig cost ($50/pig) and facility and labor cost ($10.40/pig) were also used to determine net income per pig. This experiment was conducted from April 8, 2008, to July 21, 2008.

Data were analyzed as a completely randomized design by using the PROC MIXED procedure of SAS with pen as the experimental unit.

Results

In Exp. 1, overall (d 0 to 69) ADG, ADFI, and final weight were greater ($P < 0.001$) for pigs fed using a wet-dry feeder than for those fed using the conventional dry feeder (Table 3). Feed efficiency was not different between pigs fed with either feeder type. Water usage per pig averaged 1.38 and 1.44 gal/d for pigs fed using the conventional dry feeder and wet-dry feeder, respectively.

In Exp. 2, overall (d 0 to 104) ADG, ADFI, and final weight were increased ($P <$ 0.001), but F/G was poorer ($P < 0.002$) for pigs fed using the wet-dry feeders (Table 4). Water usage per pig averaged 1.68 and 1.48 gal/d for pigs fed using the conventional dry feeder and wet-dry feeder, respectively.

At the conclusion of the study, pigs were marketed and carcass data were obtained from 494 of the pigs (11 pens per feeder type, Table 5). Hot carcass weight tended ($P < 0.06$) to be greater for pigs fed using the wet-dry feeders; however, carcass yield, fat free lean index, premium per pig, and live value per cwt were decreased ($P < 0.03$). Average backfat depth was also greater ($P < 0.002$) for pigs fed using wet-dry feeders. The combination of these responses resulted in a similar total revenue per pig, although total revenue for pigs fed with wet-dry feeders was numerically greater than for those fed using the conventional dry feeder. Because pigs fed with wet-dry feeders grew faster, they also consumed more feed and had a greater ($P < 0.001$) feed cost per pig than those fed using the conventional dry feeder. Therefore, the net income per pig was numerically greater for pigs fed using the conventional dry feeders.

In conclusion, these experiments demonstrate that growth performance is improved when pigs are offered feed and water ad libitum via a wet-dry feeder rather than a conventional dry feeder and drinker bowl. Because carcasses of pigs fed with a wet-dry feeder yielded less and were fatter, the use of wet-dry feeders may not be justified with some carcass incentive programs. More research is required to understand the reason for the decreased yield of pigs fed with the wet-dry feeders and to further determine the effect of feeder type on economic return to different production systems.

Figure 1. Conventional dry feeder with cup waterer.

Figure 2. Wet-dry feeder.

Note that the cup waterer was shut off so the only source of water was through the feeder.

Table 1. Diet composition, Exp. 1[1]

	Dietary phase			
Ingredient, %	d 0 to 10	d 10 to 28	d 28 to 50	d 50 to 69
Corn	58.88	52.09	55.31	57.93
Soybean meal (46.5% CP)	22.25	18.95	15.92	13.20
DDGS[2]	9.00	20.00	20.00	20.00
Bakery by-product	5.00	5.00	5.00	5.00
Choice white grease	2.55	2.05	2.10	2.25
Monocalcium P (21% P)	0.25	---	---	---
Limestone	0.80	0.80	0.80	0.80
Vitamins, minerals, AA/phytase/etc.	1.27	1.11	0.87	0.82
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Standardized ileal digestible (SID) amino acids				
Lysine, %	1.11	1.05	0.95	0.86
Isoleucine:lysine ratio, %	59	63	64	66
Leucine:lysine ratio, %	138	158	168	177
Methionine:lysine ratio, %	32	31	30	31
Met & Cys:lysine ratio, %	58	60	60	64
Threonine:lysine ratio, %	62	62	64	63
Tryptophan:lysine ratio, %	16	16	16	16
Valine:lysine ratio, %	68	74	77	79
CP, %	18.9	19.7	18.5	17.4
Total lysine, %	1.24	1.20	1.09	0.99
ME, kcal/lb	1,585	1,580	1,581	1,585
SID lysine:ME ratio, g/Mcal	3.19	3.02	2.72	2.46
Ca, %	0.45	0.40	0.39	0.38
P, %	0.45	0.43	0.42	0.41
Available P, %	0.26	0.26	0.25	0.25

[1] Each dietary phase was fed to both feeder types during the periods described in the table.
[2] Dried distillers grains with solubles.

Table 2. Diet composition, Exp. 2

	Dietary Phase[1]				
Ingredient, %	1	2	3	4	5 (with Paylean)
Corn	61.60	54.56	50.05	52.76	59.61
Soybean meal (46.5% CP)	21.60	18.55	13.10	10.45	16.45
DDGS[2]	9.00	20.00	30.00	30.00	17.00
Bakery by-product	5.00	5.00	5.00	5.00	5.00
Choice white grease	0.65	---	---	---	---
Monocalcium P (21% P)	0.13	---	---	---	---
Limestone	0.80	0.85	0.85	0.85	0.80
Vitamins, minerals, AA/phytase/etc.	1.22	1.04	1.00	0.94	1.14
Total	100.00	100.00	100.00	100.00	100.00
Feed budget, lb/pig	59	88	121	130	to d 104
Calculated analysis					
Standardized ileal digestible amino (SID) acids					
Lysine, %	1.11	1.05	0.90	0.81	0.94
Isoleucine:lysine ratio, %	59	63	69	71	65
Leucine:lysine ratio, %	139	159	190	204	167
Methionine:lysine ratio, %	32	30	33	35	32
Met & Cys:lysine ratio, %	59	60	68	72	62
Threonine:lysine ratio, %	62	62	64	66	65
Tryptophan:lysine ratio, %	16	16	17	17	17
Valine:lysine ratio, %	68	74	84	87	77
CP, %	18.9	19.7	19.4	18.4	18.3
Total lysine, %	1.24	1.20	1.06	0.97	1.08
ME, kcal/lb	1,547	1,537	1,538	1,539	1,538
SID lysine:ME ratio, g/Mcal	3.25	3.10	2.66	2.39	2.77
Ca, %	0.42	0.41	0.40	0.39	0.39
P, %	0.42	0.44	0.46	0.45	0.41
Available P, %	0.23	0.26	0.31	0.30	0.24

[1] Each dietary phase was fed to pigs using both feeder types in the sequence and according to the budget outlined in the table.
[2] Dried distillers grains with solubles.

Table 3. The effects of feeder design on the growth performance of finishing pigs – Exp. 1[1]

	Feeder type			
Item	Conventional dry	Wet-dry	SE	Probability, P <
d 0 to 69				
ADG, lb	2.10	2.26	0.01	0.001
ADFI, lb	5.13	5.58	0.03	0.001
F/G	2.44	2.47	0.01	---
d 69 avg wt, lb	216.35	227.30	1.04	0.001
Water use, gal/d per pig	1.38	1.44		
Water use, gal/lb gain	0.66	0.64		

[1] A total of 1,186 pigs (PIC 337 × 1050) with 26 to 28 pigs per pen and 22 pens per treatment were used in a 69-d experiment to compare the growth performance of pigs fed from either a conventional dry feeder with a cup waterer or a wet-dry feeder.

Table 4. The effects of feeder design on the growth performance of finishing pigs – Exp. 2[1]

	Feeder type			
Item	Conventional dry	Wet-dry	SE	Probability, P <
d 0 to 104				
ADG, lb	1.90	2.01	0.01	0.001
ADFI, lb	4.96	5.40	0.03	0.001
F/G	2.62	2.68	0.01	0.002
d 104 avg wt, lb	261.35	272.80	1.52	0.001
Water use, gal/d per pig	1.68	1.48		
Water use, gal/lb gain	0.89	0.73		

[1] A total of 1,236 pigs (PIC 337 × 1050) with 25 to 28 pigs per pen and 23 pens per treatment were used in a 104-d experiment to compare the growth performance of pigs fed from either a conventional dry feeder with a cup waterer or a wet-dry feeder.

Table 5. The effects of feeder design on the carcass characteristics of finishing pigs and economic return – Exp. 2[1]

Item	Feeder type		SE	Probability, P <
	Conventional dry	Wet-dry		
Plant live wt, lb	253.7	265.9	2.34	0.002
HCW, lb	194.9	200.0	1.77	0.06
Yield, %	76.86	75.21	0.43	0.02
Avg backfat depth, in.	0.64	0.70	0.01	0.002
Loin depth, in.	2.41	2.45	0.04	---
Lean, %	57.10	55.89	0.48	0.10
Fat free lean index	50.48	49.94	0.16	0.03
Premium/pig, $	8.67	5.26	1.02	0.03
Value/cwt (live), $	56.28	54.83	0.39	0.02
Total revenue/pig, $[2]	142.78	145.80	1.70	---
Feed cost/pig, $	56.23	61.12	0.68	0.001
Feed, $/cwt gain	28.43	29.17	0.32	0.13
Net income/pig, $	26.15	24.28	1.40	0.36

[1] Carcass data from 494 pigs (11 pens/feeder-type) were obtained for the comparison of carcass data and economic evaluation.
[2] Base carcass price of $71.43/cwt as used to calculate total revenue. Facility cost of $10.40/pig and initial pig cost of $50.00/pig were used to calculate net income per pig.