The effects of feeder adjustment and trough space on growth performance of finishing pigs[1]

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ABSTRACT: Two studies were conducted to determine the effects of feeder adjustment and trough space on growth performance of finishing pigs. In Exp. 1, 234 pigs (initial BW 41.5 kg) were used in an 89-d trial. Pigs were randomly allotted to 1 of 3 treatments with 9 replications of 8 pigs/pen and 1 replicate with 6 pigs/pen. Treatments consisted of a minimum feeder gap setting of 1.27, 1.91, or 2.54 cm. Feeders were adjusted to a minimum gap setting, but the agitation plate could be moved upward to a maximum opening of 1.91, 2.54, or 3.18 cm, respectively. Feeder adjustments of 1.27, 1.91, and 2.54 cm averaged 28, 58, and 75% pan coverage, respectively. From d 0 to 58, increasing feeder gap improved (linear; $P \leq 0.04$) ADG and ADFI, but decreased (linear; $P < 0.05$) G:F. Although the response was linear for ADG, no increase occurred (quadratic; $P = 0.15$) beyond the 1.91-cm feeder gap setting. From d 58 to 89, increasing feeder gap setting tended (linear; $P = 0.08$) to worsen G:F. Overall (d 0 to 89), pigs fed with increasing feeder gap had decreased (linear; $P < 0.03$) G:F due to increased (linear; $P < 0.02$) ADFI. In Exp. 2, 288 pigs (initial BW 41.3 kg) were used in a 91-d study to evaluate the effects of feeder trough space (4.45 vs. 8.9 cm/pig) and minimum feeder gap opening of 1.27 cm (narrow) vs. 2.54 cm (wide). The treatments were arranged in a 2 × 2 factorial with 6 replications per treatment. Feeder trough space was altered by having pens of either 8 to 16 pigs per pen with all pigs provided 0.74 m^2 floor space per pig. From d 0 to 56 and 56 to 91, no adjustment × space interactions or effects of trough space were observed. From d 0 to 56, pigs with the wide feeder gap setting had decreased ($P < 0.02$) G:F compared with those that had the narrow feeder gap setting. From d 56 to 91, pigs with the wider feeder gap setting had increased ($P < 0.001$) ADFI, but consequently had decreased ($P < 0.01$) G:F. Overall (d 0 to 91), no trough space × feeder adjustment interactions were observed. However, ADG tended to increase ($P = 0.08$) as feeder trough space increased from 4.45 to 8.9 cm/pig. Pigs fed with the wide feeder gap setting had increased ($P < 0.01$) feed disappearance and decreased ($P < 0.01$) G:F compared with pigs with the narrow feeder gap setting. These data indicate that pigs from 41 to 68 kg need approximately 58% pan coverage, whereas pigs greater than 68 kg should have approximately 28% pan coverage to optimize growth and reduce feed wastage.

Key words: adjustment, feeder, pig, trough space

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INTRODUCTION

Continued improvements in swine genetics and nutrition have positively affected pig performance in the finishing stage of growth, but feed must be effectively delivered to the pig to capitalize on these advancements. Inefficiencies in feed delivery may result in feed wastage of up to 30% (Baxter, 1986). Too little feeder space or too-narrow feeder adjustment has been hypothesized to limit feed intake and consequently decrease performance. Gonyou and Lou (2000) found that as feed accessibility becomes more difficult, pigs tend to spend more time at the feeder, and therefore fewer pigs are able to obtain sufficient amounts of feed. Conversely, too much feeder space or too wide of a feeder gap could increase feed wastage and decrease efficiency.

Lindemann et al. (1987) noted that nursery pigs have a minimum feeder space requirement below which decreased feed intake and consequently decreased daily

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BW gain are observed; however, no advantages in daily gain were observed above the minimum requirement. Despite these observations, exact feeder space recommendations cannot be easily determined.

Duttlinger et al. (2009) showed that feeder adjustment could be an effective method of improving feed efficiency, and that a feeder gap opening of 2.95 cm (approximately 50% feeder pan coverage) was optimum for both ADG and G:F.

Numerous studies have evaluated the effects of feeder adjustment and feeder space separately; a large variation in performance across these studies could be attributed to differences in diet form, feeder design, and BW range of pigs evaluated (Gonyou and Lou, 2000). Thus, defining and standardizing the optimal feeder adjustment and feeder space required for 40- to 120-kg pigs is difficult. Therefore, the objective of these studies was to evaluate the effects of feeder adjustment and feeder space on the growth performance and carcass traits of finishing pigs.

MATERIALS AND METHODS

All practices and procedures used in these experiments were approved by the Kansas State University Institutional Animal Care and Use Committee.

Animal Care

Both studies were conducted at the Kansas State University Swine Teaching and Research Center finishing facility in Manhattan, KS. The facility is a totally enclosed, environmentally controlled, mechanically ventilated barn. The barn has 2 identical rooms (26.8 × 23.2 m) with forty 2.4 × 3.1 m pens. The pens are equipped with adjustable gating to allow different space allowances per pig. Each pen was equipped with a dry single-sided feeder (Farmweld, Teutopolis, IL) with two 35.6 cm × 11.43 cm (length × width) feeder spaces and a 1-cup waterer to allow ad libitum access to feed and water. Pens were located over a completely slatted concrete floor with a 1.2-m-deep pit underneath for manure storage. The facility used a computerized feeding system (FeedPro; Feedlogic Corp., Wilmar, MN) that both recorded and delivered diets to pens as specified.

Experiment 1

A total of 234 growing pigs (Line TR4 × 1050, PIC, Hendersonville, TN) with an initial BW of 41.5 kg were used in an 89-d study. Pigs were randomly allotted to 1 of 3 experimental treatments. There were 9 pens per treatment with 8 pigs per pen and 1 replicate with 6 pigs per pen.

The treatments consisted of a narrow feeder adjustment (minimum gap opening of 1.27 cm), medium feeder adjustment (minimum gap opening of 1.91 cm), and wide feeder adjustment (minimum gap opening of 2.54 cm). The feeders were adjusted to the minimum feeder gap setting by tightening down the feeder plates onto a wooden block cut to the respective gap setting; however, the agitation plate could be moved upward by pigs to a maximum gap opening of 1.91, 2.54, or 3.18 cm, respectively. Feeder settings were left at their respective settings for the duration of the trial. To ensure equal floor space among replicates of 6 or 8 pigs per pen, the movable gating was adjusted to provide 0.74 m^2 floor space per pig at the start of the study. No adjustments in floor space were made if a pig was removed for health reasons.

Pigs were fed a common corn-soybean meal-based diet containing 20% dried distillers grains with solubles (Table 1) in 4 phases (42 to 70 kg, 70 to 100 kg, 100 to 122 kg, and 122 to 129 kg, respectively) in meal form. The diet was formulated to meet or exceed NRC (1998)

Table 1. Composition of diets (Exp. 1 and 2, as-fed basis)[1]

Item	Phase 1	Phase 2	Phase 3	Phase 4
Ingredient, %				
Corn	63.23	67.42	70.42	72.40
Soybean meal (46.5% CP)	14.39	10.38	7.57	5.72
Dried distillers grains with solubles	20.00	20.00	20.00	20.00
Limestone	1.25	1.20	1.13	1.07
Salt	0.35	0.35	0.35	0.35
Vitamin premix[2]	0.15	0.13	0.10	0.08
Trace mineral premix[3]	0.15	0.13	0.10	0.08
L-lys HCl	0.34	0.30	0.27	0.26
Phytase[4]	0.14	0.09	0.06	0.04
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Standardized ileal digestible AA, %				
Lys	0.88	0.75	0.66	0.60
Ile:lys	66	69	71	73
Met:lys	31	34	37	39
Met and Cys:lys	64	70	75	80
Thr:lys	60	64	67	69
Trp: lys	16.5	16.5	16.5	16.6
Val:lys	80	85	90	94
Total lys, %	1.02	0.88	0.78	0.72
CP, %	17.8	16.3	15.2	14.5
ME, kcal/kg	3,349	3,353	3,360	3,364
Ca, %	0.55	0.52	0.48	0.46
P, %	0.42	0.40	0.39	0.38
Available P, %	0.28	0.25	0.23	0.21

[1]Each dietary phase was fed for approximately 24 d.

[2]Provided per kilogram of premix: 4,409,200 IU vitamin A; 551,150 IU vitamin D3; 17,637 IU vitamin E; 1,764 mg vitamin K; 3,307 mg riboflavin; 11,023 mg pantothenic acid; 19,841 mg niacin; and 15.4 mg vitamin B12.

[3]Provided per kilogram of premix: 26.5 g Mn from manganese oxide, 110 g Fe from iron sulfate, 110 g Zn from zinc sulphate, 11 g Cu from copper sulfate, 198 mg I from calcium iodate, and 198 mg Se from sodium selenite.

[4]Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO) provided 509 FTU/kg premix.

requirement estimates for 20- to 120-kg pigs.

Average daily gain, ADFI, and G:F were determined by weighing pigs and measuring feed disappearance on d 0, 14, 28, 42, 58, 70, 84, and 89. A digital photo of each feeder pan was taken once during each phase. The feeder pan photos were then individually scored by 4 trained panelists for percentage of pan coverage. Pan coverage was determined by evaluating each feeding space for percentage of pan covered by feed, and values were then averaged for total pan coverage.

On d 81, pigs were weighed and transported (approximately 3 h) to a commercial processing plant (Triumph Foods Inc., St. Joseph, MO). Each pig was individually tattooed with its pen number to allow for data retrieval by pen and data collection at the packing plant. Hot carcass weights were taken immediately after evisceration, and each carcass was evaluated for backfat and loin depth. Percentage yield was calculated by dividing HCW by BW obtained at the farm before transport to the packing plant. Fat depth and loin depth were measured with an optical probe inserted between the 3rd and 4th last rib (counting from the ham end of the carcass) at a distance approximately 7.1 cm from the dorsal midline. Fat-free lean index was calculated using National Pork Producers Council (2000) procedures.

Experiment 2

A total of 288 growing pigs (Line TR4 × 1050, PIC) with an initial BW of 37.2 kg were used in a 91-d growth study. Pigs were randomly allotted to 1 of 4 treatments with either 8 or 16 pigs per pen and 6 pens per treatment.

Treatments were arranged in a 2 × 2 factorial with main effects of feeder space (4.45 vs. 8.9 cm) and feeder gap setting (1.27 cm, narrow, or 2.54 cm, wide). The feeders were adjusted to the minimum feeder gap setting by tightening down the feeder plates onto a wooden block cut to the respective gap setting; however, the agitation plate could be moved upward to a maximum gap opening of 1.91 or 3.18 cm, respectively. Similar to Exp. 1, feeders were left at their respective settings for the duration of the study. To attain the feeder trough space treatments of 4.45 or 8.9 cm, the number of pigs per pen was varied by having either 8 or 16 pigs per pen. For the 8.9 cm of feeder trough space per pig, pens were stocked with 8 pigs per pen. To achieve the 4.45 cm of feeder space per pig, 2 pens were combined with only 1 feeder for 16 pigs. To ensure equal floor space among pens of 8 and 16, the gating was adjusted at the start of the trial to provide 0.74 m^2/pig.

Pigs were fed corn-soybean meal-based diets containing 20% dried distillers grains with solubles (Table 1) in 4 phases (37 to 66 kg, 66 to 95 kg, 95 to 124 kg, and 124 to 130 kg, respectively) in meal form. The diet was formulated to meet or exceed NRC (1998) requirement estimates for 20- to 120-kg pigs.

Similar to Exp. 1, feeder and pigs were weighed on d 0, 14, 28, 42, 56, 70, 84, and 91 to determine the response criteria of ADG, ADFI, and G:F. In addition, a digital photo of each feeder pan was taken once per dietary phase. As in Exp. 1, the feeder pan photos were then scored by a 4-person trained panel for percentage of pan coverage.

Statistical Analysis

Data were analyzed as a completely randomized design with repeated measures over time using the PROC MIXED procedure (SAS Inst. Inc., Cary, NC) with pen as the experimental unit. In Exp. 1, linear and quadratic polynomial contrasts were used to determine the effects of increasing feeder gap adjustment. Repeated measures analysis over time period consisted of 2 time periods from d 0 to 58 and d 58 to 89 representing the grower and finisher periods, respectively. In Exp. 2 treatments were arranged in a 2 × 2 factorial and data were analyzed with repeated measures over time. Repeated measures analysis was conducted across 2 time periods from d 0 to 56 and d 56 to 91, which again represented the grower and finisher phases. Differences among treatments were considered significant with P-values ≤ 0.05 and trends if P-values > 0.05 and ≤ 0.10.

RESULTS

Experiment 1

We observed no period × treatment interactions for growth or carcass traits in this experiment (d 0 to 58 and 58 to 89). From d 0 to 58, increasing the feeder gap increased (linear; $P \leq 0.04$) ADG and ADFI, with maximum ADG observed at a feeder gap of 1.91 cm (Table 2); however, G:F was reduced (linear; $P \leq 0.05$) as feeder gap increased. As feeder gap increased, feeder pan coverage increased (linear; $P \leq 0.01$).

From d 58 to 89, increasing feeder gap did not affect ADG or ADFI, but G:F tended to be poorer (linear; $P = 0.08$) as feeder gap increased. Feeder pan coverage increased as feeder gap increased (linear; $P \leq 0.01$).

Overall (d 0 to 89), increasing feeder gap had no effect on ADG but increased (linear; $P < 0.02$) ADFI, which resulted in poorer (linear; $P < 0.03$) G:F. Feeder pan coverage increased ($P < 0.02$) as feeder gap increased, with the 1.91, 2.54, and 3.18 cm feeder adjustments averaging approximately 28, 58, and 75% pan coverage, respectively, for the entire trial (Figures 1, 2, and 3). Carcass criteria evaluated did not differ among pigs fed any of the different feeder gap settings evaluated.

Table 2. Effects of feeder gap setting (adjustment) on finishing pig performance, Exp. 1[1]

	Feeder gap, cm				*P*-value	
Item	1.27	1.91	2.54	SEM	Linear	Quadratic
d 0 to 58						
ADG, kg	0.97	1.03	1.02	0.018	0.04	0.15
ADFI, kg	2.65	2.92	2.92	0.064	0.01	0.09
G:F	0.365	0.351	0.351	0.005	0.05	0.26
Feeder coverage[2] score, %	29.9	61.3	71.9	6.35	0.01	0.19
d 58 to 89						
ADG, kg	0.68	0.66	0.68	0.018	0.89	0.41
ADFI, kg	2.37	2.42	2.47	0.064	0.26	0.97
G:F	0.289	0.275	0.276	0.005	0.08	0.22
Feeder coverage[2] score, %	26.6	36.7	76.6	6.35	0.01	0.52
d 0 to 89						
ADG, kg	0.83	0.85	0.85	0.013	0.18	0.66
ADFI, kg	2.51	2.67	2.70	0.054	0.02	0.32
G:F	0.327	0.313	0.314	0.004	0.03	0.16
Feeder coverage[2] score, %	27.7	58.2	75.0	7.56	0.01	0.28
Carcass measurements						
BW, kg	126.8	128.4	129.4	1.92	0.35	0.92
HCW, kg	93.7	95.7	95.5	1.36	0.37	0.59
Carcass yield, %	73.9	74.5	73.8	0.34	0.81	0.18
FFLI,[3] %	48.5	48.7	48.9	0.23	0.19	0.96
Backfat depth,[4] mm	27.1	26.7	26.0	0.65	0.25	0.89
Loin depth, cm	6.21	6.11	6.26	0.07	0.61	0.17

[1]A total of 234 pigs (PIC TR4 ×1050, initially 41.5 kg) were used in an 89-d study to evaluate the effects of feeder adjustment on finisher pig growth performance. There were 8 pigs per pen and 9 pens per treatment. There was 1 pen per treatment with 6 pigs per pen.

[2]Photographs of feeder pan coverage were taken once during each dietary phase. A panel of 4 scored feeder pan photos for percentage of pan coverage.

[3]FFLI = fat-free lean index (National Pork Producers Council, 2000).

[4]Backfat depth and loin depth were adjusted to a common HCW.

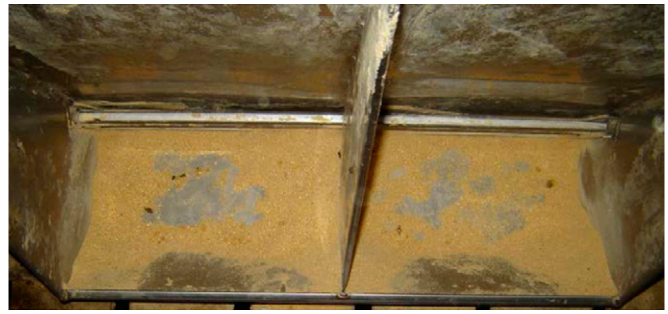

Figure 2. Medium feeder adjustment (minimum feeder gap opening was 1.91 cm with a maximum gap of 2.54 cm) averaged 58% feeder pan coverage, Exp. 1. See online version for figure in color.

Experiment 2

We observed no feeder adjustment × trough space interactions for any of the growth criteria evaluated (d 0 to 56, 56 to 91, and 0 to 91; Table 3). From d 0 to 56, pigs fed with the wide feeder adjustment (2.54 cm) had increased ($P < 0.01$) ADFI, which resulted in a poorer ($P < 0.02$) G:F. There were no differences in growth between pigs fed with either 4.45 or 8.9 cm of feeder trough space. Feeders set to the wide feeder adjustment had greater ($P < 0.01$) feeder pan coverage compared with those set to the narrow feeder adjustment.

From d 56 to 91, pigs fed with the wide feeder-gap setting (2.54 cm) had increased ($P < 0.01$) ADFI and poorer ($P < 0.001$) G:F. Pigs with 8.9-cm trough space tended ($P = 0.10$) to have increased ADG compared with those that had 4.45 cm trough space. Feeders set to the wide feeder adjustment had greater ($P < 0.01$) feeder pan coverage compared with feeders set to the narrow feeder adjustment.

Overall (d 0 to 91), pigs fed with the wide feeder-gap setting had increased ($P < 0.01$) feed disappearance and poorer ($P < 0.01$) G:F compared with pigs that had the narrow feeder-gap setting. Average daily gain tended to increase ($P = 0.08$) as feeder trough space increased from 4.45 to 8.9 cm/pig.

An adjustment × period interaction ($P \leq 0.05$) was observed for ADFI. The interaction is due to a magnitude effect where pigs with the wide feeder gap had an even greater ADFI during the second period (d 56 to 91) compared with the first period (d 0 to 56).

We observed no feeder adjustment × trough space interaction for percentage feeder pan coverage; howev-

Figure 1. Narrow feeder adjustment (minimum feeder gap opening was 1.27 cm with a maximum gap of 1.91 cm) averaged 27% feeder pan coverage, Exp. 1. See online version for figure in color.

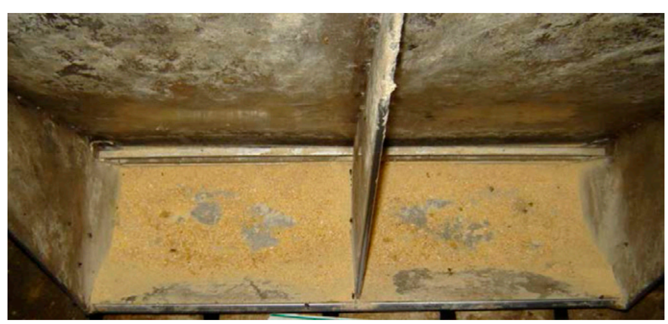

Figure 3. Wide feeder adjustment (minimum feeder gap opening was 2.54 cm with a maximum gap of 3.81 cm) averaged 75% feeder pan coverage, Exp. 1. See online version for figure in color.

Table 3. Effects of trough space and feeder gap setting (narrow vs. wide) on finishing pig performance, Exp. 2[1]

		Trough space/pig, cm					Probability, $P <$		
		4.45 cm		8.9 cm					
Item	Feeder gap[2]	Narrow	Wide	Narrow	Wide	SEM	Adjustment × space	Adjustment	Trough space
d 0 to 56									
ADG, kg		1.01	1.03	1.03	1.05	0.013	0.92	0.18	0.24
ADFI, kg		2.72	2.85	2.76	2.92	0.042	0.80	0.01	0.22
G:F		0.372	0.360	0.371	0.358	0.006	0.89	0.02	0.78
Feeder coverage score,[3] %		37.5	77.9	41.5	82.1	5.11	0.98	0.01	0.43
d 56 to 91									
ADG, kg		0.98	0.99	1.02	1.00	0.016	0.33	0.82	0.10
ADFI, kg		3.44	3.66	3.49	3.74	0.050	0.74	0.01	0.20
G:F		0.284	0.270	0.291	0.267	0.004	0.33	0.01	0.66
Feeder coverage score,[3] %		48.4	88.6	66.7	90.8	5.11	0.13	0.01	0.05
d 0 to 91									
ADG, kg		0.99	1.01	1.02	1.03	0.011	0.57	0.46	0.08
ADFI,[a] kg		2.99	3.16	3.03	3.23	0.041	0.75	0.01	0.17
G:F		0.337	0.319	0.334	0.321	0.004	0.51	0.01	0.93
Average feeder coverage score, 3%		42.9	83.3	54.1	86.5	3.76	0.38	0.01	0.12

[a]Adjustment × period interactions ($P < 0.05$).

[1]A total of 228 pigs (PIC TR4 × 1050, initially 37.2 kg) were used, with either 8 (8.9 cm/pig) or 16 (4.45 cm/pig) pigs per pen with 6 replications per treatment.

[2]Narrow = 1.27 cm minimum gap opening. Wide = 2.54 cm minimum gap opening.

[3]Photographs of feeder pan coverage were taken once during each dietary phase. A panel of 4 then scored feeder pan photos for percentage of pan coverage.

er, pigs with wide feeder-gap setting had increased ($P < 0.01$) feeder pan coverage compared with those that had narrow feeder adjustment. Results of the feeder pan coverage evaluations indicated that narrow-adjusted feeders averaged approximately 48% coverage (Figure 4) and wide-adjusted feeders averaged approximately 85% coverage (Figure 5).

DISCUSSION

Maintaining proper feeder adjustments has been shown to be an effective method of decreasing feed wastage and subsequently improving feed efficiency. Both of the current studies assessed feeder adjustments, and the findings agree with previous research (Liptrap et al., 1985; Smith et al., 2004; Duttlinger et al., 2009) where ADFI increased as feeder gap increased. Although not significant, Duttlinger et al. (2009) observed a numerical decrease in G:F as feeder adjustment increased from 2.20 to 3.60 cm. These findings agree with those in the present studies where pigs with a 1.27-cm feeder gap had improved G:F compared with those with a 1.91- or 2.54-cm feeder gap. There was approximately a 4 to 5% improvement in G:F with the narrow feeder adjustment compared with the wide adjustment observed among the 2 experiments. This represents a savings of 12- to15-kg of feed for a pig with a typical 100 kg of BW gain and a 0.333 G:F.

Additionally, the present studies showed that as finishing pigs approach market weight, feeder gap should be decreased to reduce feed wastage. Gonyou (1998) observed that young pigs (25 kg) ate slowly and thus spent

Figure 4. Narrow feeder adjustment (minimum feeder gap opening was 1.27 cm with a maximum gap of 1.91 cm) averaged 45% feeder pan coverage, Exp. 2. See online version for figure in color.

Figure 5. Wide feeder adjustment (minimum feeder gap opening was 2.54 cm with a maximum gap of 3.81 cm) averaged 83% feeder pan coverage, Exp. 2. See online version for figure in color.

more time at the feeder compared with older pigs. Smith et al. (2004) observed that as feed becomes more difficult to access, pigs compensate by spending more time at the feeder; consequently, the number of pigs able to obtain a sufficient amount of feed decreases. Combining the observations of Gonyou (1998), Smith et al. (2004), and the present studies supports the idea that smaller pigs need a larger feeder gap to help accommodate their slower eating speeds and ensure that all pigs attain an adequate amount of feed for optimum performance. In an effort to reduce feed wastage and improve feed efficiency, feeders should be adjusted accordingly as pigs move from placement (25 kg) to market weight.

Evaluating a subjective measure of the percentage of the feeder pan covered is a common management practice to minimize feed wastage in commercial production. The present studies have attempted to evaluate the subjective measure quantitatively by photographing each feeder at different time points and having multiple evaluators score pan coverage. Our results agree with those of Smith et al. (2004) and Duttlinger et al. (2009) that as feeder gap increases, a concomitant increase occurs in the percentage of feeder pan covered by feed. Our studies found that when pigs are 37 to 70 kg, the ideal feeder pan coverage is about 60%, and as the pigs grow from 70 to 130 kg, the ideal feeder pan coverage decreases to about 30%. These findings coincide with those of Smith et al. (2004), who evaluated feeder adjustment in weanling pigs (7 to 30 kg) and found that both growth and feed efficiency was optimized when about 40 to 70% of the feeder pan was covered. In contrast, Duttlinger et al. (2009) reported that about 50% of the feeder pan should be covered without feed accumulating in the corners of the feed pan for pigs 59 to 115 kg.

It is important to emphasize that these studies were conducted with 1 specific type of feeder and the same pan coverage recommendations might be expected to vary with different types of feeders. The diet form (meal vs. pellet), formulation, and the degree of flowability of the diet, perhaps affected by humidity or DM content, may also influence ideal feeder adjustment. It should also be noted that the feeder adjustment of 1.27 and 2.45 cm resulted in approximately 27 and 75% pan coverage, respectively, whereas the same settings in Exp. 2 resulted in 45 and 83% pan coverage. This underscores the challenges with making 1 specific feeder gap adjustment setting to achieve a specific pan coverage.

Studies have evaluated the ideal number of pigs per feeder space, but research is limited on the actual feeder space dimensions required by the pig (Kornegay and Notter, 1984; Gonyou and Lou, 2000), which led to the second experiment in which feeder trough space was evaluated alongside feeder adjustment. The number of pigs per pen was varied (8 or 16 pigs/pen) in an effort to mimic how feeder space would be adjusted in commercial operations. Even though the number of pigs per pen was varied, floor space (0.74 m^2) remained constant across treatments, which was necessary to prevent further confounding of variables. Research conducted by Kornegay and Notter (1984) found that as the number of pigs/pen was altered, floor space was the main driver of changes in growth performance. Gonyou and Lou (2000) found that as many as 12 pigs could be accommodated with a single feeding space. In Exp. 2, there were 16 (4.5 cm) or 8 pigs (8.9 cm) per feeding space, and a tendency ($P = 0.08$) for increased ADG was observed as feeder trough space increased from 4.45 to 8.9 cm/pig. Gonyou (1998) reported that larger pigs could afford to be more crowded in terms of feeder space due to their increased eating speed, whereas smaller pigs eat more slowly and subsequently spend more time at the feeder, which merits fewer pigs per feeding space.

Both Australia and the EU (English et al., 1988) have specific guidelines regarding recommended trough space per pig. Australia recommends about 6.25 cm/pig trough space and the EU recommends 5.9 cm/pig. Recommendations of Australia and the EU indicate that perhaps feeder trough space was not restricted enough in Exp. 2. Interestingly enough, for the overall study (d 0 to 91), pigs with 8.9 cm of trough space had a tendency for increased ADG. This could be explained by the fact that the pigs averaged 130 kg at the time of marketing and due to their size, feeder space could have become a limiting factor.

Our findings indicate that pigs from 37 to 70 kg need a larger feeder gap, or about 60% feeder pan coverage to maximize ADG, but from 70 to 130 kg, feeder gap needs to be decreased to about 30% feeder pan coverage to reduce feed wastage and optimize growth. Using feeder pan coverage as an indicator for proper feeder adjustment may be a practical method that can be standardized across a wide range of commercially available feeder types.

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