Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 22

2010

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## Recommended Citation

Potter, M L.; Tokach, Michael D.; DeRouchey, Joel M.; Goodband, Robert D.; Nelssen, Jim L.; and Dritz, Steven S. (2010) "Effects of mat-feeding duration and different waterer types on nursery pig performance in a wean-to-finish barn," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.3442

Effects of mat-feeding duration and different waterer types on nursery pig performance in a wean-to-finish barn


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# Effects of Mat-Feeding Duration and Different Waterer Types on Nursery Pig Performance in a Wean-to-Finish Barn[1]

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## Summary

A total of 3,680 weanling pigs were used in 2 experiments to determine the effects of mat-feeding strategies and different waterer types on pig performance and removal rates. In Exp. 1, a total of 24 pens (58 pigs per pen) were blocked by source farm and allotted to 1 of 4 gender (barrow or gilt) × feeding (control or mat-fed) treatments in a 27-d trial. Pigs were initially 15.4 lb. Control pigs did not receive any pelleted feed placed on mats, while pigs assigned to the mat-fed treatment were given 1.1 lb of pelleted diet on the mats 3 times daily for 6 d (with the exception of 1 pen, which was mat-fed for 5 d due to early mat disintegration). Pigs were weighed and feed intake by pen was recorded on d 0, 11, and 27 to calculate ADG, ADFI, and F/G. The numbers of removed and dead pigs were recorded, although individual pigs were not weighed. Thus, for Exp. 1, removed pig gain was not accounted for in ADG calculations. In Exp. 2, a total of 44 pens (52 pigs per pen) were allotted to 1 of 8 waterer types (swinging or pan) × gender (barrow or gilt) × mat-feeding duration (1.6 lb of pelleted feed given 3 times daily for either 3 or 7 d) treatments in a 32-d trial. Pigs were initially 13.6 lb. Waterer types evaluated in this study were a dual swinging waterer (Swinging; Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS) or an under-the-fence-line 14-inch pan waterer (Pan; Koca, Des Moines, IA). Pigs were weighed and feed intake by pen was recorded on d 0, 7, 20, and 32 to calculate ADG, ADFI, and F/G. Removed and dead pigs were tracked, and for Exp. 2, all removed pigs were individually weighed and included in calculations involving gain.

Results from Exp. 1 indicate a difference ($P = 0.04$) in overall (d 0 to 27) removal percentage between control and mat-fed pigs. Fewer pigs fed on mats died or were removed from pens (5.9%) than control pigs (9.8%), with most removals between treatments occurring within the first 11 d (control: 8.0% vs. mat-fed: 4.6%; $P = 0.03$).

Because of the difference in removal percentages, overall ADG and F/G tended to be improved ($P = 0.06$) for mat-fed pigs compared to the controls. However, average pig weights on d 0, 11, and 27 were not different ($P \geq 0.57$) between treatments, indicating that the ADG advantage was due to the difference in removals rather than increasing weight gain of pigs remaining in the pens. Thus, the results of Exp. 1 indicate a benefit by feeding on mats for 6 d in reducing the percentage of removed pigs, but no advantages on growth performance were observed.


[1] Appreciation is expressed to J-Six Enterprises, Seneca, KS, for their assistance and for providing the pigs and facilities used in this experiment.

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For Exp. 2, removal percentages from d 0 to 7 were similar ($P \geq 0.17$) regardless of treatment. By d 20 and through the end of the trial (d 32), a 2-way interaction ($P = 0.03$) was observed between water source and mat-feeding duration on removal percentages. Pigs that were fed on mats for 3 d and provided swinging waterers had the lowest removal rate among treatments. Biologically, it is difficult to understand why feeding on mats for 7 d would increase removals compared with 3-d mat-feeding for pigs provided with swinging waterers. Overall, there was a trend ($P \geq 0.08$) for pigs using the swinging waterer to have increased ADG and improved F/G, resulting in pigs having a 1.4-lb numeric advantage in weight at d 32 compared with pigs drinking from the pan waterer. Much of the overall effect was due to pigs using the swinging waterer having improved ($P = 0.02$) ADG and F/G compared with pigs with pan waterer access in the early stages (d 7 to 20) of the nursery period.

Overall, pigs fed on mats for 3 d had similar ($P \geq 0.12$) ADG and F/G compared with pigs fed on mats for 7 d. There was a trend ($P = 0.08$) for pigs fed on mats for 7 d to consume more feed than pigs fed on mats for 3 d, although this increased intake did not result in significant changes in growth rate. Thus, F/G was poorer ($P = 0.01$) from d 0 to 7 for pigs fed on mats for 7 d vs. those fed on mats for 3 d.

Results of these 2 experiments indicate that, in periods during these trials, performance and removal rates of pigs postweaning were able to be improved by feeding on mats and using swinging waterers instead of pan waterers.

Key words: growth, mat-feeding, waterer

## Introduction

Feeding pigs a small amount of feed on floor mats (mat-feeding or floor-feeding) immediately after weaning is a common industry practice to help introduce newly weaned pigs to solid feed. It has been documented that feed intake within the first week postweaning is important to maintaining pig health. During the postweaning period a pig experiences a variety of stressors that can reduce performance, including a change in diet form, vaccination, and adaptation to a new environment and social structure. Therefore, practices that encourage feed intake and help maintain health are critical during this period. Although mat-feeding is practiced throughout the industry, the duration of this practice varies and published information on its effects on subsequent growth and removal rates is limited.

Waterer types also vary among swine facilities. Two commercially available waterers include a dual swinging waterer with guard (Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS), and an under-the-fence-line pan waterer (Koca, Des Moines, IA). Research indicates that using the swinging waterers results in less water disappearance compared to stationary nipple waterers or bowl-type waterers. There has been little published information on water disappearance with the pan waterer; however, reports from the field indicate disappearance is similar to that when bowl-type waterers are used. During the early postweaning period, young pigs are highly susceptible to dehydration. Therefore, water availability and learning to access the water source is critical. It is thought that pigs have easier access to water with a pan-type waterer, which may lead to a lower rate of dehydration. Also, adequate water availabil-

ity is critical for stimulating feed intake during the weaning process. It is thought that greater access to the water source will lead to increased feed intake during the early postweaning period. Therefore the objectives of these experiments were to: (1) determine the effects of mat-feeding on weanling pig performance, and (2) determine the effects of different durations of mat-feeding with 2 waterer types on pig performance immediately postweaning in a wean-to-finish barn.

## Procedures

The Kansas State University (K-State) Institutional Animal Care and Use Committee approved procedures used in these studies. Both experiments were performed in the same double-curtain-sided commercial research facility in northeast Kansas. Pens in this barn were 10 × 18 ft and equipped with a single-sided dry, 3-hole, stainless-steel feeder (AP-3WFS-QA; Automated Production Systems, Assumption, IL), allowing pigs ad libitum access to feed. The barn was equipped with an automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN), facilitating recording of feed delivery to individual pens.

For Exp. 1, each pen was equipped with a dual swinging waterer (Trojan Plastic Waterswing; Trojan Specialty Products, Dodge City, KS). Waterers varied in Exp. 2 according to the treatment assignment. Pigs were allowed to have ad libitum access to water in both experiments. All pens had a biodegradable mat and a brooder lamp placed above the mat. According to standard production procedures, all pigs were vaccinated with commercial porcine circovirus type 2 and *Mycoplasma hyopneumoniae* vaccines at 3 and 6 weeks of age.

For Exp. 1, a total of 1,392 weanling pigs (initially 15.4 lb) were placed in 24 pens (58 pigs per pen) according to gender (barrow or gilt) and blocked by source farm in a 27-d trial. Each block consisted of 2 barrow and 2 gilt pens. On d 0, pens of pigs were weighed and randomly allotted within block and gender to 1 of 2 feeding treatments (control or mat-fed) in a 2 × 2 factorial arrangement. Controls did not receive any pelleted feed on mats, while pigs on the mat-fed treatment were fed on the mats 3 times daily for 6 d (except for 1 pen which was fed on the mat for only 5 d before the mat disintegrated). Mat-feeding consisted of removing 1.1 lb of pellets from the feeder for that pen and placing it on the mats. All pigs were fed common diets in 3 phases, according to standard production procedures. Pigs were fed a pelleted diet (3 lb/pig) followed by a Phase 2 diet formulated for an average pig weight range of 15 to 25 lb (13 lb/pig). A Phase 3 diet, formulated for an average pig weight range of 25 to 50 lb, was then fed until the end of the trial. Phase 2 and 3 diets were both fed in meal form.

Pigs were weighed by pen and feed intake recorded on d 0 (weaning), 11, and 27. From these data, ADG, ADFI, and F/G were calculated. Pig removals and mortalities were recorded throughout the trial; however, mortality was not tracked on pigs after they were removed from the study. Pig removal weights and gain of removed pigs were not used in the calculation of ADG for Exp. 1. However, the days prior to removal that pigs were in test pens (pig days) were accounted for in all calculations.

For Exp. 2, a total of 2,288 pigs (52 pigs per pen) in 44 pens were used in a 32-d trial. Pigs (initially 13.6 lb) were allotted to 1 of 8 treatments in a 2 × 2 × 2 factorial arrange-

ment in a split-plot design with waterer type (swinging or pan), gender (barrow or gilt), and mat-feeding duration (3 d or 7 d) as the factors evaluated. Waterers tested were a dual swinging waterer (Swinging; Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS) or an under-the-fence-line 14-inch pan waterer (Pan; Koca, Des Moines, IA). Pan waterers were placed 2 ft away from the side-edge of the feeder. A set of 2 pens (1 barrow and 1 gilt pen) was designated as the unit of replication for the waterer treatments, as 2 adjacent pens shared a pan waterer; however, a whole-plot was made of 4 pens (2 sets of 2 pens), allowing complete gender × duration treatment arrangements within each whole-plot. There were 6 whole-plots of swinging waterers and 5 whole-plots of pan waterers for a total of 44 pens on test. Waterers were distributed in pens throughout the barn such that both types of waterers were represented in each quadrant.

Pigs were supplied from multiple sources for Exp. 2. On d 0 (less than 24 hours after weaning for all sources), pigs were sorted by sex and randomly placed in pens to create whole-plots, comprising pigs from comparable sources. As each set of 2 similar waterer pens consisted of a barrow and a gilt pen, mat-feeding duration treatments were randomly assigned within gender and whole-plots. This ensured that each set of 2 pens on a similar waterer had both mat-feeding treatments (3-d and 7-d) after the split-plot treatment allotment. Average pig start weights were checked and balanced as closely as possible across both waterer and mat-feeding duration treatments.

Pens of pigs were weighed and feed intake was recorded on d 0, 7, 20, and 32 to calculate ADG, ADFI, and F/G. All pigs were mat-fed for the initial 3 d. Pigs assigned to the 7-d treatment were mat-fed for an additional 4 d. Mat-feeding procedures consisted of feeding 1.6 lb of pelleted feed on mats 3 times daily (total of 4.8 lb of feed per pen per day). For the first 2 d of feeding, bagged SEW diet was fed on the mats. For the remainder of the mat-feeding, a transition diet was removed from the feeders at each feeding and placed on the mats. All pigs were fed common diets in phases throughout the trial. Initially, 25 lb of bagged SEW diet was hand-added to each feeder (0.5 lb/pig). On top of the SEW diet, the FeedPro system was used to add approximately 3 lb/pig pelleted transition diet, followed by approximately 13 lb/pig Phase 2 diet in meal form. After feeding the Phase 2 diet, a Phase 3 diet was fed until the end of the trial. Removals and mortalities from each pen were recorded throughout the trial in a similar manner as Exp. 1. For Exp. 2, all removed pigs were weighed, and removal weights and pigs days were used for all calculations.

Data were analyzed as a randomized complete block design and a split-plot design for Exp. 1 and 2, respectively, using the GLIMMIX procedure in SAS (SAS Institute, Inc., Cary, NC). Fixed factors for Exp. 1 were feeding treatment, gender, and their interaction. Source was a random effect, and pen was the experimental unit for analysis of Exp. 1. For Exp. 2, the fixed factors were waterer type (whole-plot factor), gender (split-plot factor), mat-feeding duration (split-plot factor), and all 2-way and 3-way interactions between whole-plot and split-plot factors. For Exp. 2, the unit of replication was a set of 2 pens for analysis of the whole-plot, whereas for analysis of the split-plot, the unit of replication was an individual pen. Differences between treatments were determined by using least squares means ($P < 0.05$).

## Results and Discussion

For Exp. 1, there were no 2-way interactions ($P \geq 0.06$) between gender and treatment for any responses (Table 1). Removal percentages (including removals and mortalities) throughout the trial were not affected by gender, but were affected by treatment. There was a difference ($P \leq 0.04$) in removal percentage within the first 11 days of the trial and overall (d 0 to 27) between control and mat-fed pigs. Overall, fewer ($P = 0.04$) pigs fed on mats were removed from pens (5.9%) than control pigs (9.8%), with the majority of the removals occurring within the first 11 d (control: 8.0% vs. mat-fed: 4.6%; $P = 0.03$).

Performance of barrows and gilts throughout the trial was similar ($P \geq 0.17$), despite gilts weighing 0.5 lb less ($P < 0.01$) than barrows at weaning (d 0). On d 27, consistent with arrival weight patterns, barrows tended ($P = 0.05$) to be heavier than gilts.

From d 0 to 11, 11 to 27, and overall, there were numeric improvements ($P \geq 0.06$) in ADG and F/G for mat-fed pigs compared with control pigs. Between control and mat-fed pigs, ADFI was similar ($P \geq 0.48$). It is noteworthy that F/G was not worse for mat-fed pigs, indicating that excessive wastage of feed was not apparent in this trial.

For Exp. 1, increased removal percentage for control pigs negatively affected ADG. This was reflected in the data, as average weights of control and mat-fed pigs were similar within day ($P \geq 0.57$) on d 0, 11, and 27. Thus, the ADG and F/G advantages were due to differences in removals rather than an increase in growth rate of pigs that remained in the pens. Reasons for removal in this trial were primarily slow-starting pigs that were off-feed. Other removal reasons included lack of response to treatment for respiratory disease or scours. Thus, the results of this first trial indicate that there may be some benefit in feeding on mats for 6 d in reducing the percentage of pulled pigs. There did not appear to be any negative effects of mat-feeding on F/G, which can be a concern when considering implementation of a mat-feeding program.

In Exp. 2, removal percentages from d 0 to 7 were similar regardless of treatment. Though by d 20, there was a 2-way interaction ($P = 0.03$) between water source and mat-feeding duration on removal percentages (Table 2). Pigs fed for 3 d on the mat and using a swinging waterer were less likely ($P \leq 0.04$) to be removed from pens than pigs that were mat-fed for 7 d with a swinging waterer or 3 d mat-fed with a pan waterer. Pigs mat-fed for 7 d and with a pan waterer had intermediate removal percentages. The removal percentage differences were detectable through d 32, though the reasons for the water × mat-feeding duration interaction are not known. It is speculated that there is little biologic significance to this interaction.

There was no difference ($P \geq 0.14$; Table 3) in removal percentages between barrows and gilts, though gilts had a numerically higher rate of removal (10.1% vs. 9.8%) compared with barrows. Primary reasons for removal in this trial included light-weight pigs, which were poor-starting pigs, or illness with influenza-like symptoms, which was first detected within d 7 to 20. It is unknown what effect source of pigs had on removal percentages, as some pens were mixed with pigs from similar sources. Pigs were not tracked after removal to determine whether they remained alive or died; however, individual weights of removed pigs were recorded and used in growth-performance calculations.

There were no 3-way or 2-way interactions with water source, gender, or mat-feeding duration for any performance responses, with the exception of d 0 to 7 ADFI. This water source × gender × mat-feeding duration interaction ($P < 0.01$) resulted from pigs mat-fed for 7 d having a 0.10-lb higher ADFI compared with pigs mat-fed for 3 d for barrows on swinging waterers (barrow-swinging-7 d: 0.44 ± 0.026 lb vs. barrow-swinging-3 d: 0.33 ± 0.026 lb; $P < 0.01$) and gilts on pan waterers (gilt-pan-7 d: 0.42 ± 0.028 lb vs. gilt-pan-3 d: 0.32 ± 0.028 lb; $P < 0.01$). Performance was similar, regardless of mat-feeding duration, for barrows on pan waterers (barrow-pan-7 d: 0.36 ± 0.028 lb vs. barrow-pan-3 d: 0.36 ± 0.028 lb; $P = 0.94$) and gilts on swinging waterers (gilt-swinging-7 d: 0.39 ± 0.026 lb vs. gilt-swinging-3 d: 0.38 ± 0.026 lb; $P = 0.69$). For the remainder of the performance responses, main effects of gender, water source, and mat-feeding duration are reported and discussed.

Barrows and gilts had similar ($P \geq 0.30$) overall ADG and ADFI. Barrows had a tendency (barrow vs. gilt: 1.37 ± 0.009 vs. 1.39 ± 0.009; $P = 0.08$) to have improved F/G compared with gilts. This trend for improved overall F/G was due to the improved (barrow vs. gilt: 1.58 ± 0.023 vs. 1.63 ± 0.023; $P = 0.03$) F/G for barrows compared with gilts from d 20 to 32. Despite this F/G improvement and a slight numeric weight advantage on d 0 (barrow vs. gilt: 13.8 ± 0.62 lb vs. 13.5 ± 0.62 lb; $P = 0.31$), barrows and gilts were of a similar (barrow vs. gilt: 36.5 ± 0.92 lb vs. 36.4 ± 0.92 lb; $P = 0.82$) weight at the end of the trial on d 32.

From d 0 to 7, water source did not affect ($P \geq 0.20$) pig performance (Table 3). From d 7 to 20, pigs with the swinging waterers had improved ($P = 0.02$) ADG and F/G, with a trend ($P = 0.10$) for higher ADFI compared with pigs using the pan waterers. Performance during d 20 to 32 was similar ($P \geq 0.30$), regardless of water source. Overall, there was a trend ($P \geq 0.08$) for pigs using swinging waterers to have increased ADG and improved F/G, resulting in pigs on the swinging waterer having a 1.4 lb numeric advantage on d 32 over pigs on the pan waterer. Although, pigs performed comparably overall regardless of waterer type, performance differences detected from d 7 to 20 appear to provide an advantage to pigs using swinging waterers in the early stages as pigs are transitioning into the nursery period.

Mat-feeding duration did not affect ADG ($P = 0.52$) during the first 7 d of the trial; however, F/G was dependent upon duration (Table 3). Pigs fed on mats for 7 d had poorer ($P = 0.01$) F/G than pigs fed on mats for 3 d. With only a 0.01 lb difference in ADG between the 2 mat-feeding treatments during this 7-d period, there is a strong likelihood that some of this feed was wasted. Each pen received 4.8 lb of feed per day throughout the assigned mat-feeding duration. This was approximately 1.5 lb more feed placed on mats than in Exp.1, with fewer pigs per pen (52 pigs per pen in Exp. 2 and 58 pigs per pen in Exp. 1). Therefore, the higher amount fed may have resulted in more wastage in Exp. 2, leading to the inconsistencies in F/G between the 2 trials for the mat-feeding period.

From d 7 to 20 and d 20 to 32, there was no difference ($P \geq 0.18$) in ADG, ADFI, or F/G between the 2 mat-feeding duration treatments. Overall, pigs fed on mats for 3 d had similar ($P \geq 0.12$) ADG and F/G compared with pigs fed on mats for 7 d. There was a trend ($P = 0.08$) for pigs fed on mats for 7 d to consume more feed than pigs fed on mats for 3 d, though this ADFI increase did not result in large changes in growth

rate. On d 32, pigs fed on mats for 7 d had a 0.5 lb numeric advantage ($P = 0.33$) in weight over pigs fed on mats for 3 d.

Mat-feeding reduced the removal percentage in the first experiment. However, increasing the duration from 3 to 7 d did not improve the removal percentage in the second experiment, and the extended duration of mat-feeding led to numerically poorer feed efficiency. Therefore, we believe these data support limiting the duration of mat-feeding to the first few days after weaning while pigs are learning feeding behavior. Cumulative removal rate tended to be lower at d 20 and 32 postweaning for pigs using the swinging waterer. Also, growth rate and F/G were better for pigs using the swinging waterer for the d 7 to 20 period postweaning. There was no evidence that pigs performed better when provided water with the pan waterer. Therefore, additional research may be warranted to evaluate alternating or combining water sources and their effects on pig performance and water usage to optimize management and production. Strategic implementation of these tools may be used to aid in starting pigs in the nursery.

**Table 1. Main effects of gender or mat-feeding on postweaning pig performance and removal percentages (Exp. 1)[1]**

| | Gender | | | Treatment[2] | | | Probability, *P* < | |
|---|---|---|---|---|---|---|---|---|
| Item | Barrow | Gilt | SEM | Control | Mat-fed | SEM | Gender | Treatment |
| Pens, no. | 12 | 12 | --- | 12 | 12 | --- | --- | --- |
| Removals within period[3] | | | | | | | | |
| d 0 to 11 removals, % | 7.3 | 5.3 | 1.24 | 8.0 | 4.6 | 1.24 | 0.20 | 0.03 |
| d 11 to 27 removals, % | 2.0 | 1.2 | 0.50 | 1.9 | 1.4 | 0.50 | 0.27 | 0.48 |
| Cumulative removals[4] | | | | | | | | |
| Through d 27, % | 9.2 | 6.5 | 1.23 | 9.8 | 5.9 | 1.23 | 0.13 | 0.04 |
| d 0 to 11 | | | | | | | | |
| ADG, lb | 0.26 | 0.30 | 0.025 | 0.25 | 0.30 | 0.025 | 0.24 | 0.15 |
| ADFI, lb | 0.45 | 0.47 | 0.017 | 0.46 | 0.47 | 0.017 | 0.17 | 0.64 |
| F/G | 2.01 | 1.69 | 0.169 | 2.04 | 1.67 | 0.169 | 0.20 | 0.14 |
| d 11 to 27 | | | | | | | | |
| ADG, lb | 0.92 | 0.90 | 0.013 | 0.90 | 0.92 | 0.013 | 0.30 | 0.26 |
| ADFI, lb | 1.24 | 1.22 | 0.023 | 1.24 | 1.22 | 0.023 | 0.45 | 0.48 |
| F/G | 1.35 | 1.35 | 0.022 | 1.38 | 1.32 | 0.022 | 0.99 | 0.09 |
| d 0 to 27 | | | | | | | | |
| ADG, lb | 0.64 | 0.65 | 0.016 | 0.63 | 0.66 | 0.016 | 0.58 | 0.06 |
| ADFI, lb | 0.91 | 0.91 | 0.019 | 0.91 | 0.90 | 0.019 | 0.95 | 0.80 |
| F/G | 1.43 | 1.40 | 0.031 | 1.46 | 1.37 | 0.031 | 0.51 | 0.06 |
| Weight, lb | | | | | | | | |
| d 0 | 15.6 | 15.1 | 0.27 | 15.4 | 15.4 | 0.27 | <0.01 | 0.85 |
| d 11 | 19.9 | 19.5 | 0.40 | 19.8 | 19.6 | 0.40 | 0.13 | 0.57 |
| d 27 | 35.2 | 34.2 | 0.51 | 34.7 | 34.7 | 0.51 | 0.05 | 0.99 |

[1] A total of 1,392 pigs (initially 15.4 lb) with 58 pigs per pen were blocked by background and used in a 27-d trial.
[2] Treatments were no mat-feeding (control) or mat-feeding 3 times daily (1.1 lb of pelleted feed per feeding) for an average of 6 days (mat-fed).
[3] Removed pig weights were considered to be zero, assuming removed pigs did not contribute value.

**Table 2. Interactive effect of waterer type and mat-feeding duration on pig performance and removal percentages (Exp. 2)[1]**

| | Waterer[2] | | | | | Probability, $P <$ |
|---|---|---|---|---|---|---|
| | Swinging | | Pan | | | Waterer × |
| Item Duration:[3] | 3 d | 7 d | 3 d | 7 d | SEM[4] | Duration |
| Replication, no.[5] | 12 | 12 | 10 | 10 | --- | --- |
| Within period removals | | | | | | |
| d 0 to 7, % | 3.8 | 6.2 | 6.5 | 6.9 | 1.26 | 0.31 |
| d 7 to 20, % | 2.3 | 4.0 | 5.3 | 2.5 | 1.13 | 0.03 |
| d 20 to 32, % | 0.3 | 1.2 | 0.4 | 1.1 | 0.42 | 0.66 |
| Cumulative removals | | | | | | |
| Through d 20, % | 6.1[a] | 9.9[b] | 11.5[b] | 9.2[ab] | 1.43 | 0.03 |
| Through d 32, % | 6.4[a] | 11.1[b] | 11.9[b] | 10.2[ab] | 1.48 | 0.03 |
| d 0 to 7 | | | | | | |
| ADG, lb | 0.38 | 0.41 | 0.35 | 0.35 | 0.029 | 0.38 |
| ADFI, lb[6] | 0.35 | 0.41 | 0.34 | 0.39 | 0.022 | 0.86 |
| F/G | 0.94 | 1.02 | 1.00 | 1.16 | 0.066 | 0.43 |
| d 7 to 20 | | | | | | |
| ADG, lb | 0.73 | 0.75 | 0.65 | 0.66 | 0.025 | 0.73 |
| ADFI, lb | 0.87 | 0.90 | 0.83 | 0.84 | 0.025 | 0.47 |
| F/G | 1.20 | 1.21 | 1.29 | 1.28 | 0.026 | 0.73 |
| d 20 to 32 | | | | | | |
| ADG, lb | 0.89 | 0.91 | 0.88 | 0.90 | 0.032 | 0.91 |
| ADFI, lb | 1.43 | 1.48 | 1.40 | 1.40 | 0.045 | 0.23 |
| F/G | 1.61 | 1.64 | 1.59 | 1.57 | 0.034 | 0.36 |
| d 0 to 32 | | | | | | |
| ADG, lb | 0.71 | 0.73 | 0.66 | 0.67 | 0.022 | 0.71 |
| ADFI, lb | 0.96 | 1.00 | 0.92 | 0.94 | 0.026 | 0.53 |
| F/G | 1.36 | 1.38 | 1.39 | 1.40 | 0.013 | 0.62 |
| Weight, lb | | | | | | |
| d 0 | 13.7 | 13.6 | 13.5 | 13.7 | 0.91 | 0.54 |
| d 7 | 16.5 | 16.7 | 16.2 | 16.4 | 0.85 | 0.98 |
| d 20 | 26.1 | 26.6 | 25.0 | 25.0 | 1.08 | 0.50 |
| d 32 | 36.8 | 37.6 | 35.7 | 35.9 | 1.36 | 0.58 |

[1] A total of 2,288 weanling pigs (52 pigs per pen) were used in a 32-d trial. Pigs were initially 13.6 lb.

[2] Waterer treatments allowed ad libitum access to water through a dual swinging waterer (Swinging; Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS) or a 14-inch under-the-fence-line pan waterer (Pan; Koca, Des Moines, IA).

[3] Mat-feeding duration treatments were fed 3 times daily (1.6 lb of pelleted feed each time) on mats for either 3 d or 7 d.

[4] SEM among the treatments differ because of the unbalanced design. The highest SEM among treatments is reported.

[5] Pen is the unit for replication.

[6] There was a 3-way interaction ($P < 0.01$) with gender, waterer, and mat-feeding duration for ADFI from d 0 to 7. This interaction resulted from pigs mat-fed for 7 d having a 0.10-lb higher ADFI compared with pigs mat-fed for 3 d for barrows on swinging waterers (barrow-swinging-7 d: 0.44 ± 0.026 lb vs. barrow-swinging-3 d: 0.33 ± 0.026 lb; $P < 0.01$) and gilts on pan waterers (gilt-pan-7 d: 0.42 ± 0.028 lb vs. gilt-pan-3 d: 0.32 ± 0.028 lb; $P < 0.01$), while performance was similar regardless of mat-feeding duration for barrows on pan waterers (barrow-pan-7 d: 0.36 ± 0.028 lb vs. barrow-pan-3 d: 0.36 ± 0.028 lb; $P = 0.94$) and gilts on swinging waterers (gilt-swinging-7 d: 0.39 ± 0.026 lb vs. gilt-swinging-3 d: 0.38 ± 0.026 lb; $P = 0.69$).

[ab] Results without a common superscript letter differ ($P < 0.05$).

**Table 3. Main effects of waterer type and mat-feeding duration on pig performance and removal percentages (Exp. 2)[1]**

| | Waterer[2] | | | Duration[4] | | | Probability, $P <$ | |
|---|---|---|---|---|---|---|---|---|
| Item | Swinging | Pan | SEM[3] | 3 d | 7d | SEM | Water | Duration |
| Replication, no.[5] | 12 | 10 | --- | 22 | 22 | --- | --- | --- |
| Within period removals | | | | | | | | |
| d 0 to 7, % | 5.0 | 6.7 | 1.03 | 5.2 | 6.6 | 0.85 | 0.26 | 0.17 |
| d 7 to 20, %[6] | 3.1 | 3.9 | 0.87 | 3.8 | 3.2 | 0.77 | 0.53 | 0.56 |
| d 20 to 32, % | 0.8 | 0.7 | 0.34 | 0.4 | 1.2 | 0.28 | 0.93 | 0.03 |
| Cumulative removals | | | | | | | | |
| Through d 20, %[6] | 8.0 | 10.4 | 1.07 | 8.8 | 9.6 | 0.97 | 0.12 | 0.56 |
| Through d 32, %[6] | 8.7 | 11.1 | 1.05 | 9.2 | 10.6 | 1.00 | 0.14 | 0.31 |
| d 0 to 7 | | | | | | | | |
| ADG, lb | 0.40 | 0.35 | 0.025 | 0.37 | 0.38 | 0.020 | 0.20 | 0.52 |
| ADFI, lb[7] | 0.38 | 0.37 | 0.019 | 0.35 | 0.40 | 0.015 | 0.53 | <0.01 |
| F/G | 0.98 | 1.08 | 0.056 | 0.97 | 1.09 | 0.044 | 0.25 | 0.01 |
| d 7 to 20 | | | | | | | | |
| ADG, lb | 0.74 | 0.65 | 0.021 | 0.69 | 0.70 | 0.017 | 0.02 | 0.46 |
| ADFI, lb | 0.89 | 0.83 | 0.021 | 0.85 | 0.87 | 0.017 | 0.10 | 0.39 |
| F/G | 1.21 | 1.29 | 0.020 | 1.25 | 1.25 | 0.018 | 0.02 | 0.99 |
| d 20 to 32 | | | | | | | | |
| ADG, lb | 0.90 | 0.89 | 0.030 | 0.89 | 0.90 | 0.022 | 0.83 | 0.40 |
| ADFI, lb | 1.46 | 1.40 | 0.042 | 1.41 | 1.44 | 0.030 | 0.36 | 0.18 |
| F/G | 1.63 | 1.58 | 0.030 | 1.60 | 1.61 | 0.023 | 0.30 | 0.85 |
| d 0 to 32 | | | | | | | | |
| ADG, lb | 0.72 | 0.67 | 0.019 | 0.69 | 0.70 | 0.015 | 0.09 | 0.31 |
| ADFI, lb | 0.98 | 0.93 | 0.023 | 0.94 | 0.97 | 0.018 | 0.16 | 0.08 |
| F/G | 1.37 | 1.40 | 0.012 | 1.37 | 1.39 | 0.009 | 0.08 | 0.12 |
| Weight, lb | | | | | | | | |
| d 0 | 13.6 | 13.6 | 0.89 | 13.6 | 13.6 | 0.62 | 0.97 | 0.83 |
| d 7 | 16.6 | 16.3 | 0.82 | 16.3 | 16.5 | 0.57 | 0.78 | 0.45 |
| d 20 | 26.3 | 25.0 | 1.05 | 25.6 | 25.8 | 0.73 | 0.38 | 0.50 |
| d 32 | 37.2 | 35.8 | 1.31 | 36.2 | 36.7 | 0.92 | 0.44 | 0.33 |

[1] A total of 2,288 weanling pigs (52 pigs per pen) were used in a 32-d trial. Pigs were initially 13.6 lb.

[2] Waterer treatments allowed ad libitum access to water through a dual swinging waterer (Swinging; Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS) or a 14-inch under-the-fence-line pan waterer (Pan; Koca, Des Moines, IA).

[3] SEM among the treatments differ because of the unbalanced design. The highest SEM among treatments is reported.

[4] Mat-feeding duration treatments were feeding 3 times daily (1.6 lb of pelleted feed each time) on mats for either 3 d or 7 d.

[5] A set of 2 pens was the unit of replication for the waterer treatments, while a single pen was the unit of replication for the mat-feeding duration treatments.

[6] There were 2-way interactions ($P = 0.03$) with waterer and mat-feeding duration for d 0 to 7 removal percentage, removal percentage through d 20, and removal percentage through d 32.

[7] There was a 3-way interaction ($P < 0.01$) with gender, waterer, and mat-feeding duration for ADFI from d 0 to 7. This interaction resulted from pigs mat-fed for 7 d having a 0.10-lb higher ADFI compared with pigs mat-fed for 3 d for barrows on swinging waterers (barrow-swinging-7 d: 0.44 ± 0.026 lb vs. barrow-swinging-3 d: 0.33 ± 0.026 lb; $P < 0.01$) and gilts on pan waterers (gilt-pan-7 d: 0.42 ± 0.028 lb vs. gilt-pan-3 d: 0.32 ± 0.028 lb; $P < 0.01$), while performance was similar regardless of mat-feeding duration for barrows on pan waterers (barrow-pan-7 d: 0.36 ± 0.028 lb vs. barrow-pan-3 d: 0.36 ± 0.028 lb; $P = 0.94$) and gilts on swinging waterers (gilt-swinging-7 d: 0.39 ± 0.026 lb vs. gilt-swinging-3 d: 0.38 ± 0.026 lb; $P = 0.69$).