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Effects of Mat Feeding on the Growth Performance and Mortality of Pigs After Weaning

Abstract

Three experiments were conducted to determine the effect of different mat feeding strategies on the growth performance and morbidity and mortality of pigs after weaning. Upon arrival to the nursery facility, pigs were randomized to pen. A total of 96 pens (48 feeders) with 30 to 35 pigs/pen were used for each experiment, with one barrow pen and one gilt pen per feeder. Thus, feeder (2 pens) was the experimental unit. Feeders were then blocked by group (date of placement) and randomly allotted to treatment. In Exp. 1, treatments consisted of two feed management strategies; mat feeding vs. no mat feeding. Overall, a tendency was observed for ADG (P = 0.056) with mat fed pigs having poorer ADG compared to the control group, which resulted in decreased (P < 0.026) final body weights. No differences were observed in ADFI or feed efficiency. Mat fed pigs had reduced total removals (P = 0.019) compared to the control group. In Exp. 2, treatments were arranged in a 2 × 2 factorial with main effects of diet form (pellet or crumble) and mat feeding (without or with). No interactions between diet form and mat feeding were observed. No differences were observed in overall growth performance for the main effect of mat feeding, but for diet form, pigs that received pelleted feed had decreased overall ADFI *(P* = 0.013) and improved feed efficiency (*P < 0.001). No differences were observed in total removals. In Exp. 3, treatments consisted of three feed management strategies: mat feeding small (1/8 in.) pellets, mat feeding large (1/2 in.) pellets, and no mat feeding. No differences were observed in overall ADG or feed efficiency; however, mat fed pigs had increased ADFI (*P < 0.05), regardless of pellet size. Although not statistically significant, mat feeding the small pellets reduced the total removal rate by 2.1 percentage points compared to the control group, and 1.2 percentage points compared to mat feeding the large pellets. When combining the removal and mortality data for the three experiments, mat fed pigs had fewer total removals (P = 0.025) compared to the control group. In summary, mat feeding has limited effects on the growth performance of pigs after weaning; however, mat feeding may encourage earlier feed intake, therefore reducing the morbidity and mortality rate of pigs.

Keywords

performance, pig, mat feeding, mortality, weaning

Cover Page Footnote

This project was supported by the National Pork Board and the Foundation for Food and Agriculture Research grant #18-147. Appreciation is expressed to Holden Farms Inc. (Northfield, MN) for their technical support in this trial.

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K-STATE Research and Extension

SWINE DAY 2021

Effects of Mat Feeding on the Growth Performance and Mortality of Pigs After Weaning[1,2]

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Summary

Three experiments were conducted to determine the effect of different mat feeding strategies on the growth performance and morbidity and mortality of pigs after weaning. Upon arrival to the nursery facility, pigs were randomized to pen. A total of 96 pens (48 feeders) with 30 to 35 pigs/pen were used for each experiment, with one barrow pen and one gilt pen per feeder. Thus, feeder (2 pens) was the experimental unit. Feeders were then blocked by group (date of placement) and randomly allotted to treatment. In Exp. 1, treatments consisted of two feed management strategies; mat feeding vs. no mat feeding. Overall, a tendency was observed for ADG ($P = 0.056$) with mat fed pigs having poorer ADG compared to the control group, which resulted in decreased ($P < 0.026$) final body weights. No differences were observed in ADFI or feed efficiency. Mat fed pigs had reduced total removals ($P = 0.019$) compared to the control group. In Exp. 2, treatments were arranged in a 2 × 2 factorial with main effects of diet form (pellet or crumble) and mat feeding (without or with). No interactions between diet form and mat feeding were observed. No differences were observed in overall growth performance for the main effect of mat feeding, but for diet form, pigs that received pelleted feed had decreased overall ADFI ($P = 0.013$) and improved feed efficiency ($P < 0.001$). No differences were observed in total removals. In Exp. 3, treatments consisted of three feed management strategies: mat feeding small (1/8 in.) pellets, mat feeding large (1/2 in.) pellets, and no mat feeding. No differences were observed in overall ADG or feed efficiency; however, mat fed pigs had increased ADFI ($P < 0.05$), regardless of pellet size. Although not statistically significant, mat feeding the small pellets reduced the total removal rate by 2.1 percentage points compared to the control group, and 1.2 percentage points compared to mat feeding the large pellets. When combining the removal and mortality data for the three experiments, mat fed pigs had fewer total removals ($P = 0.025$) compared to the control group. In summary, mat

[1] This project was supported by the National Pork Board and the Foundation for Food and Agriculture Research grant #18-147.

[2] Appreciation is expressed to Holden Farms Inc. (Northfield, MN) for their technical support in this trial.

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feeding has limited effects on the growth performance of pigs after weaning; however, mat feeding may encourage earlier feed intake, therefore reducing the morbidity and mortality rate of pigs.

Introduction

Mat feeding is commonly practiced throughout the swine industry to increase feed accessibility after weaning; however, limited research data is available to validate current protocols or potential benefits. Previously, mat feeding, in addition to standard trough feeding, was shown to reduce morbidity and mortality during the first 3 weeks post-weaning.[5] It is suggested that similar to the events surrounding suckling, mat feeding may help stimulate group feeding behavior, subsequently reducing fallout rates. More research is needed to fully understand these implications. Therefore, the objective of these studies was to determine the effect of different mat feeding strategies on the growth performance and morbidity and mortality of pigs post-weaning.

Materials and Methods

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in these experiments. Three experiments were conducted at a commercial research nursery site in Minnesota. Each pen was equipped with a 5-hole stainless steel feeder (36 in. × 6 in.) and cup waterer to allow *ad libitum* access to feed and water. Additionally, an automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN) was used to measure and record daily feed additions to individual pens.

A total of 2,912 (Exp. 1), 3,264 (Exp. 2), or 3,227 (Exp. 3) pigs (PIC sow × Duroc sire (PIC 800 and DNA 600), initially 12 lb) were used in two 37-d growth trials (Exp. 1 and 2) and one 14-d growth trial (Exp. 3). Pigs were weaned at approximately 21 d of age and transported to the nursery facility. Upon arrival to the nursery, pigs were randomized to pen. A total of 96 pens (48 feeders) were used for each experiment, with one barrow pen and one gilt pen per feeder. Thus, feeder (2 pens) was the experimental unit. Feeders were then blocked by group (date of placement) and randomly allotted to 1 of 2 (Exp. 1), 4 (Exp. 2), or 3 (Exp. 3) treatments with 60 to 70 pigs per feeder and 24 (Exp. 1), 12 (Exp. 2), or 16 (Exp. 3) feeders per treatment. Pens of pigs were weighed and feed disappearance measured on every 7 to 14 d to determine ADG, ADFI, and G:F.

In Exp. 1, treatments consisted of two feed management strategies; mat feeding vs. no mat feeding. In Exp. 2, treatments were arranged in a 2 × 2 factorial with main effects of diet form (pellet or crumble) and mat feeding (without or with). In Exp. 3, treatments consisted of three feed management strategies; mat feeding small (1/8 in.) pellets, mat feeding large (1/2 in.) pellets, and no mat feeding. For each experiment, pens of pigs assigned to the mat feeding treatment group were provided one (Exp. 1 and 2) or two (Exp. 3) scoops of feed on 18 in. × 24 in. pieces of DuraTuff solid flooring three times daily (morning chores – before walking the pens, morning chores – prior to leaving, and afternoon chores) for 10 d post-placement. Mat feed was provided from a cart (not from the feeder) and the amount of feed applied was used to calculate total feed usage.

[5] Potter, M. L., S. S. Dritz, M. D. Tokach, J. M. DeRouchey, R. D. Goodband, and J. L. Nelssen. 2010. Effect of mat-feeding duration and different waterer types on nursery pig performance in a wean-to-finish barn. Kansas Agricultural Experimental Station Research Reports: doi:10.4148/2378-5977.3442.

Approximately 0.70 lb of pelleted feed (Exp. 1), 0.70 lb of pelleted or 0.82 lb of crumble feed, or 1.60 lb of pelleted feed (Exp. 3) were provided at each feeding, totaling 21.0, 21.0 or 24.6, or 48.0 lb of feed per feeder (divided amongst 2 pens) for Exp. 1, 2, and 3, respectively.

Nursery diets were fed in 3 different phases and were based on a feed budget. Phase 1 feed budget was provided at 4 lb per head, phase 2 feed budget was provided at 12 lb per head, and phase 3 feed budget was provided at 35 lb per head. For Exp. 1 and 3, phase 1 diets were in pellet form and phase 2 and 3 diets were in meal form. Only phase 1 diets were fed in Exp. 3 because the trial ended on d 14 due to a PRRS outbreak. For Exp. 2, diet form for phase 1 and 2 was based on pen treatment assignment where phase 1 diets were either in pellet or crumble form, phase 2 diets were either in meal or crumble form, and phase 3 diets were in meal form.

Data analysis

Data were analyzed as a randomized complete block design using the GLIMMIX procedure of SAS version 9.4 (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Treatment was considered a fixed effect and group as a random effect. A binomial model was used to determine removal and mortality percentage points. Results were considered significant at $P \leq 0.05$.

Results and Discussion

In Exp. 1, from d 0 to 10 after nursery placement, no differences were observed in ADG (Table 1); however, mat fed pigs had increased ADFI and F/G ($P < 0.001$). These results are likely in response to mat feed being used to account for total feed usage. In contrast, from d 10 to 17, mat fed pigs had decreased ADFI ($P = 0.010$) compared to the control group, with no differences in ADG or F/G. Mat fed pigs also had decreased ADG ($P = 0.010$) and ADFI ($P = 0.027$) from d 17 to 39. Overall, a tendency was observed for ADG ($P = 0.056$), with mat fed pigs having poorer ADG compared to the control group, which resulted in decreased ($P < 0.026$) final body weights. No differences were observed in ADFI or F/G. Mat fed pigs had fewer total removals ($P = 0.019$) compared to the control group. When growth data were calculated on a closeout basis, based on weight produced per pig placed, no differences were observed.

In Exp. 2, no interactions between diet form and mat feeding were observed (data not shown) post-weaning. Similarly, no differences were observed in overall growth performance for the main effect of mat feeding (Table 2). Although not statistically significant, numerical differences were observed, with mat fed pigs having 0.5 percentage points fewer total removals compared to the control group. For the main effect of diet form, pigs that received pelleted feed had decreased overall ADFI ($P = 0.013$) and improved F/G ($P < 0.001$), with no differences in ADG. This response was driven by decreased ADFI ($P < 0.001$) and improved feed efficiency ($P < 0.001$) from d 7 to 14 and 14 to 21. When calculated as a closeout based on per pig placed, a tendency was observed for total feed intake ($P = 0.061$) and overall ADFI ($P = 0.066$), with pigs receiving pelleted feed having decreased feed consumption and improved F/G ($P < 0.001$). For the main effect of diet form, no differences were observed in total removals.

In Exp. 3, no differences were observed in overall ADG or F/G (Table 3) post-weaning; however, mat fed pigs had increased ADFI ($P < 0.05$), regardless of pellet size. These results are likely in response to mat feed being used to account for total feed usage. When calculated based on per pig placed, total feed intake ($P < 0.001$) and ADFI ($P < 0.001$) were also increased for mat fed pigs compared to the control group, regardless of pellet size. No differences in ADG or feed efficiency were observed. Although not statistically significant, numeric differences were observed in the total removal rate of mat fed pigs compared to the control group. Mat feeding small pellets reduced the total removal rate by 2.1 percentage points compared to the control group and 1.2 percentage points compared to mat feeding the large pellets.

When combining the removal and mortality data for the three experiments, mat fed pigs had fewer total removals ($P = 0.025$) compared to the control group (Table 4). In summary, mat feeding had limited effects on the growth performance of pigs after weaning; however, mat feeding strategies may encourage earlier feed intake therefore reducing the morbidity and mortality rate of pigs. The results herein indicate that the outcome of mat feeding may also be determined by health status and current morbidity and mortality rates. The economics and duration of mat feeding should be considered in future trials. Lastly, the results of Exp. 2 indicate that pelleted feed helps improve the feed efficiency of weanling pigs compared to crumble feed.

Table 1. Experiment 1, effect of mat feeding on post-weaning growth performance, removal, and mortality rates[1]

	Treatment[2]			
	Control	Mat	SEM	*P* =
Count d 0	1,456	1,456	---	---
Count d 39	1,353	1,384	---	---
Body weight, lb				
d 0	12.2	12.1	0.67	0.795
d 10	16.2	16.0	0.98	0.476
d 17	21.2	20.7	1.21	0.107
d 39	43.1	42.4	1.84	0.026
d 0 to 10				
ADG, lb	0.36	0.35	0.029	0.739
ADFI, lb[3]	0.37	0.40	0.020	< 0.001
F/G[4]	1.03	1.14	0.047	< 0.001
d 10 to 17				
ADG, lb	0.69	0.67	0.038	0.192
ADFI, lb[3]	1.00	0.96	0.027	0.010
F/G[4]	1.45	1.43	0.024	0.491
d 17 to 39				
ADG, lb	1.03	1.01	0.032	0.010
ADFI, lb[3]	1.58	1.54	0.126	0.027
F/G[4]	1.53	1.52	0.036	0.588
d 0 to 39				
ADG, lb	0.78	0.77	0.029	0.056
ADFI, lb[3]	1.13	1.12	0.073	0.161
F/G[4]	1.45	1.45	0.029	0.766

continued

Table 1. Experiment 1, effect of mat feeding on post-weaning growth performance, removal, and mortality rates[1]

	Treatment[2]			
	Control	Mat	SEM	*P* =
d 0 to 39, per pig placed[5]				
Total gain, lb	27.8	28.0	1.97	0.675
ADG, lb	0.72	0.72	0.045	0.567
Total feed intake, lb	41.6	41.7	3.45	0.769
ADFI, lb	1.07	1.08	0.083	0.707
F/G[4]	1.49	1.50	0.029	0.568
Removals, %[6]	5.6	3.8	1.93	0.026
Mortality, %	1.1	0.8	0.27	0.588
Total removals, %[7]	6.7	4.7	2.12	0.019

[1] A total of 2,912 mixed sex pigs were used with 60 to 64 pigs per feeder (2 pens) and 24 replicates per treatment.
[2] Treatment consisted of two feed management strategies; mat feeding vs. no mat feeding. Pens of pigs assigned to the mat feeding group were provided a scoop of feed (0.35 lb) on an 18 in. × 24 in. piece of DuraTuff solid flooring three times daily for 10 d post-placement.
[3] Average daily feed intake includes additional feed provided on pen mats. A total of 2.1 lb of pelleted feed was applied to mat fed pens daily for the first 10 d post-weaning.
[4] Feed-to-gain was calculated from G/F.
[5] Total gain per pig placed = (total pen weight at the end of the trial – total pen weight at the beginning of the trial) ÷ pig inventory on d 0.
ADG per pig placed = total gain per pig placed ÷ total days on trial.
Total feed intake per pig placed = total feed intake ÷ pig inventory on d 0.
ADFI per pig placed = total feed intake per pig placed ÷ total days on trial.
F/G per pig placed = total feed intake per pig placed ÷ total gain per pig placed.
[6] Pigs that were removed during the trial were followed through the end of the trial to determine outcome. All pigs in the removed population remained alive at trial completion.
[7] Total removals = removals + mortality.

Table 2. Experiment 2, main effect of feed form and mat feeding on post-weaning growth performance, removal, and mortality rates[1]

	Feed form				Mat feeding[2]			
Item	Pellet	Crumble	SEM	*P* =	No	Yes	SEM	*P* =
Count d 0	1,632	1,632	---	---	1,632	1,632	---	---
Count d 35	1,509	1,504	---	---	1,502	1,511	---	---
Body weight, lb								
d 0	12.1	12.1	0.10	0.968	12.2	12.1	0.10	0.905
d 7	13.9	13.5	0.49	0.004	13.7	13.8	0.49	0.703
d 14	18.2	17.7	0.24	< 0.001	18.0	18.0	0.24	0.648
d 21	23.2	22.6	0.44	< 0.001	22.9	22.9	0.44	0.746
d 28	29.6	28.9	0.56	0.004	29.2	29.3	0.56	0.704
d 35	37.8	37.4	1.01	0.157	37.6	37.6	1.01	0.871
d 0 to 7								
ADG, lb	0.25	0.19	0.053	< 0.001	0.22	0.23	0.053	0.494
ADFI, lb[3]	0.24	0.23	0.033	0.107	0.22	0.25	0.033	0.010
F/G[4]	0.96	1.21	0.123	0.006	1.00	1.09	0.123	0.561
d 7 to 14								
ADG, lb	0.58	0.57	0.026	0.252	0.57	0.58	0.026	0.535
ADFI, lb[3]	0.77	0.81	0.018	< 0.001	0.78	0.79	0.018	0.190
F/G[4]	1.33	1.42	0.039	< 0.001	1.37	1.36	0.039	0.938
d 14 to 21								
ADG, lb	0.70	0.69	0.027	0.239	0.71	0.69	0.027	0.062
ADFI, lb	1.00	1.05	0.030	< 0.001	1.03	1.02	0.030	0.227
F/G[4]	1.43	1.52	0.015	< 0.001	1.45	1.48	0.015	0.168
d 21 to 28								
ADG, lb	0.90	0.90	0.063	0.901	0.89	0.91	0.063	0.261
ADFI, lb	1.30	1.31	0.042	0.272	1.31	1.30	0.042	0.272
F/G[4]	1.44	1.46	0.034	0.140	1.47	1.43	0.034	0.005
d 28 to 35								
ADG, lb	1.17	1.20	0.086	0.043	1.20	1.18	0.086	0.125
ADFI, lb	1.72	1.75	0.087	0.162	1.75	1.73	0.087	0.332
F/G[4]	1.47	1.46	0.029	0.359	1.46	1.47	0.029	0.436
d 0 to 35								
ADG, lb	0.71	0.70	0.030	0.108	0.71	0.71	0.030	0.907
ADFI, lb[3]	0.99	1.02	0.041	0.013	1.01	1.00	0.041	0.855
F/G[4]	1.39	1.46	0.006	< 0.001	1.42	1.41	0.006	0.957

continued

Table 2. Experiment 2, main effect of feed form and mat feeding on post-weaning growth performance, removal, and mortality rates[1]

	Feed form				Mat feeding[2]			
Item	Pellet	Crumble	SEM	*P* =	No	Yes	SEM	*P* =
d 0 to 35, per pig placed[5]								
Total gain, lb	22.8	22.3	1.30	0.155	22.5	22.6	1.30	0.673
ADG, lb	0.65	0.64	0.037	0.187	0.64	0.65	0.037	0.699
Total feed intake, lb	33.0	33.7	1.63	0.061	33.2	33.4	1.63	0.671
ADFI, lb	0.92	0.96	0.046	0.066	0.95	0.95	0.046	0.605
F/G[4]	1.45	1.51	0.009	< 0.001	1.48	1.48	0.009	0.826
Removals, %[6]	6.7	7.1	1.46	0.627	7.2	6.6	1.47	0.527
Mortality, %	0.7	0.5	0.22	0.468	0.5	0.6	0.21	0.731
Total removals, %[7]	7.4	7.7	1.34	0.774	7.8	7.3	1.35	0.571

[1] A total of 3,264 mixed sex pigs were used with 68 pigs per feeder (2 pens) and 12 replicates per treatment.

[2] Treatment consisted of a 2 × 2 factorial design. Factor one was feed management strategies (mat feeding vs. no mat feeding), and factor two was feed forms (pellet vs. crumble). Pens of pigs assigned to the mat feeding group were provided a scoop of feed (0.35 lb pellet or 0.41 lb crumble) on an 18 in. × 24 in. piece of DuraTuff solid flooring three times daily for 10 d post-placement.

[3] Average daily feed intake includes additional feed provided on pen mats. A total of 2.1 lb of pelleted feed or 2.5 lb of crumble feed was applied to mat fed pens daily for the first 10 d post-weaning.

[4] Feed-to-gain was calculated from G/F.

[5] Total gain per pig placed = (total pen weight at the end of the trial – total pen weight at the beginning of the trial) ÷ pig inventory on d 0.
ADG per pig placed = total gain per pig placed ÷ total days on trial.
Total feed intake per pig placed = total feed intake ÷ pig inventory on d 0.
ADFI per pig placed = total feed intake per pig placed ÷ total days on trial.
F/G per pig placed = total feed intake per pig placed ÷ total gain per pig placed.

[6] Pigs that were removed during the trial were followed through the end of the trial to determine outcome. All pigs in the removed population remained alive at trial completion.

[7] Total removals = removals + mortality.

Table 3. Experiment 3, effect of mat feeding and pellet size on post-weaning growth performance, removal, and mortality rates[1]

		Mat feeding[2]			
	Control	1/8 in. pellet	1/2 in. pellet	SEM	*P* =
Count d 0	1,075	1,076	1,076	---	---
Count d 14	921	932	945	---	---
Body weight, lb					
d 0	11.3	11.4	11.3	0.20	0.822
d 7	12.0	12.2	12.2	0.30	0.623
d 14	15.1	15.3	15.5	0.58	0.313
d 0 to 7					
ADG, lb	0.06	0.08	0.08	0.045	0.391
ADFI, lb[3]	0.19[b]	0.26[a]	0.27[a]	0.016	< 0.001
F/G[4]	3.17	3.25	3.38	0.164	0.873
d 7 to 14					
ADG, lb	0.43	0.46	0.49	0.020	0.086
ADFI, lb	0.58[b]	0.63[a]	0.65[a]	0.054	0.022
F/G[4]	1.35	1.37	1.33	0.076	0.353
d 0 to 14					
ADG, lb	0.23	0.25	0.26	0.033	0.115
ADFI, lb[3]	0.37	0.43	0.44	0.038	< 0.001
F/G[4]	1.61	1.72	1.69	0.043	0.311
d 0 to 14, per pig placed[5]					
Total gain, lb	1.59	2.03	2.05	0.497	0.170
ADG, lb	0.12	0.15	0.15	0.034	0.195
Total feed intake, lb	4.56[b]	5.36[a]	5.48[a]	0.652	< 0.001
ADFI, lb	0.34[b]	0.40[a]	0.41[a]	0.032	< 0.001
F/G[4]	2.87	2.64	2.67	0.070	0.940
Removals, %	14.1	11.8	13.1	2.22	0.267
Mortality, %	0.09	0.28	0.19	0.162	0.720
Total removals, %[6]	14.2	12.1	13.3	2.19	0.329

[1] A total of 3,227 mixed sex pigs were used with 63 to 70 pigs per feeder (2 pens) and 16 replicates per treatment. Trial was cut short due to PRRS outbreak.

[2] Treatment consisted of three feed management strategies; mat feeding small (1/8 in.) pellets, mat feeding large (1/2 in.) pellets, and no mat feeding. Pens of pigs assigned to the mat feeding group were provided two scoops (0.80 lb) of feed on two 18 in. × 24 in. pieces of DuraTuff solid flooring three times daily for 10 d post-placement.

[3] Average daily feed intake includes additional feed provided on pen mats. A total of 4.8 lb of pelleted feed was applied to mat fed pens daily for the first 10 d post-weaning.

[4] Feed-to-gain was calculated from G/F.

[5] Total gain per pig placed = (total pen weight at the end of the trial – total pen weight at the beginning of the trial) ÷ pig inventory on d 0.
ADG per pig placed = total gain per pig placed ÷ total days on trial.
Total feed intake per pig placed = total feed intake ÷ pig inventory on d 0.
ADFI per pig placed = total feed intake per pig placed ÷ total days on trial.
F/G per pig placed = total feed intake per pig placed ÷ total gain per pig placed.

[6] Total removals = removals + mortality.

Table 4. Experiment 1-3, Effect of mat feeding on the removal and mortality rate of pigs post-weaning[1]

	Treatment[2]			
	Control	Mat	SEM	*P* =
Removals, %	8.6	7.3	2.52	0.022
Mortality, %	0.5	0.5	0.25	0.840
Total removals, %[3]	9.3	8.0	2.32	0.025

[1] A total of 9,403 mixed sex pigs were used with 60 to 70 pigs per feeder and 24 (Exp. 1), 12 (Exp. 2), or 16 (Exp. 3) feeders per treatment.
[2] In Exp. 1, treatments consisted of two feed management strategies; mat feeding vs. no mat feeding. In Exp. 2, treatments were arranged in a 2 × 2 factorial with main effects of diet form (pellet or crumble) and mat feeding (without or with). In Exp. 3, treatments consisted of three feed management strategies; mat feeding small (1/8 in.) pellets, mat feeding large (1/2 in.) pellets, and no mat feeding.
[3] Total removals = removals + mortality.