Performance of Barrows and Gilts in Hoop Structures and Confinement During Winter and Summer

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ASL-R680

Summary and Implications

A mixture of barrows and gilts as fed for four trials over two years in bedded hoop structures and a confinement building with slotted floors. When the central Iowa summer and winter feeding periods for two years were combined, the trials showed that as expected the barrows grew faster, had thicker backfat, smaller loin muscle areas, and lower percentage of lean than the gilts. The hoop-reared barrows and gilts grew 3% faster, but had thicker backfat (7.9% more for barrows and 6.5% for gilts) and 5% smaller loin muscle areas than their counterparts in confinement. The hoop barrows and gilts were 1.3 percentage units less lean than the confinement barrows and gilts.

During the summer, the pigs in hoops grew faster than the pigs in confinement. During the winter the growth rate was similar. These trends were consistent for both barrows and gilts. However, during the summer, the barrows had 10.6% thicker backfat and the gilts had 11.1% thicker backfat than their counterparts in confinement. In winter, the hoop barrows had 5.2% thicker backfat than the confinement barrows, but the gilts' backfat was similar. Also, during the summer, hoop barrows and gilts had 4.5–4.7% smaller loin muscle areas than their counterparts in confinement. During the winter, the hoop barrows and gilts had 5.7% smaller loin muscle areas than their counterparts in confinement. Therefore, during the summer, barrows and gilts had 1.6–1.7 percentage units less calculated lean than pigs in confinement. And during the winter, hoop gilts and barrows had 1.0–1.2 percentage units less lean than pigs in confinement.

Introduction

Growth, management, and economic and environmental information for finishing pigs in bedded hoop structures has been scarce. The Hoop Research Complex (HRC) was developed in 1997 at the ISU Rhodes Research Farm, Rhodes, Iowa, to conduct research and demonstrations related to feeding pigs in hoop structures. The HRC has three hoops and one mechanically ventilated modular confinement building with slatted floors. Comparing the two production systems provides information for improved management of finishing pigs in hoops in the Midwest.

During the winter of 1997–1998, a pretrial was conducted at the HRC. During 1998 to 2000 four trials were fed at the HRC, two summer trials (June through October/November) and two winter trials (November through April/May).

The objectives of the study were to document the performance of barrows and gilts fed in hoops during the summer and winter, and to evaluate barrow and gilt performance in hoops compared with barrows and gilts in a confinement housing system.

Materials and Methods

The summer trials started in June and the winter trials started in November of 1998 and 1999. For each trial, three groups of pigs (barrows and gilts mixed) were placed in three (30 ft x 60 ft) bedded hoop structures (150 pigs per hoop). The fourth group was placed in a mechanically ventilated modular confinement building with slatted floors with six pens (22 pigs per pen). The three hoops and confinement were filled over a three-week period or less. A total of 2,249 pigs were marketed over the duration of the four trials. The pigs weighed approximately 33-35 lb at the beginning of the trials (Table 1).

The stocking densities for finishing pigs in hoop structures was 12 ft^2 per pig and 8 ft^2 per pig in confinement. With 12 ft^2 per pig, each (30 ft x 60 ft) hoop structure was designed to hold 150 pigs. The confinement pens (13.5 ft x 13 ft) were designed to hold 22 pigs per pen. In the trials, a hoop is defined as a pen. There were three pens of hoop pigs and six pens of confinement pigs for each of the four trials. All pigs were from terminal Duroc boars crossed on predominantly white sows.

Pigs were fed five diets in phase ad libitum during the trials. All diets were corn and soybean meal based and were fed in meal form. The diets were dispensed in each hoop by two round feeders with 12 feeding spaces each. The confinement pens contained a single round feeder with eight spaces. The hoops contained two waterers with two drinking spaces each and the confinement contained four nipple waterers per pen.

The hoop structures were operated as cold facilities that used cornstalk bales for deep bedding. The north end was kept closed during the winter and the south was left open. This allowed air to be exchanged at a sufficient rate to prevent condensation on the underside of the roof. Bedding was added to maintain a relatively dry bedding pack. During summer, both ends were left open and a sprinkler system with a cycle timer was used during hot weather.

The confinement facility used a variable-speed fan to maintain a sufficient minimum ventilation rate during

winter. A propane makeup air heater was used to maintain temperature. The facility used mechanical ventilation during the summer along with a sprinkler system controlled with a cycle timer to reduce heat stress.

The pigs were weighed every 28 days. Marketing began when a pen achieved an average weight of 240 lb There were two marketings for each pen. On the first marketing, all pigs weighing 240 lb or more were marketed. At this time, the pigs were scanned for backfat and loin muscle area using real-time ultrasound by a certified technician. The pigs weighing less than 240 lb were returned to their respective pens and fed until the next marketing. When the remaining pigs in a pen averaged at least 235 lb, the second marketing occurred. All remaining pigs were marketed at this time. All pigs were transported to the Excel plant, Ottumwa, IA, for processing.

The summer trials were marketed in October and November of 1998 and 1999 and the winter trials were marketed in April and May of 1999 and 2000.

The data were analyzed using GLM model of SAS. The experimental design was a split plot with pens nested within building type. The model used the variables-year, pen, housing type, season, and gender. The number of pigs per pen was inherent to the housing system. Pens were not completely independent because of proximity to one another. Means presented are least squares means.

Results and Discussion

The performance of barrows and gilts fed in hoops and confinement for four trials during two years is shown in Table 1. The barrows and gilts grew about 3% faster in hoops than in confinement (P<.001). However, the hoop barrows had 7.9% thicker backfat than the confinement barrows, and the hoop gilts had 6.5% thicker backfat than the confinement gilts (P<.01). The hoop barrows and gilts had about 1.3 percentage units less calculated lean than the confinement barrows and gilts, respectively (P<.001).

The performance of the barrows and gilts fed in hoops and confinement for the summer and winter seasons is shown in Tables 2 and 3, respectively. During the summer, pigs fed in hoops grew faster than pigs fed in confinement. During the summer, hoop barrows grew 4.9% faster and hoop gilts grew 4.6% faster than their counterparts in confinement (P<.001). During the winter, there were no differences in growth rate (P>.25). Also, summer hoop barrows grew 9.1% faster and summer hoop gilts grew 8.3% faster than their counterparts in hoops fed during the winter (P<.001). During the summer confinement barrows grew 4.6% faster and confinement gilts grew 4.8% faster than their counterparts in confinement during the winter (P<.001).

However, pigs fed in hoops have more backfat than pigs fed in confinement. During the summer, barrows in hoops had 10.6% and gilts in hoops had 11.1% thicker backfat than their counterparts fed in confinement (P<.001). Summer hoop barrows had 18.2% thicker backfat and summer hoop gilts had 20% thicker backfat than their counterparts during the winter (P<.001). During the winter, the hoop barrows had 5.2% thicker backfat (P<.05) than the confinement barrows, but there was no difference between hoop gilts and confinement gilts (P>.69). In confinement, the seasonal differential for increased backfat was 11.9% for summer barrows (P<.05) compared to winter barrows. There was no difference for gilts summer to winter (P>.69). The values used were backfat thickness adjusted to 250 lb.

Also pigs fed in hoops have smaller loin muscle areas than pigs fed in confinement. During the summer, hoop barrows had 4.5% smaller loin muscle areas and hoop gilts had 4.7% smaller loin muscle areas than their counterparts in confinement (P<.01). During the winter, both barrows and gilts fed in hoops had 5.7% smaller loin muscle areas than their counterparts fed in confinement (P<.001). Seasonally, hoop barrows fed in summer had 8% smaller loin muscle areas and hoop gilts 6.5% smaller loin muscle areas than their counterparts fed in winter (P<.01). In confinement, the seasonal reduction in loin muscle area was 9.1% for barrows and 7.6% for gilts (P<.001). The values used were loin muscle area values adjusted to 250 lb.

Therefore, the pigs fed in hoops have a lower percentage of calculated lean than pigs fed in confinement. During the summer, hoop barrows and gilts had 1.6-1.7 percentage units less lean than their confinement counterparts (P<.001). During the winter, hoop barrows have 1.2 percentage units less lean and hoop gilts have 1.0 percentage units less lean than their confinement counterparts (P<.01). Seasonally, hoop barrows fed in summer had 3.2 percentage units less lean and hoop gilts had 2.8% percentage units less lean than their counterparts fed in winter (P<.001). In confinement, the seasonal differential was 2.7 and 2.2 percentage units less lean for summer compared with winter (P<.001).

Based on these results, barrows and gilts respond similarly to the hoop environment with faster summer growth rates, greater fat deposition, and smaller loin muscle areas. Additional research is needed to improve pig performance in hoops.

Acknowledgments

We gratefully acknowledge the support of this project by the Leopold Center for Sustainable Agriculture; the cooperation of Excel, Corp., Ottumwa, IA; M. Hoge, D. Newcom, and J. Lampe for conducting the ultrasound scans; and Chauncey Jorgensen and the ISU Rhodes Research Farm Staff, Rhodes, IA. An interdisciplinary team of researchers, including M. Honeyman and D. Lay, animal science; J. Kliebenstein, economics; J. Harmon and T. Richard, ag and biosystems engineering; and B. Thacker, veterinary medicine, supervised this project.

Table 1. Performance of barrows and gilts fed in hoops and confinement (4 trials, 2 seasons, 2 years).

	Barrows		Gilts		SEM		
Measure	Hoop	Conf	Hoop	Conf	Hoop	Conf	
Start wt., lb	34.5	33.7	34.3	34.0	.4	.3	
End wt., lb[a]	260.7	257.4	254.7	251.0	1.3	.9	
Weight gain, lb	226.2	223.7	220.4	216.9	1.2	.9	
Days on feed	124.5	125.5	126.6	127.8	.6	.4	
Adjusted days to 250[b]	166.8	167.0	171.4	172.7	.8	.5	
ADG, lb/day	1.84	1.79	1.76	1.71	.01	.01	***
Scan wt., lb	247.7	248.9	238.2	239.3	1.3	.9	
Test period, days	118.4	121.0	118.4	121.0	0	0	**
Backfat, in.	.95	.88	.78	.74	.01	.01	**
Adj. backfat, in.[b]	.96	.89	.82	.77	.01	.01	**
Loin muscle area, sq.in.	6.11	6.46	6.18	6.54	.05	.04	*
Adj. LMA, sq. in.[b]	6.15	6.48	6.37	6.72	.05	.03	***
Lean, lb/pig	93.3	96.5	93.4	96.2	.05	.04	***
Lean, %[c]	51.0	52.4	53.1	54.4	.19	.14	***
Lean gain, lb/d on test	.70	.71	.70	.71	.01	.01	
FFLI, %	49.1	50.7	51.8	53.2	.21	.15	***

SEM, standard error of the mean.

[a]End weight is the liveweight at the farm prior to shipping to the plant.

[b]Adjusted to 250 lb liveweight.

[c]Includes 0% fat, calculated with NPPC formula.

*P<.05, **P<.01, ***P<.001.

Table 2. Performance of barrows fed in hoops and confinement during summer and winter.

	Summer		Winter		SEM	
Measure	Hoop	Conf	Hoop	Conf	Hoop	Conf
Start wt., lb	33.7	35.3	35.2	32.2	0.6	0.4
End wt., lb[a]	263.3	257.8	258.1	257.1	1.8	1.3
Weight gain, lb	229.6	222.6	222.8	224.9	1.7	1.2
Days on feed	119.8	122.3	129.1	128.8	0.8	0.6
Adjusted days to 250[b]	156.6	168.0	179.0	174.4	1.1	0.8
ADG, lb/day	1.92	1.83	1.76	1.75	.01	.01
Scan wt., lb	254.4	251.7	241.4	246.1	1.9	1.3
Test period, days	116.5	119.0	120.3	123.0	0	0
Age at 250 lb, days	156.6	168.0	179.0	174.0	1.1	.08
Backfat, in.	1.06	.94	.85	.82	.02	.01
Adj. backfat, in.[b]	1.04	.94	.88	.84	.02	.01
Loin muscle area, sq. in.	5.95	6.2	6.27	6.72	.08	.05
Adj. LMA, sq. in.[b]	5.89	6.17	6.40	6.79	.07	.05
Lean, lb/pig	92.7	95.1	93.9	97.9	0.7	0.5
Lean, %[c]	49.4	51.1	52.6	53.8	0.3	0.2
Lean gain, lb/d on test	.71	.71	0.70	.72	.01	.01
FFLI, %	47.4	49.2	50.8	52.2	0.3	0.2

[a]End weight is the liveweight at the farm prior to shipping to the plant.

[b]Adjusted to 250 lb liveweight.

[c]Includes 0% fat, calculated with NPPC formula.

Table 3. Performance of gilts fed in hoops and confinement during summer and winter.

	Summer		Winter		SEM	
Measure	Hoop	Conf	Hoop	Conf	Hoop	Conf
Start wt., lb	32.7	34.8	36.0	33.3	0.6	0.4
End wt., lb[a]	256.5	251.7	253.0	250.3	1.8	1.3
Weight gain, lb	223.8	216.9	217.0	217.0	1.7	1.2
Days on feed	122.7	124.6	130.5	130.9	0.8	0.6
Adjusted days to 250[b]	161.1	165.0	181.7	180.4	1.1	0.8
ADG, lb/day	1.83	1.75	1.69	1.67	.01	.01
Scan wt., lb	241.8	241.4	234.6	237.3	1.9	1.3
Test period, days	116.5	119.0	120.3	123.0	0	0
Age at 250 lb, days	162.5	173.4	183.1	180.4	1.1	0.8
Backfat, in.	.87	.78	0.70	0.70	.02	.01
Adj. backfat, in.[b]	.90	.81	.75	.74	.02	.01
Loin muscle area, sq. in.	6.02	6.31	6.33	6.76	.08	.05
Adj. LMA, sq. in.[b]	6.15	6.45	6.58	6.98	.07	.05
Lean, lb/pig	92.4	95.1	94.4	97.3	0.7	0.5
Lean, %[c]	51.7	53.3	54.5	55.5	0.2	0.2
Lean gain, lb/d on test	.71	.71	0.70	.71	.01	.01
FFLI, %	50.3	52.0	53.2	54.4	0.3	0.2

[a]End weight is the liveweight at the farm prior to shipping to the plant.

[b]Adjusted to 250 lb liveweight.

[c]Includes 0% fat, calculated with NPPC formula.