Serial Scanning of Pigs in Bedded Hoop and Confinement Buildings During Summer and Winter for Growth, Loin Muscle Area, and Backfat: A Progress Report

A.S. Leaflet R2033

J.R. Morrical, research assistant
M.S. Honeyman, professor
Department of Animal Science

Summary and Implications

In recent years the high fixed costs of confinement swine finishing buildings, coupled with increased pressure from environmental, community, and animal welfare groups have led swine farmers to explore hoop buildings as an alternative housing system. This experiment examined the growth and development of finishing pigs in relation to housing environment, and the seasonal effects of raising finishing pigs in bedded hoop or confinement buildings using serial ultrasound measurements of backfat thickness and loin muscle area, plus serial weighing during the finishing period.

Pigs were either housed in a (9.1 × 18.3 m) hoop finishing building (designed to hold 150 pigs in one pen) or a mechanically ventilated, totally slatted confinement building (designed with six pens holding 22 pigs per pen). Feeder pigs were placed in the pens at 16 kg and were marketed at 124 kg. Pigs were randomly selected from the hoop building (n=48) and eight pigs from each of the six pens in the confinement building (n=48). All pigs were provided ad-libitum access to corn soy diets. Pigs were weighed and ultrasound images were recorded every 14 days during the last 56 days of the finishing phase. All pigs were scanned by a certified technician using an Aloka 500-V SSD ultrasound machine. Two trials were conducted—one in summer (April–August) and one in winter (October–February). Comparisons were made between hoop and confinement buildings within a season (summer and winter) and for the seasons combined. Comparisons, between seasons within building type (hoop or confinement) were also made.

Preliminary results indicate that although pigs in each building type reached a similar end weight at about the same time, hoop-fed pigs displayed more variation during the finishing period. Confinement-fed pigs in both seasons grew at a more constant rate. Environmental or seasonal variation may have more impact on growth, and fat and muscle deposition for pigs finished in bedded hoop buildings than pigs in confinement buildings. Also, differences in social structure and number of feeder holes in relation to pig number may impact appetite and feeding time causing more variation in live weight due to gut fill. Further research could be conducted to reduce the variability in growth caused in hoop buildings. Modifying diets, providing supplemental heat during the first 30 days pigs are placed in hoop buildings, and/or placing pigs into hoop buildings at heavier weights are all possible solutions that need further investigation.

Introduction

In recent years the high fixed costs of confinement swine finishing buildings, coupled with increased pressure from environmental, community, and animal welfare groups has caused producers and researchers to look for low cost alternatives to confinement swine housing. One of the alternatives currently being adopted is hoop buildings. In 1997 the Iowa State University Hoop Research Complex (HRC) was built to conduct research and demonstrate swine finishing practices in hoop buildings at the Iowa State University Rhodes Research Farm near Rhodes, Iowa. Three hoop buildings (9.1m × 18.3 m) each with capacity of 150 pigs and one conventional, mechanically ventilated, confinement building were erected to study the differences in the two swine housing systems. A hoop building is a large open air facility with a Quonset shaped structure made from a tarp pulled tightly over trusses. Four to six foot walls made from tongue and groove style boards make up the longer two sides of the hoop and the two shorter ends are open. During winter months the north end of the buildings are closed to reduce cold drafts on pigs. There is a concrete pad on one end of the structure where waterers and feeders are placed. Hoop buildings are earthen floored structures using a deep bedding pack usually of straw or cornstalks. The bedding pack is added to as needed during the finishing phase and is then completely removed after the marketing of the finishing pigs.

In this study pigs raised in hoop buildings and conventional confinement finishing units were weighed, and backfat and loin muscle area measurements were taken using an Aloka 500 ultrasound machine, five times during the last 56 days of the finishing phase. This data was used to evaluate the environmental effects on the growth as well as the deposition of lean and adipose tissue of pigs in the two housing systems.

Materials and Methods

A total of 181 finishing pigs raised in hoop buildings (n=91) and confinement buildings (n=90) were used in the experiment. For the first trial, the pigs were finished from April through August (Summer). For the second trial, the pigs were finished from October through February (Winter). Forty-eight pigs were randomly selected from the hoop

building pen for each season. Eight pigs from each of the six confinement pens were randomly selected for each trial. All pigs were finished at the Hoop Research Complex at the Rhodes Research Farm near Rhodes, IA. Dimensions of the hoop building were 9.1 × 18.3 m and held approximately 150 pigs. The hoop building was considered one pen. The confinement building housed 22 pigs per pen and each pen has an area of 4.1 × 3.96 m. At the beginning of the trial all pigs were vaccinated for erysipelas and dewormed with injectable ivermectin. At 55 kg all pigs were dewormed again with senbendazole in the feed.

All pigs for the experiment were from terminal Duroc boars crossed with predominantly white sows and were porcine reproductive and respiratory syndrome (PRRS)-negative and high health status. The groups consisted of approximately half barrows and gilts, and weaning groups were randomly assigned to housing systems. Pigs entering a building were all weaned at the same time and entered the two buildings types weighing 16 kg and were marketed at 124 kg. Pigs were harvested at a commercial packing plant (Excel Corp., Ottumwa, IA). Every 14 days, pigs selected for the experiment were weighed and scanned using an Aloka 500 V SSD ultrasound machine fitted with a 3.5-MHz, 12.5-cm linear-array transducer.

All pigs were fed the same five ad libitum diets in phase during the trials according to published nutrient guidelines. All diets were corn-soy based and fed in meal form. Two round feeders with twelve spaces each and two waterers with two spaces each were used in the hoop building. In the confinement building one round feeder with eight spaces, and four nipple waterers were used in each pen.

Results and Discussion

The results presented are preliminary means and have not been statistically analyzed. All discussion is preliminary and subject to revision based on final statistical tests.

In examining the raw data, there were some possible trends. Average daily gain may be higher for the hoop-fed pigs in summer and for confinement-fed pigs in winter. Hoop-fed pigs were slightly fatter in summer and leaner than confinement-fed pigs in winter, but confinement-fed pigs had larger average loin muscle areas for both seasons (Table 1).

Interval weight gain of the pigs raised in hoop buildings was more variable than confinement finished pigs in both seasons (Table 2). The first interval's gain for pigs fed in hoop buildings in winter was extremely low which could have been due to an abnormally cold period. Pigs fed in confinement facilities grew at a more constant rate when compared to pigs fed in hoop facilities, in both seasons, and took eight days less to reach market weight for the winter (Table 3).

Because of severe winter conditions, one scan was not completed. The rates of deposition for backfat, and loin muscle area were variable for both housing systems. There appeared to be higher compensatory rates after intervals with lower rates (Table 4).

Overall, pigs housed in hoop and confinement buildings reached a similar end weight at about the same time. However, the hoop pigs displayed more variability during the finishing period. Pigs fed in hoop facilities may grow and deposit fat and muscle at different rates when compared to pigs fed in confinement facilities. It is likely that environmental / seasonal variation may have a greater impact on growth and fat and muscle deposition for pigs finished in hoops than for the confinement-finished pigs. Many other factors like the larger pen size and pig numbers in the group may influence growth in hoop buildings. Also, social structure and number of feeder holes in relation to pig number may impact appetite and feeding time causing more variation in live weights due to gut fill.

Acknowledgments

The authors gratefully acknowledge the support of the Leopold Center for Sustainable Agriculture, the ISU Rhodes Research Farm staff, D. Newcom, M. Hoge, and A. Penner. An interdisciplinary team of researchers, including M. Honeyman, and T. Baas, animal science; J. Kliebenstein, economics; and J. Harmon, ag and biosystems engineering, supervised the project.

Table 1. Performance of pigs for summer and winter in hoop and confinement buildings.

	Summer		Winter	
	Hoop	Confinement	Hoop	Confinement
Pig no.	47	45	44	45
St. Weight, kg	16.1	16.8	15.8	15.2
End Weight, kg	117.6	116.4	123.7	123.4
Days on Test	126.1	127.4	134	126
ADG, g/day	810	790	800	850
End BF, mm	20.9	20.0	19.4	20.8
End LMA,cm^2	44.5	45.5	40.65	44.2

Table 2. Average serial weights for pigs in summer and winter in hoop and confinement buildings.

	Summer		Winter	
	Hoop	Confinement	Hoop	Confinement
St. Weight, kg	16.1	16.8	15.8	15.2
Weight 1, kg	54.2	55.8	59.5	56.3
Weight 2, kg	69.2	66.7	64.0	70.6
Weight 3, kg	81.5	79.3	80.2	84.5
Weight 4, kg	91.9	90.6	90.7	97.2
Weight 5, kg	105.0	103.7	102.0	107.3
End Weight, kg	117.6	116.4	123.7	123.4

Table 3. Interval weight gain for pigs in summer and winter in hoop and confinement buildings.

	Summer		Winter	
	Hoop	Confinement	Hoop	Confinement
Wt.1 to Wt.2, g	148	108	47	146
Wt. 2 to Wt. 3, g	124	134	167	142
Wt. 3 to Wt. 4, g	103	105	112	124
Wt. 4 to Wt.5, g	131	131	102	101

Table 4. Interval differences in ultrasound measurements for pigs in summer and winter groups in hoop and confinement buildings.

	Summer				Winter			
	Hoop		Confinement		Hoop		Confinement	
	BF, mm	LMA, cm^2	BF, mm	LMA, cm^2	BF, mm	LMA, cm^2	BF, mm	LMA cm^2
Int. 1	2.12	5.81	3.93	1.06	1.65	4.71	1.55[b]	4.52[b]
Int. 2	2.75	3.20	-0.04	5.34	1.57[a]	4.70[a]	1.55[b]	4.52[b]
Int. 3	1.71	3.07	1.65	4.84	1.57[a]	4.70[a]	2.24	6.67
Int. 4	2.72	3.23	3.40	2.80	1.43	6.41	1.76	2.27

[a] Interval differences are (Scan 4 minus Scan 2) /2.
[b] Interval differences are (Scan 3 minus Scan 1) /2.