Title: Reduced Nocturnal Temperature for Early-Weaned Pigs – **NPB #06-072**

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Industry Summary

Research in the 1980's demonstrated that nursery room temperature could be reduced 10^{o}F during the night without adversely affecting pig performance. This resulted in a significant savings in utilities without compromising pig performance. However, pigs in those studies were weaned at a much older age (24-28 days) than today's 17 days of age at weaning, and no research was available to see if the younger pig responded the same way to a reduction in night-time temperature . Therefore, the objective of this study was to determine if reducing nocturnal temperature (RNT) between 1900 and 0700 hours by 10^{o}F affected the performance of early-weaned pigs (approximately 17 days of age). A common protocol was developed and 4 universities (SDSU, U of MN, UNL, & U of MO) each ran two trials in the fall, winter or spring months. Two nursery rooms were used: 1) CON where initial temperature was 86^{o}F and then reduced 3.6^{o}F weekly through the nursery phase; and 2) RNT where on day 7 post-weaning, nocturnal temperature was reduced 10^{o}F from the CON between 1900 and 0700 hours, and then returned to CON from 0700 to 1900 hours. Performance was measured weekly in the nursery phase (35-42 d), and electrical and propane usage recorded weekly as well. SDSU data were dropped from the analysis due to a confounding factor within the building. A total of 1258 weaned pigs weighing 13.7 lbs were used in the 6 trials. Nursery average daily gain (.95 lbs/d), average daily feed intake (1.36 lbs/d), and feed/gain (1.46) were identical for the CON and RNT pigs. Heating fuel consumption (BTU/pig) was reduced by 17.4% and electrical usage (Kwh/pig) was reduced by 10.7% for the pigs in the RNT treatment. Therefore, producers can save a substantial amount of money through reduced propane and electrical costs by reducing nocturnal temperature the second week after weaning for early-weaned pigs (13.7 lbs) without affecting growth performance. Using heating fuel at $2.00/gal and electricity at $.08/kwh, that equates to a heating fuel savings of $1.55/pig ($8.81 vs $7.26) and an electrical savings of $.05/pig ($.45 vs $.40), for an overall utility savings of $1.60/pig.

Scientific Abstract

The objective of this project was to determine the effect of a reduced nocturnal nursery temperature regimen on performance of early-weaned pigs and energy consumption during the nursery phase. A common protocol was developed and 4 universities (South Dakota State University, University of Minnesota, University of Nebraska-Lincoln, & University of Missouri) each ran two trials in the fall, winter or spring months. Two nursery rooms were used and the experimental treatments were: Control (CON) room temperature in nursery (30 C at pig height at weaning lowered 2 C per week) and Reduced Nocturnal Temperature (RNT - beginning on day 7 post weaning, target temperature lowered 6 C from 1900 to 0700 from CON, then returned to CON from 0700 to 1900). Prior to day 7, CON regimen was employed in the RNT treatment as well. Performance was measured weekly in the nursery phase (35-42 d), and electrical and heating fuel usage recorded weekly. Data from SDSU were dropped from the analysis due to a confounding factor within the building. A total of 1258 weaned pigs weighing 6.2 kg were used in the 6 trials. Nursery average daily gain (.43 kg/d), average daily feed intake (.62 kg/d), and feed/gain (1.46) were identical for the CON and RNT pigs. There were no statistical differences in BTU (405,447 BTU/pig vs 334,049 BTU/pig) or Kwh usage (5.6 Kwh/pig vs 5.0 Kwh/pig) between CON and RNT treatments. However, the lack of treatment effect could have been due to the large standard error associated with these two variables. Heating fuel use (BTU/pig) was numerically reduced by 17.4% and Kwh/pig was reduced by 10.7% for the pigs in the RNT treatment. If these differences are repeatable in commercial facilities, producers can save a substantial amount of money through reduced propane and electrical costs by reducing nocturnal temperature the second week after weaning for early-weaned pigs (6.2 kg) without affecting growth performance

Introduction

As energy costs have dramatically risen the past year, pork producers are looking for ways to reduce utility costs. Since the highest temperatures are maintained in the nursery, it makes sense that this would be the first place to lower temperature. Research conducted in the 1980's has shown that nocturnal temperature can be reduced without depressing pig performance. However, this was done with pigs weaned at 28 days of age. Today, pigs are weaned at 17 days of age or less, and they are a totally different animal physiologically than one weaned at 28 days of age. Therefore, research needs to be conducted to determine if nocturnal temperatures for early-weaned pigs can be reduced without affecting growth performance or disease susceptibility.

This experiment is designed to determine the overall effect of reduced nocturnal temperatures on pig performance and energy utilization for temperature control using current energy prices. Ultimately, this project will establish a basis for determination of the optimal daytime and nocturnal ambient temperature settings for pigs in conventional nurseries from initial population to removal. Optimal temperatures are defined as nursery temperature settings that optimize pig performance through slaughter while minimizing energy costs to create maximum potential profit for pork producers.

Objective

To determine an optimal pig performance and energy consumption level for a reduced nocturnal nursery temperature regimen that will optimize pig performance and energy usage to maximize profitability for pork producers.

Materials & Methods

The two treatments were either normal nursery temperatures (CON) or Reduced Nocturnal Temperature (RNT). Initial temperature for CON was 86^{o}F and then reduced 3.6^{o}F weekly through the nursery phase. RNT was, starting on day 7 post-weaning, reducing nocturnal temperature 10^{o}F from the CON between 1900 and 0700 hours, and then returning to CON temperatures from 0700 to1900 hours. There were four Experiment Stations with 2 replicates per station (Table 1). At arrival pigs were eartagged, weighed and assigned to treatments on the basis of sex and arrival weight such that sex ratio, weight and CV were similar among pens. Weight blocks were not used. Pigs were weighed weekly during the nursery phase for computation of weight gain and feed conversion efficiencies. Utility usage was recorded weekly for each nursery room, and nursery treatments were switched between rooms for each trial. Standard nursery nutrition programs were followed at each institution, but they were not uniform among institutions. However, nutrition programs within station were uniform across CON and RNT treatments.

Data analyzed included initial weight, final weight, daily gain, feed intake, feed:gain, and BTU & Kwh usage. The model included station, treatment, replicate, and the appropriate interactions using the GLM procedure of SAS (2001).

Results and Discussion

The results are for data collected in MN, MO, and NE. Data from SD was not included because barn design confounded the results. A 20' x 30' feed room was attached to the west side of the SD barn, which protected that side of the barn from wind and lower temperatures. This meant that the east nursery was exposed to the outside environment on 3 sides and the west nursery was only exposed on 2 sides. When the CON treatment was in the west nursery, propane usage was actually less than the RNT nursery since the west room was partially insulated by the feed room. Based on that, the researchers decided to omit SD's data from the data set.

There were no treatment x location interactions (P>.20) for any of the criteria measured so only main effects are shown in Table 2. Nursery average daily gain (.43 kg/d), average daily feed intake (62 kg/d), and feed/gain (1.46) were identical for the CON and RNT pigs. Therefore, even pigs weaned < 21 days of age (6.2 kg BW) can compensate for reduced nocturnal temperatures after one week in the nursery without adversely affecting growth performance.

There were no statistical differences in BTU or Kwh usage between treatments (Table 2). However, this could be explained by several factors. First, the lack of treatment effect could have been due to the large standard error associated with these two variables. Secondly, with only six replicates per treatment for energy consumption data, there might not have been enough replicates to detect any differences. There was a significant location effect for BTU and Kwh usage ($P<.001$), and those data from individual stations are reported in Table 3.

When looking at numeric means, heating fuel use (BTU/pig) was reduced by 17.4% and Kwh/pig was reduced by 10.7% for the pigs in the RNT treatment. Using $2.00/gal for heating fuel price and $.08/Kwh, this equates to a saving of $1.55/ pig in heating fuel and $.05/pig in electricity. This relates to a total saving of $1.60/pig. Therefore, producers can save a substantial amount of money through reduced propane and electrical costs by reducing nocturnal temperature beginning the second week after weaning for early-weaned pigs (6.2 kg) without affecting growth performance.

NCERA-89 Reduced Nocturnal Temperature Study Summary

October 22, 2008

Table 1. Participation

Station	Dates	# of Pigs	# of Pigs/Room CON	# of Pigs/Room RNT	Rep
NE	12/3/2004 – 1/7/2005	118	59	59	1
	11/30/2005 – 1/4/2006	120	60	60	2
SD*	12/1/2005 – 1/5/2006	349	174	175	1
	5/19/2006 – 6/22/2006	298	149	149	2
MO	1/26/2006 – 3/9/2006	240	120	120	1
	3/16/2006 – 4/20/2006	240	120	120	2
MN	5/29/2007 – 7/11/2007	415 (270)[a]	208 (135)[a]	207 (135)[a]	1
	2/5/2008 – 3/19/2008	505 (270)[a]	253 (135)[a]	252 (135)[a]	2

* SD data is omitted from following tables due to a confounding factor within the building

[a] Number in parenthesis indicates number of pigs included in performance measures.

Table 2. Effect of Nocturnal Temperature Reduction on Pig Performance and Energy Use.[a,b]

Trait	CON	RNT	Std Error	No. of replications
Initial wt, kg	6.22	6.21	0.048	6
Final wt, kg	23.68	23.73	0.646	6
ADG, kg	0.43	0.43	0.015	6
ADFI, kg	0.62	0.62	0.021	6
F/G	1.46	1.46	0.032	6
Avg room temp, °C	26.6	25.6	0.32	6
BTU/day	1,301,464	1,075,113	159,803	6
BTU/pig	405,447	334,049	30,885	6
Kwh/day	16.8	15.2	1.17	6
Kwh/pig	5.6	5.0	0.09	6

[a] Data from MN, MO, & NE

[b] No effect of temperature regimens (P<.05).

Table 3. Effect of Nocturnal Temperature Reduction on Pig Performance by Station.[abc]

Trait	NE Control	NE RNT	MO Control	MO RNT	MN Control	MN RNT	Std Error
Initial Wt, kg	6.31	6.21	5.81	5.99	6.55	6.44	0.083
Final Wt, kg	18.89	18.80	26.29	26.54	25.86	25.86	1.12
ADG, kg	0.358	.361	0.488	.488	0.449	.454	0.027
ADFI, kg	0.569	.574	0.635	.624	0.669	.669	0.036
F/G	1.59	1.61	1.31	1.28	1.49	1.48	0.0004
BTU/Day	3,918	3,918	3,059,524	2,500,000	840,950	721,421	276,788
BTU/Pig	2,307	2,307	1,070,833	875,000	143,200	124,841	53,495
Kwh/Day	5.57	5.15	31.13	26.99	13.69	13.46	1.17
Kwh/Pig	3.28	3.03	10.9	9.45	2.54	2.50	0.09

[a] There were station effects on all variables at $P < 0.05$.

[b] There were no Trt x Location interactions ($P>.20$)

[c] Trial duration: NE = 35 days, MO & MN = 42 days.