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Environmental Effects on Growing Swine Performance

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The effects of environmental conditions on performance of growing pigs (30-50 kg) were studied over a four-week period. Pigs were exposed to natural occurring diurnal temperatures and a constant 32°C ambient temperature during normally hot weather conditions and constant 21and 10°C ambient temperature conditions during cold weather. For each temperature treatment pigs were divided into single, 9 and 18 head per pen groups. The constant 32°C ambient temperature had a significant (P<0.05) effect on average daily gain and feed intake. Average daily gains were reduced from 0.72 to 0.64 kg/d and average daily feed intake was reduced from 1.53 kg/d to 1.36 kg/d when comparing pig performance from the naturally occurring diurnal to constant 32°C temperature treatments. The 10°C cold weather treatment had no significant (P>0.05) effects on overall pig performance. Pigs from the 10°C treatment gained at a rate of 0.72 vs 0.74 kg/d for pigs in the 21°C treatment. Average daily feed intake was 1.61 kg/d for pigs at 10°C versus 1.64 kg/d for pigs at 21°C. The 9 and 18 pigs per pen group size had no significant effect on pig performance in any of the temperature treatments. Pen microenvironments varied considerably with each temperature treatment. Pig and floor surface temperatures were significantly affected by temperature and group size. During the cold weather tests the pigs housed in the single pigpens had significantly (P<0.0001) lower surface temperatures than the pigs from the 9 and 18 pigs per pen group. The objective of the study was to determine the effects of maintained warm or cold temperatures and group size on growing swine and characterize the pen environment for each condition.

(Key words: growing swine, temperature, environment, surface temperatures and group size)

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Experimental Procedure

Environmental and swine growth studies were conducted at a newly remodeled mechanically ventilated swine growing and finishing facility located at South Dakota State University's Southeast Station Experiment Farm near Beresford, SD. The growing and finishing swine research facility was divided into two 11 x 6.1 meter (m) rooms with 8 pens per room. The ventilation and heating system in each room consisted of ten (5 on each side) counter weighted bi-flo ceiling air inlets, three variable speed fans, one variable 5857-11715 watt supplemental unit heater and programmable controller. All ventilation components were commercially available and commonly used by swine producers.

Hot weather treatments consisting of three 28-day replications compared the performance of growing pigs exposed to 1) 21°C plus natural diurnal variations in ambient air temperature and 2) a steady state hot temperature condition of 32°C. These trials were conducted from June 4th to July 9th, July 16th to August 20th and from August 27th to October 1st, 1997. Pigs were acclimated for one week prior to each 28-day test period at 21°C plus any natural diurnal temperature variations. Cold weather treatments consisting of three 28-day replications compared the performance of growing pigs exposed to steady state 1) 10°C and 2) 21°C ambient air temperature conditions. The three replications of cold weather trials were conducted from November 18th to December 23rd, 1997; from January 6th to February 10th and from February 27th to March 27th, 1998. Pigs were acclimated for one week prior to each 28-day test period at a steady state temperature of 21°C.

Each room was stocked with between 60 to 69 barrows and gilts, depending on the number of pigs delivered to the site. Starting weights ranged from 20 to 30 kg. All pigs were weighed and randomly allotted in each test pen implementing light and heavy weight blocks to reduce within pen

randomly allotted in each test pen implementing light and heavy weight blocks to reduce within pen variation. The experimental design within season was a 2 x 3 factorial. Allotment of pigs in each test room included two pens (2.4x 4.6 m) stocked with 18 pigs with a pen density of 0.62 square meters (m^2) of space per pig, two pens (1.2 x 4.6 m) stocked with 9 pigs at 0.62 square meter (m^2) of space per pig and two pens (1.2 x 4.6 m) along the center dividing wall with one pig in each pen (5.5 m^2/pig) for a total of 56 pigs in each trial. The ratio of barrows to gilts in each of the 9 and 18 pigs per group test pens was kept constant (i.e. 9 pig group: 5 barrows: 4 gilts; 18 pig group: 10 barrows: 8 gilts) depending on the number of barrows and gilts delivered to the site. All single pigpens were stocked with barrows.

Results

Environmental conditions for each hot weather and cold weather treatment are shown in Tables 1 and 2, respectively. Average temperature and humidity in the 21C+ room were 25°C +/- 4°C and 61%, respectively. The ventilation system in the 21C+ room at the maximum rate of 0.05 m^3/s/pig produced air speeds of 0.4 to 0.5 m/s at pig level in the center of the pen. The ventilation system was near maximum capacity 85 percent of the time. The levels of carbon dioxide and ammonia averaged 960 ppm and 8 ppm, respectively over the 12 weeks (3 replications, 4 weeks each) of testing. Pigs in the 32C room were exposed to a constant 32°C ambient temperature at the minimum ventilation rate of 0.004 m^3/s/pig. This ventilation rate produced a low air speed of <0.15 m/s at pig level. Relative humidity averaged 56% and carbon dioxide and ammonia gas levels were 2100 and 30 ppm, respectively.

In the 21C room, the constant ventilation rate of 0.004 m^3/s/pig produced airflow rates of <0.15 m/s at pig level. Humidity, carbon dioxide and ammonia levels averaged 57%, 3390 ppm and 22.6 ppm, respectively. In the 10C room, temperature averaged 12°C due to a mild winter. However, to maintain a temperature, the ventilation rate was increased to 0.0.015 m^3/s/pig. This increase in airflow by the second stage fan generally occurred during daylight hours and was in operation 60% of the total test period. Due to the increased ventilation, average carbon dioxide (1570 ppm) and ammonia (9.2 ppm) levels were lower in the 10C room than the 21C room.

The average surface temperatures of the pig and solid floor, slatted floor and exterior wall (a.m. and p.m.) for the 28 day test period are given in Table 3. Surface temperatures were averaged over the three replications for single, 9 and 18 head pens respectively. Average hourly ambient air temperature over the three replications at 9:00 a.m. was 23.3°C and at 4:00 p.m. ambient temperature was 29.0°C.

Treatment ambient air temperatures did have a significant effect ($P<0.005$) on pig surface temperatures. Pig surface temperatures in the 21C+ treatment ranged from 35.0°C and 35.1°C for pigs in the single and 18 head pens, respectively, to 35.8°C for pigs in the 9-head pen. Average pig surface temperature in the 32C room was 39°C for single and 18 head pens and 38.8°C for the 9 pigpens. The effect of group size on pig surface temperature was non-significant. The surface temperature between all pigs for the 21C+ versus 32C group increased at a rate of 0.4°C per degree temperature change.

Average floor surface temperatures from the a.m. to p.m. time periods and between the solid surface and slatted surface differed significantly ($P<0.0001$) in the 21C+ rooms and between the 21C+ and 32C treatments. Solid surface temperatures ranged from an a.m. reading of 24.5°C to a p.m. reading of 27.1°C in the single head pens, from 28.5 to 30.3°C in the 9 head pens and from 29.1 to 30.8°C in the 18 head pens. The slatted floor average surface temperatures for a.m. and p.m. readings had increased from 24.6 to 28.5°C for the single head pens, 25.7 to 29.3°C for the 9 head pens and 25.8 to 29.4°C in the 18 head pens.

The average surface temperatures of the pig, solid and slatted floor and exterior wall from 21C and 10C treatment rooms and single, 9 and 18 head pens are presented in Table 4. Treatment ambient air temperatures and group size did have an effect ($P<0.01$) on pig surface temperature. In the 10C room, the average surface temperature of the pig ranged from 29.0°C for the single pigs, to 30.5°C for pigs in the 9-head pen and 31.7°C in the 18 head pens. Average pig surface temperatures in the 21C room were 34.3°C for pigs in the single head pen, 34.7°C for pigs in the 9-head pen, and 35.3° C for pigs in the 18 head pen. Group size did have an overall effect ($P<0.002$) on pig surface temperature. The significant differences were between the pigs in the single and 9 head pens vs. the surface temperatures from pigs in the 18 head pens.

Surface temperatures of pigs in the single head pens were 2.7° C cooler (P<0.0001) than surface temperatures of pigs in the 18 head pens. Also the surface temperatures from pigs in the 9 head pens were 1.2°C cooler (P<0.001) when compared to surface temperatures of pigs in the 18 head pens. The difference in surface temperature between pigs in the 21C room versus pigs in the 10C room was approximately 0.4°C per degree temperature change.

Floor surface temperatures during the cold weather trials were significantly affected by treatment temperatures, time of day, group size and type of floor surface. Average surface temperatures were different (P<0.0001) when comparing the a.m. to p.m. time periods, solid and slatted floor surfaces and group sizes for both temperature treatments. Differences (P<0.0001) were noted between surface temperatures on solid surface in the single pen versus surface temperatures in the 9 and 18 head pens in both the 21C and 10C rooms. Solid floor surface temperatures in the 10C room decreased (P<0.0001) from 27.9°C (a.m.) to 23.2°C (p.m.) in the 9 head pens and from 28.5 to 25.1°C in the 18 head pens. There were no decreases in surface temperature on the solid floor from the a.m. to p.m. periods in the single head pens in both the 10C and 21C rooms.

The effects of the hot weather treatments and 9 and 18 head group size on overall pig performance are presented in Table 5. Average initial weight after acclimation for pigs in the 21C+ room was 27.1 kg and for pigs in the 32C room weights averaged 26.6 kg. The weight of pigs in the 9 head pens averaged 27.0 kg and 26.8 kg for pigs in the 18 head pens after acclimation. Average starting weights after the one-week acclimation period in the 9 pig per pen groups was 27.3 kg for the barrows and 26.2 kg for the gilts. The average starting test weights in the 18 pig per pen groups were 27.3 kg for the barrows and 25.2 kg for the gilts.

The final average weight (Table 5) for all pigs (9 and 18 head groups) in the 21C+ room after four weeks of testing over the three replications was 47.1 kg. Pigs in the 32C room averaged 44.4 kg at the end of the 4-week period. Temperature had a significant effect (P<0.05) on final average weight but group size did not. Overall average daily gain (Table 5) for pigs in the 21C+ room was 0.72 kg/d vs 0.64 kg/d for pigs in the 32C room (P<0.05). Week 1 average daily gains were slightly higher (0.68 vs. 0.64 kg/d) for the pigs in the 21C+ treatment versus 32C treatment. During week 2, average daily gains drop to 0.58 kg/d for the 32C pigs and increased to 0.72 kg/day for the 21C+ pigs. Average daily gain continued to increase for the pigs exposed to the 21°C+ temperatures increasing to 0.84 kg/d for the final week of testing. Average daily gain for the pigs exposed to 32°C leveled out at 0.60 kg/day resulting in a 29 percent decrease in average daily gain during the fourth week when compared to pigs in the 21C+ room. Overall average daily gain in both rooms for pigs in the 9 head pens was 0.68 kg/d and for pigs in the 18 head pens daily was 0.67 kg/d. The differences in average daily gain for pigs between the 9 and 18 head pens were non-significant.

Average daily feed intake (ADFI) for pigs exposed to 21°C+ and 32°C ambient temperatures and for 9 and 18 head groups is shown in Table 5. Average daily feed intake between pigs exposed to 21°C+ and 32°C ambient temperatures was significantly different (P<0.05) over time. Daily feed intake increased from 1.26 kg/d during the first week to 1.74 kg/d during the fourth week for pigs exposed to 21°C+ ambient temperatures. At 32°C, daily feed intake increased from 1.19 kg/d during the first week to 1.49 kg/d during the fourth week. This represented a 14 percent decrease in daily feed intake for pigs exposed to 32°C temperature compared to 21°C+ over the last week of the tests. There were no significant differences in average daily feed intake between 9 and 18 pig/pen groups for any of the time periods investigated. Average daily feed intake for all pigs in the 9 and 18 head pens was 1.22 kg/ during the first week of testing and increased to 1.60 and 1.63 kg/d, respectively during the fourth week.

The average feed efficiencies for pigs in the 21C+ and 32C treatments and 9 and 18 head group size over the four week period are presented in Table 5. Feed efficiency was significantly (P<0.07) different when considering each of the experimental ambient temperatures over the four week time period. During week 1, feed efficiency averaged 1.79 for pigs in the 32C group and 1.99 for pigs in the 21C+ groups. During week 4, feed efficiencies increased to 2.17 for pigs in the 21C+ group and 2.46 for pigs in the 32C group. This represented a 22 percent increase in feed requirement over the four week time period when comparing pigs from the 32C group to the 21C+ group. The increase in feed requirement was due to the drop in average daily

gain for pigs in the 32C group.

Temperature effects (Table 6) during the cold weather trials on overall average daily gain over four weeks was non- significant. Overall average daily gain for pigs in the 10C room was 0.72 kg/d and 0.74 kg/d for pigs in the 21C room. Average daily gain during the first week was 0.58 kg/d for pigs in both 10C and 21C rooms. Average daily gains improved to 0.77 kg/d the second week for pigs in both test rooms and finished at 0.80 and 0.84 kg/d for pigs in the 10C and 21C rooms, respectively, during the final week of testing. The number of pigs in a pen had no significant effect on overall average daily gain (P>0.10).

Average daily feed intake (ADFI) for pigs exposed to 10 and 21°C ambient temperatures and for 9 and 18 head groups are shown in Table 6. Temperature had no effect on ADFI (P>0.10). Feed intake averaged 1.33 kg/d for the first week and increased to1.85 kg/d during the fourth week for the pigs in the 10C room. In the 21C room pigs had an ADFI of 1.33 kg/d during the first week and increased during the fourth week to 1.92 kg/d. There was no effect on feed intake when comparing the group sizes of 9 vs 18 head per pen. Average daily feed intakes during the first week were 1.33 kg/d and 1.30 kg/d for the 9 and 18 head groups, respectively.

Discussion

The pen environment is a composite of variables (ambient temperatures, surface temperatures, humidity, and airflow over the pig, gas levels and dust) that may or may not affect the well being of the pig and ultimately the pig's performance. Pigs in these studies were exposed to two environmental conditions (21°C+ and 21°C) at ventilation rates recommended by for growing swine during hot weather and cold weather conditions. The extreme condition of a constant ambient room temperature of 32°C with a low ventilation rate would be an example of a system that was either improperly designed and/or managed or because of weather conditions such as a still day and a naturally ventilated facility. The cold weather extreme with an ambient room temperature 10°C set point would primarily result from producers conserving energy during cold weather. Each of these temperature set points provided a different and unique set of environmental circumstances for the pig to modify and adapt to, which may either enhance or impede overall performance.

Pigs in the 21C+ treatment were exposed to an average temperature of 25°C with natural occurring daily diurnal variations of -4 to +5°C at the highest ventilation rate possible in this facility. The logic is to create a situation, where because of increased ambient room temperatures, the increased air flow at pig level will reduce the effective environmental temperature enough that the pig would be at thermoneutral conditions and maintain optimal levels of performance. Thus, though room temperatures in the 21°C+ room averaged 25°C, the combination of high ventilation rate and airflow at pig level should have placed pigs in this treatment group in their thermoneutral zone a majority of the time thus optimizing pig performance. The design typifies today's swine growing and finishing operations where pigs are raised from 20 kg to market weight in one facility.

The average ammonia and carbon dioxide levels in the 21C+ room at the maximum ventilation rate were 7.7 and 964 ppm, respectively. Even though the recorded levels of ammonia and carbon dioxide were below recommendations, it does raise concern, especially for ammonia because the ventilation rate was already at maximum capacity. This level of ammonia can be attributed to a manure handling system that has a sludge accumulation and dunging on the solid portion of some of the pens.

This study suggests that raising pigs in 10°C temperature environment on partially slatted floors will not alter performance for group sizes of 9 or 18 pigs per pen. Raising growing swine at reduced temperatures could improve overall air quality because of increased ventilation rates to maintain cooler temperatures and reduce heating energy costs. In the present study group size had an effect when comparing average daily gain of the single pigs to pigs in the 9 and 18 head groups between the 10C and 21C treatments. This increase in average daily gain was related to the relative increase in feed intake. Because the single penned pigs had less opportunity to modify their environment, they ate more and gained at a faster rate than their counterparts in the 9 and 18 head groups for both temperature treatments.

The significant differences in pig surface temperatures between the single penned pigs and the pigs in the 18 pigs per pen group at 10°C suggests the pigs in the18 head group were able to modify their environment by huddling on the

solid portion of the pen, increasing floor temperatures. These results, in conjunction with no additional feed intake to compensate for the cooler temperatures, will have further implications in modeling swine growth.

Implications

The relationship between optimal performance and economics will need further evaluation. If pigs are only reaching 65 to 75 percent of their genetic potential, there may be a benefit to changing management practices, but this may also increase the overall cost of production. Smaller group sizes and providing an opportunity for the pig to change its microclimate are key factors in achieving genetic potential. If optimal environmental conditions are maintained, will improved pig performance exceed the possible additional input costs?

TABLE 1. AVERAGE HOT WEATHER PEN ENVIRONMENT

	Treatments	
Item	**21C+ [a]**	**32C [a]**
Ambient Air Temp, °C	25.0 (3.5)[b]	31.7 (1.6)
Pen Surface Temp, °C	28.2 (1.8)	33.7 (1.2)
Relative Humidity, %	61.0 (6.3)	56.0 (5.9)
Ventilation Rate, m^3/s/pig	0.015 : 15%[c] 0.05 : 85%	0.004 : 100%
Airflow at Pig Level, m/s	<0.20 : 15% >0.40 :85%	<0.15 : 100%
Ammonia Level, ppm	7.7 (2.7)	30.5 (6.8)
Carbon Dioxide Level, ppm	964 (354)	2104 (857)

[a] 21C+ = 21°C plus natural diurnal variation
32C = 32°C constant temperature
[b] Standard deviation
[c] Percent of test period time (672 hrs)

TABLE 2. AVERAGE COLD WEATHER PEN ENVIRONMENT

	Treatments	
Item	**21C[a]**	**10C[a]**
Ambient Air Temp, °C	21.6 (0.3) [b]	11.75 (1.6)
Pen Surface Temp, °C	23.8 (1.8)	15.7 (2.1)
Relative Humidity, %	57 (4.6)	65 (3.4)
Ventilation Rate, m^3/s/pig	0.004	>0.015 : 60%[c] 0.004: 40%
Airflow at Pig Level, m/s	<0.15	>0.20 : 60% <0.15 : 40%
Ammonia Level, ppm	22.6 (4.3)	9.2 (2.2)
Carbon Dioxide Level, ppm	3390 (672)	1571 (441)

[a] 10C = 10°C constant
21C = 21°C constant
[b] Standard deviation
[c] Percent of test period time (672 hrs)

TABLE 3. HOT WEATHER SURFACE TEMPERATURES

Item	Time	1		9		18		Significant Treatment Effects
		21C+	32C	21C+	32C	21C+	32C	
		Temperature, °C						
Pig Surface	a.m.	35.0 (1.3)[a]	39.0 (0.5)	35.8 (0.9)	38.8 (0.7)	35.1 (0.7)	39.0 (0.7)	T[b] (P< 0.005)
Solid Surface	a.m.	24.5 (1.5)	30.8 (1.3)	28.5 (1.2)	33.2 (1.0)	29.1 (1.7)	34.5 (1.1)	T (P<0.02)
	p.m.	27.1 (1.6)	30.8 (0.9)	30.3 (1.5)	33.3 (1.0)	30.8 (1.8)	34.1 (0.9)	GS[c] (P<0.0001)[f]
								TI[d] (P<0.0001)
Slat Surface	a.m.	24.6 (1.5)	31.9 (1.4)	25.7 (2.4)	33.5 (1.7)	25.8 (1.4)	33.7 (1.8)	FS[e] (P<0.0001)
	p.m.	28.5 (1.8)	32.3 (1.0)	29.3 (2.4)	33.6 (1.3)	29.4 (1.5)	33.5 (1.3)	GS x FS (P<0.0001)[g]
								T x TI x FS (P<0.0001)[h]
Wall Surface	a.m.	23.8 (1.5)	32.3 (1.4)	24.6 (1.9)	33.5 (1.5)	24.5 (1.8)	33.3 (1.4)	
	p.m.	29.6 (1.6)	33.4 (0.5)	30.1 (2.0)	34.2 (0.7)	30.2 (2.1)	34.4 (0.8)	

[a]Standard deviation
[b]T = Treatment temperatures: 21C+ vs 32C
[c]GS = Group size: 1 vs 9 vs 18
[d]TI = Time: a.m. vs p.m.
[e]FS = Floor surface: solid vs slatted
[f]GS: 1 vs 9 and 1 vs 18 (P<0.0001) and 9 vs 18 (P<0.03)
[g]All GS x FS interactions significant (P<0.01) except slat surface in 9 and 18 head pens.
[h]All T x TI x FS interactions are significant (P<0.01) except 32C vs 32C and associated periods and floor surfaces.

TABLE 4. COLD WEATHER SURFACE TEMPERATURES

Item	Time	1		9		18		Significant Treatment Effects
		21C	10C	21C	10C	21C	10C	
		Temperature, °C						
Pig Surface	a.m.	34.3 (0.9) [a]	29.0 (1.7)	34.7 (1.1)	30.5 (1.3)	35.3 (1.2)	31.7 (1.3)	T [b] (P<0.004) GS [c] (P<0.0001)
Solid Surface	a.m.	21.9 (1.3)	14.6 (1.9)	28.7 (1.2)	27.9 (1.7)	30.4 (0.9)	28.5 (2.7)	T (P<0.004) GS (P<0.0001) TI [d] (P<0.0001) FS [e] (P<0.0001) T x GS x TI x FS (P<0.0001) [f]
	p.m.	21.5 (1.1)	14.7 (1.7)	26.6 (0.7)	23.2 (2.4)	28.8 (0.9)	25.1 (3.2)	
Slat Surface	a.m.	19.1 (1.4)	10.0 (1.7)	21.5 (2.8)	9.4 (1.7)	22.8 (4.0)	9.8 (2.0)	
	p.m.	19.2 (1.4)	11.1 (2.1)	20.4 (2.2)	10.7 (2.1)	22.1 (3.2)	11.2 (2.0)	
Wall Surface	a.m.	18.9 (1.0)	8.7 (1.5)	20.4 (1.4)	9.4 (1.5)	21.0 (1.8)	9.9 (1.6)	
	p.m.	19.6 (1.1)	10.5 (2.3)	20.8 (1.2)	11.6 (2.4)	21.5 (1.4)	12.0 (2.2)	

[a] Standard deviation
[b] T = Treatment temperatures: 21C vs 10C
[c] GS = Group size: 1 vs 9 vs 18
[d] TI = Time: a.m. vs p.m.
[e] FS = Floor surface: solid vs slatted

		Solid	Slatted			Solid	Slatted
[f] 10C: 1 vs 9	a.m.	P<0.01	NS [g]	21C: 1 vs 9	a.m.	P<0.01	P<0.05
	p.m.	P<0.01	NS		p.m.	P<0.01	NS
1 vs 18	a.m.	P<0.01	NS	1 vs 18	a.m.	P<0.01	P<0.01
	p.m.	P<0.01	NS		p.m.	P<0.01	P<0.01
9 vs 18	a.m.	NS	NS	9 vs 18	a.m.	NS	NS
	p.m.	P<0.01	NS		p.m.	P<0.01	NS

[g] Non-significant (P>0.10)

TABLE 5. EFFECT OF HOT TEMPERATURE TREATMENTS AND GROUP SIZE ON OVERALL PIG PERFORMANCE

	Temperature		Pigs/Pen (0.62 m2/pig)				Treatment Effects	
			9		18		Pigs/Pen (GS)[b]	
Item	21C+[a]	32C[a]	21C+	32C	21C+	32C	Temp (T)	
Number of pens	12	12	6	6	6	6		
Pig weight, kg								
Initial	27.1 (6.75)[c]	26.6 (6.3)	27.4 (7.0)	26.6 (6.1)	27.0 (6.7)	26.6 (6.4)		
Final	47.1 (8.2)	44.0 (7.1)	47.4 (8.1)	44.1 (6.8)	46.7 (8.1)	44.0 (7.3)	NS[d]	P<0.05
Average Daily Gain, kg/d	0.72 (0.11)	0.64 (0.09)	0.72 (0.12)	0.64 (0.11)	0.72 (0.11)	0.63 (0.09)	NS	P<0.05
Average Daily Feed, kg	1.53 (0.18)	1.36 (0.15)	1.54 (0.21)	1.36 (0.16)	1.53 (0.16)	1.35 (0.15)	NS	P<0.05
Feed /Gain	2.10 (0.26)	2.18 (0.31)	2.10 (0.30)	2.21 (0.36)	2.10 (0.22)	2.17 (0.24)	NS	NS
Backfat, mm	6.4 (1.8)	6.1 (1.7)	6.5 (2.1)	6.1 (1.6)	6.5 (1.9)	6.2 (1.7)	NS	P<0.11

[a]21C+=21°C diurnal; 32C=32°C constant
[b]GS: Group Size (pigs/pen) 9 or 18
[c]Standard deviation of treatment mean
[d]Non significant (P>0.1)

TABLE 6. EFFECT OF COLD TEMPERATURE TREATMENTS AND GROUP SIZE ON PIG PERFORMANCE

	Temperature		Pigs/Pen (0.62m2/pig)				Treatment Effects	
			9		18		Pigs/Pen (GS) [b]	
Item	21C [a]	10C [a]	21C	10C	21C	10C	Temp (T)	
Number of pens	12	12	6	6	6	6		
Pig weight, kg								
Initial	28.0 (6.2) [c]	28.0 (6.2)	28.1 (6.1)	28.1 (6.3)	28.0 (6.3)	27.9 (6.2)	NS [d]	NS
Final	49.1 (10.1)	48.2 (10.1)	48.8 (10.2)	48.2 (9.7)	49.0 (10.1)	48.1 (10.2)	NS	NS
Average Daily Gain, kg/d	0.74 (0.16)	0.72 (0.16)	0.73 (0.17)	0.71 (0.15)	0.75 (0.16)	0.73 (0.17)	NS	P<0.06
Average Daily Feed, kg	1.64 (0.29)	1.61 (0.32)	1.65 (0.28)	1.63 (0.31)	1.62 (0.32)	1.60 (0.35)	NS	NS
Feed Gain	2.22 (0.23)	2.26 (0.22)	2.28 (0.24)	2.29 (0.22)	2.17 (0.20)	2.24 (0.22)	NS	NS
Backfat, mm	7.7 (2.6)	6.8 (2.4)	7.7 (2.8)	7.0 (2.3)	7.8 (2.6)	6.7 (2.6)	NS	NS

[a]21C+=21°C constant; 32C=32°C constant
[b]Group Size (pigs/pen) 9 or 18
[c]Standard deviation of treatment mean
[d]Non-significant (P>0.10)