

## ANIMAL WELFARE

**Title:** The influence of small versus large pens on the welfare of the grow-finisher pig (revised)

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### Industry Summary

Industry accounts have suggested that growth performance traits and morbidity / mortality may be compromised when pigs are reared in large pen configurations. Therefore, the objective of this study was to determine the effects of small (34 pigs per pen) versus large (272 pigs per pen) pen configurations on the performance, behavior and welfare of the pig during the grow-finish period. Overall pigs in the small pen configuration had better performance measures and improved lesion scores compared to pigs housed in the large pen configuration. The drug cost for small penned pigs was lower, and opening up small to large pens did not adversely affect their resource management behavior. Applying this knowledge to the commercial swine industry may yield several advantages for the producer; including decreased feed costs and fewer days for pigs to reach market weight.

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### Scientific Abstract

In 2004, the National Pork Board conducted a workshop to review the current scientific literature pertaining to the welfare of the finisher pig during transportation. The scientific experts concluded that “*At the farm, major factors impacting behavioral and physiological responses of the pig during transport include genetics, slaughter weight, environmental conditions (temperature and humidity), health status, marketing strategy, time off feed, pre-transport experiences, **facility design**, and nature of handling during loading*” (Ritter et al., 2005). Industry accounts have suggested that growth performance traits and morbidity / mortality

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may be compromised when pigs are reared in large pen configurations. Therefore, the objective of this study was to determine the effects of small (32 pigs per pen) versus large (256 pigs per pen) pen configurations on the performance, behavior and welfare of the pig during the grow-finish period. One wean-to-finish site within a large Midwestern commercial production system was used for both replications. The site was divided into two naturally tunnel ventilated buildings that each had two rooms. Each room had fully slatted concrete floors, an 81 cm-wide center aisle, and pens (7.1 m long  $\times$  3.2 m wide) that provided 0.69 m<sup>2</sup>/pig of pen floor space. Pens were divided by steel gates (91 cm height), and the back gates of each pen had the ability to swing freely or to be locked in a closed position. Pigs were fed a standard grow-finish diet that met or exceeded the nutritional requirements of the pigs for each phase/weight (NRC, 1998). Feed was delivered on demand to a dry four hole feeder and two nipple cup bowl drinkers were located in each pen. Pigs were observed daily at 0800 h to ensure pig health and facility maintenance. The protocol for this experiment was approved by the Iowa State University Institutional Animal Care and Use Committee (4-09-6716-S). Two treatments were compared a small pen treatment (SP) and a large pen treatment (LP). In both treatments there was the same number of pigs ( $n = 35$  / pen) with the same space allowance (0.69 m<sup>2</sup>/pig of pen floor space). Both treatments were represented in each room. All pigs were kept in smaller pen configurations for ~8 wks and then the back gates of eight consecutive small pens were opened to form one large pen. Pens were mixed sexed and when the first market group of pigs reached targeted market weight in both treatments the trial was terminated. The following measures were collected; climate, (relative humidity and temperature). Performance (start and end weights, ADG, removals, death and drug usage). Behavior (total of 192 pigs in double-stocked pens (96 barrows and 96 gilts), live observations using an instantaneous 10 min scan sample for 2-hour duration (0800 to 1000-h). Pigs received a unique colored ear tag in their left ear ( $n = 4$  barrows and 4 gilts per small pen that would be opened to a large pen). The number of pigs at their home feeder or home drinker was recorded along with pigs that were using a new feeder and new drinker respectively. Lesions (total of 316 pigs [158 per treatment; 79 barrows and 79 gilts]) were lesion scored. Each candidate pig was identified by sex and market weight. These pigs were then visually assessed by two observers and once scored; the pig received a mark on their back with an animal safe paint stick. Lesions were defined per the PQA Plus definition of skin lesions (NPB, 2007). The pig's body was divided into 4 regions. Region 1 was the head, jowl and neck, including the snout and ears. Region 2 was the withers, shoulders and front legs. Region 3 consisted of the trunk of the pig, which included the back, chest, loin, abdomen and flank. Region 4 was the rump, thigh and back legs. Each region received a score of 0 to 3. A 0 indicated there were no lesions present in that region of the gilt. A score of 1 indicated there were 1 or 2 lesions in that region. A score of 2 indicated 3 or 4 lesions present, and a score of 3 indicated that there were 5 or more lesions present. Small penned pigs had a higher ADG ( $P = 0.004$ ) and overall gain ( $P = 0.05$ ) than large penned pigs. The average temperature over the trial (9 April to August 2009) was fairly consistent, ranging

between 23.2 and 23.9 °C respectively. This temperature was on the upper end of the optimal thermal environment recommended for a grow-finish pig in the Swine Care handbook (2003). Relative humidity varied more from 47.2 % in May to 70.9 % in August. Pigs raised in small pens throughout the grow-to-finish period had a higher average daily gain ( $P = 0.004$ ) and overall gain ( $P = 0.05$ ) compared to pigs in the large pen configurations. Within the first 2-h, pigs did not prefer to visit their “home feeder and drinker but the majority of pigs at each scan sample were engaged in other behavioral activities within their home pen. When comparing treatment within region, pigs in the large pen design scored higher or more severe lesions over the head (region 1), withers, shoulders and front legs (region 2), trunk of the pig, which included the back, chest, loin, abdomen and flank (region 3) and rump, thigh and back legs (region 4). A total of 24 pigs died on trial. 15 pigs died in the large pen (0.47%) and 9 pigs died in the small (0.28%). A total of 39 pigs were removed off trial and placed into hospital pens. A total of 23 pigs were removed from the large pen (0.72%) and 16 were removed from the small pens (0.50%). The cost for drugs used over this trial was \$127.63 vs. \$95.47 for larger vs. small. Applying this knowledge to the commercial swine industry may yield several advantages for the producer; including decreased feed costs and fewer days for pigs to reach market weight.

**Key words:** behavior, grow-finish pigs, health, lesions, pen design, performance

## Introduction

Transportation losses of market weight pigs (dead and non-ambulatory pigs) represent multiple challenges for the entire U.S. food chain. First, improving the welfare of the finisher pig during transport and reducing the incidence of dead and non-ambulatory pigs has become an animal welfare priority (NPB, 2007). Market hog mortalities from the farm to the harvest facility are typically called dead on arrivals (DOA's), and mortalities at the harvest facility are typically referred to as dead in plant (DIP's). Industry statistics reported for Dead on Arrival at plants in 2004 was 0.23 % of pigs marketed were lost, and incidence of Dead in Plant was reported at 0.17 % (Hill, 2004). Non-ambulatory pigs at the packing plant are defined as pigs unable to move or keep up with contemporaries at the packing plant and can be classified into two distinct groups; fatigued or injured. Ritter et al. (2008) calculated weighted averages across 17 field studies ( $n = 2,913,417$  pigs) for the fatigued (0.24 %; range: 0.05 % to 1.98 %) and injured (0.06 %; range: 0.04 % to 0.45 %), and this suggests a 4 to 1 ratio of fatigued to injured pigs. Second, non-ambulatory livestock are being considered for increasing rules and regulations (Down Animal Protection Act; U.S. House of Representatives Bill H.R. 661 and U.S. Senate Bill S. 394) and third, transport losses represent direct financial losses to pig producers and pork packers as dead and non-ambulatory pigs have been estimated to cost the U.S. swine industry approximately \$50 to \$100 million annually (Ellis et al., 2003). Known identified stressors are: *group size* (Street and Gonyou, 2007);

caretaker to pig interactions (McGlone et al., 2004; Ritter, 2006; Stewart et al., 2008), pre-sorting (Chevillon, 2000; Tarrant, 1989), loading chute angle (van Putten and Elshof, 1978; Warris et al., 1991) and length (Berry et al., 2007a, b) lighting patterns (Phillips et al., (1987) and floor surface (Applegate et al., 1988). In 2004, the National Pork Board conducted a workshop to review the current scientific literature pertaining to the welfare of the finisher pig during transportation. The scientific experts concluded that “*At the farm, major factors impacting behavioral and physiological responses of the pig during transport include genetics, slaughter weight, environmental conditions (temperature and humidity), health status, marketing strategy, time off feed, pre-transport experiences, **facility design**, and nature of handling during loading*” (Ritter et al., 2005).

Auto-sort technologies offer producers many potential advantages over conventional finishing buildings in regards to minimizing stress on the pigs during loading and transportation. In conventional finishing buildings, pigs are placed into pens of 25 to 30 pigs as weaner or feeder pigs, and usually these pigs do not leave their pens until they are marketed. As a result, pigs marketed from conventional finishing buildings have limited exercise and changes to their environment during rearing. On the other hand, auto-sort barns utilize large group sizes (~500 pigs), allow pigs to move freely throughout the building, weigh pigs daily prior to entering food courts, identify market weight pigs, and sort market weight pigs into a loading pen by the barn exit prior to loading. In theory, auto-sort systems may reduce transport losses because pigs are not sorted from pen mates during loading, not moved long loading distances, and are not mixed during transport. Recent survey data has in fact suggested that auto-sort systems may reduce transport losses (Brumsted, 2004; Rademacher and Davies, 2005).

Despite the potential reduction on dead and non-ambulatory pigs, many pork producers have expressed frustration with auto-sort systems due to the learning curve of the software, the time required to train the pigs, the up keep of the system, difficulties associated with identify and treating sick pigs, and potentially negative effects on growth performance traits (Gonyou and Whittington, 2006). Therefore, several large production systems in the U.S. are currently utilizing large pen configurations ( $\geq 200$  pigs / pen) during the grow-finish period and site personnel are manually pre-sorting market weight pigs from pen mates prior to loading by using internal swing gates. Industry accounts have suggested that this is an effective approach to reduce transport losses at the packing plant, but controlled research is necessary to confirm these reports.

Johnson et al., (2010) conducted a controlled study under commercial conditions in which small pens (32 pigs / pen) not pre-sorted the day before transportation, were compared versus large pens (192 pigs / pen) that were pre-sorted the day before loading. Both facility design treatments were compared within each barn and each trailer load of pigs. This work demonstrated that utilizing large pens and pre-sorting prior to loading, reduced physical signs of stress during loading and unloading, and reduced transport losses at the plant by 66 % compared to pigs from traditional finisher pens. However this work was confounded and so Gesing et al.,

(2010) compared large pre-sort vs. large no pre-sort and large vs. small no pre-sort to tweak apart these confounding factors. Gesing et al., (2010a) reported that when pigs were pre-sorted the loading time differed ( $P < 0.01$ ) between treatments with NON (no-presort) taking longer to load compared to PRE (pre-sorted). During loading, PRE pigs had fewer ( $P < 0.01$ ) incidences of open mouth breathing and skin discoloration compared to NON pigs. However, the incidence of muscle tremors and non-ambulatory pigs at loading and open mouth breathing, skin discoloration, and muscle tremors at unloading were not ( $P > 0.05$ ) different. There were no ( $P > 0.05$ ) differences between treatments for total losses at the harvest facility. Two PRE and zero NON pigs were classified as dead on arrival. In conclusion, the authors noted that pre-sorting market weight pigs reduced loading time and some stress responses on farm; however, there were no observed treatment differences for stress responses or transport losses at the harvest facility. Gesing et al., (2010b) compared small (SP) and large pens (LP). The SP treatment group had 36 pigs / pen, while the LP treatment group had 324 pigs / pen. Floor space and feeder space were standardized across treatments. Market weight pigs from both treatments were sorted from pen mates at the time of loading. Loading time differed ( $P < 0.01$ ) between treatments with LP taking longer to load compared to SP. The SP pens had lower ( $P < 0.01$ ) incidences of open mouth breathing (OMB) and skin discoloration (SD) during loading compared to LP, but there were no differences ( $P < 0.05$ ) in the incidence of muscle tremors (MT) or non-ambulatory pigs at loading. At the harvest facility, LP had a lower incidence of SD ( $P < 0.01$ ) than SP; however, there were no differences ( $P < 0.05$ ) between treatments for OMB or MT. There were no differences between treatments for fatigued, total non-ambulatory, or total losses. Two LP and no SP were classified as injured and no pigs from either treatment were dead on arrival. In summary, there appears to be no pen size effect on the incidence of transport losses.

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## **Objectives**

To determine the effects of small (34 pigs per pen) versus large (272 pigs per pen) pen configurations on the performance, behavior and welfare of the pig during the grow-finish period.

## **Materials and Methods:**

### ***Animals, housing and feeding***

One wean-to-finish site within a large Midwestern commercial production system was used for both replications. The site was divided into two naturally tunnel ventilated buildings that each had two rooms. Each room had fully slatted (2.5 cm wide  $\times$  1.3 m long) concrete floors, an 81 cm-wide center aisle, and pens (7.1 m long  $\times$  3.2 m wide) that provided 0.69 m<sup>2</sup>/pig of pen floor space. Pens were divided by steel gates (91 cm height), and the back gates of each pen had the ability to swing freely or to be locked in a closed position. This feature allowed the investigators to make single pens or to combine multiple pens. Pigs were fed a standard grow-finish diet that met or exceeded the nutritional requirements of the pigs for each phase/weight (NRC, 1998). Feed was delivered on demand to a dry four hole feeder (91 cm high  $\times$  53 cm wide  $\times$  1.4 m long, with a 15 cm-deep pan; Nol Thorp Equipment, Inc. Stainless Steel N14160 County Rd M, Thorp, WI 54771-7715). Two nipple cup bowl drinkers were located in each pen. The drinkers were 20 cm long and 30 cm high. Pigs were observed daily at 0800 h to ensure pig health and facility maintenance. The protocol for this experiment was approved by the Iowa State University Institutional Animal Care and Use Committee (4-09-6716-S). The experiment was conducted in April, 2009.

### ***Treatments***

Four rooms were on site and each room housed 1200 hd. For both replications, within each room one side of the aisle was set-up with the small pen treatment (SP) while the other side was set-up with the large pen treatment (LP). In both treatments there was the same number of pigs ( $n = 34$  / pen) with the same space allowance (0.69 m<sup>2</sup>/pig of pen floor space). Therefore, both treatments were represented in each room. All pigs were kept in smaller pen configurations for ~8 wks and then the back gates of eight consecutive small pens were opened to form one large pen. Pens were mixed sexed and when the first market group of pigs reached targeted market weight in both treatments the trial was terminated.

### ***Climate***

Relative humidity (%) and temperature ( $^{\circ}$ C) were monitored by a computerized system (Varilink/IC-610 controller system) located within each room of the facility. The computerized system automatically recorded hourly information and the data was stored onto an excel sheet. Means, standard deviations, minimum and maximum temperatures and relative humidity will be calculated and these values will be presented descriptively.

### ***Performance***

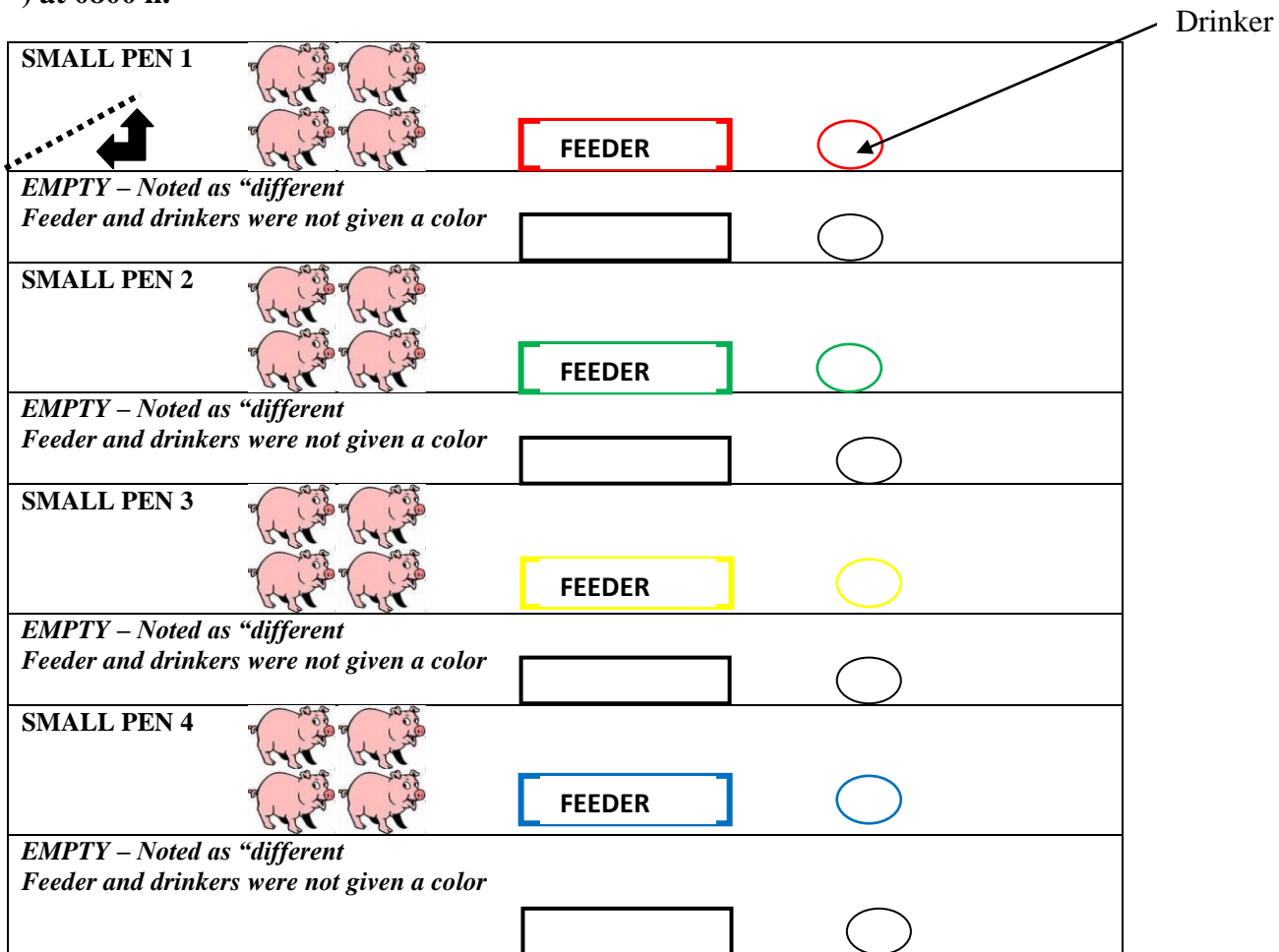
A total of 6,528 crossbred pigs were used (two trials from April to August and August to December 2009). SP;  $n = 96$  pens [34 pigs/pen]), while the other side was set-up with the large pen treatment (LP;  $n = 12$  pens [272 pigs/pen]). Pigs were weighed at the beginning of the trial (~wk 8 post-weaning) and when the first

pigs in both treatments had reached the target market weight (~wk 24 post-weaning). Starting and ending weights and average daily gain (ADG) on a pen basis over the grow-finish period were calculated. To weigh the small pens, all pigs in the small pen were moved using sort boards and paddles, down the center aisle and onto a weigh scale that measured 6 m long x 3 m wide with 91 cm high sides (Central City Scale Model 640, Central city NE). Swing gates in the large pens were used to split large pen pigs into smaller groups to be handled and moved to the weigh scale as previously described for the small pens.

### ***Behavior***

SP; n = 48 pens [34 pigs/pen]), while the other side was set-up with the large pen treatment (LP; n = 6 pens [272 pigs/pen]). After beginning weights were taken on all pigs (April to August 2009), and the day before the swing gates were opened up for the LP configuration a total of 192 pigs in double-stocked pens (96 barrows and 96 gilts) received a unique colored ear tag in their left ear (n = 4 barrows and 4 gilts per small pen that would be opened to a LP). The feeder and drinkers in that respective SP were marked with the same color as the pigs ear tag (n = 4 colors / “same” and n = 4 not colored or “different”). Immediately upon opening up the swing gates, live observations occurred using an instantaneous 10 min scan sample for 2-hour duration (0800 to 1000-h). The number of pigs at their home feeder or home drinker was recorded along with pigs that were using a new feeder and new waterer respectively. All other marked pigs that were not at a feeder or waterer were categorized as “other”.

**Figure 1. Schematic diagram from small to large pen configuration. Pigs were ear tagged the same color as their feeders and drinker (same). Empty pens did not receive a color. Swing gates were opened ( ) at 0800 h.**

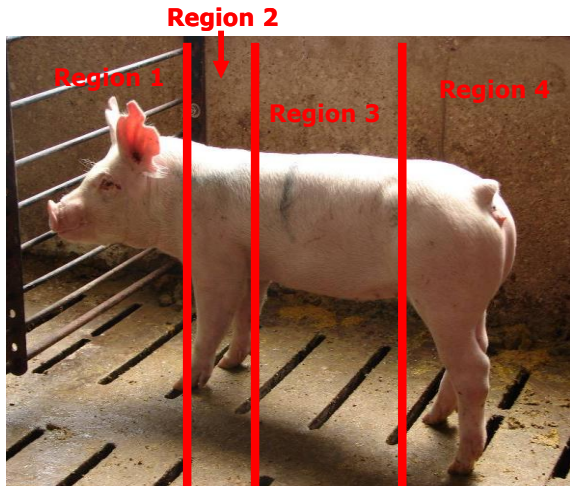


### ***Lesion scores***

SP; n = 48 pens [34 pigs/pen], while the other side was set-up with the large pen treatment (LP; n = 6 pens [272 pigs/pen]). The day before pigs (April to August 2009) were weighed a total of 316 pigs (158 per treatment; 79 barrows and 79 gilts) were lesion scored. Briefly, each candidate pig was identified by sex and market weight. These pigs were then visually assessed by two observers and once scored; the pig received a mark on their back with an animal safe paint stick. Lesions were defined per the PQA Plus definition of skin lesions (NPB, 2007), as “...breaks that completely penetrate the skin, such as bites or other lesions that penetrate through the skin.” A lesion was included in the count if the scab was tightly adhered to it and covered it. If the scab was ready to fall off it was not included. Gilts were scored for all lesions present on the visible portions when standing (e.g., lesions on the underbelly or inside the ears, which are not normally visible on standing pig would not have been included). The pig’s body was divided into 4 regions. ***Region 1*** was the head,

jowl and neck, including the snout and ears. **Region 2** was the withers, shoulders and front legs. **Region 3** consisted of the trunk of the pig, which included the back, chest, loin, abdomen and flank. **Region 4** was the rump, thigh and back legs. Each region received a score of 0 to 3. A 0 indicated there were no lesions present in that region of the gilt. A score of 1 indicated there were 1 or 2 lesions in that region. A score of 2 indicated 3 or 4 lesions present, and a score of 3 indicated that there were 5 or more lesions present (Figure 2).

**Figure 2. Photograph to demonstrate the regions on the gilt.**



### ***Health and removal***

SP; n = 48 pens [34 pigs/pen]), while the other side was set-up with the large pen treatment (LP; n = 6 pens [272 pigs/pen]). The number of pigs that died on trial was recorded (April to August 2009). The date, room, pen, sex, weight and reason were collected on all pigs that were removed and re-housed into a hospital pen. (1) **skin** defined as PDNS-PCV 2, Erysipelas, greasy pig and purple ears (2) **respiratory** defined as pneumonia, A. suis / APP and HPS / Strep (3) **gut** defined as Ileitis acute, ulcer. HBS and diarrhea and (4) **other** defined as fallout, injury, lame, rupture, blind anus and stress. The number of pigs that were removed from the home pen whilst on trial was collected. Pigs that were removed were not placed back onto trial. The date, room, pen, sex, weight and reason were collected on all pigs that were removed and re-housed into a hospital pen. The reason for removal was assigned to one of eleven categories which was the Standard operating procedure on the farm. These categories were; fallout, prolapse, rupture, lameness, respiratory, strep, greasy pig, flank bit, purple pig, spots and down. Finally, when a pig was identified within their home pen as requiring medication, five types of drugs could be utilized by the veterinarian, and these were Excede, Excenel, penicillin, Dex and Duramycin.

## *Statistical Analysis*

The experimental design for this trial was a complete randomized block design. Block was pen and pen was the experimental unit. Performance data were evaluated for normality of distribution, an assumption of ANOVA, before analysis using UNIVARIATE procedure (SAS Institute Inc., Cary, NC). Data met the assumption of normality and was run using the PROC MIXED procedure of SAS. Treatment (large vs. small pen) and block (n = 12) were used in the class statement. The statistical main plot model included the parameters of interest (ADG and gain) and the fixed effect of treatment with the random effect of block. Pig starting weight on trial was used as a linear covariate but this was not significant ( $P = 0.53$ ) therefore, this was removed from the final model. Lesion data were evaluated for normality of distribution, an assumption of ANOVA, before analysis using UNIVARIATE procedure (SAS Institute Inc., Cary, NC). A Poisson distribution was noted and used in the evaluation using the GLIMMIX procedures. Further, the I-Link option was used to transform the mean and standard error values back to the original units of measure. Treatment (large vs. small pen), sex (barrow vs. gilt), pen and room (1 to 4) were used in the class statement. The statistical main plot model included the parameters of interest (region on the pig for lesions) and the fixed effect of treatment sex and the interaction. Random effect of room nested with pen by treatment was used. Sex and the interaction were not significant and were therefore removed from the final analysis. A value of  $P < 0.05$  was considered significant. For the number of pigs treated (not the sex), the dose amount and cost per dose (drugs) removal, death and behavior all will be presented descriptively.

## **Results**

### *Climate*

The average temperature over the trial (April to August 2009) was fairly consistent, ranging between 23.2 and 23.9 °C respectively. This temperature was on the upper end of the optimal thermal environment recommended for a grow-finish pig in the Swine Care handbook (2003). Relative humidity varied more from 47.2 % in May to 70.9 % in August (Table 1).

**Table 1. Indoor environmental measurements for the commercial nursery facility<sup>1</sup>**

Parameter	Month				
	April	May	June	July	August
<i>Air temperature, °C</i>					
Minimum <sup>2</sup>	20.6	21.6	20.9	19.9	20.2
Maximum <sup>3</sup>	29.3	32.6	33.2	29.3	29.1
Average	23.9	23.9	23.9	23.2	23.7
<i>Relative humidity, %</i>					
Minimum <sup>4</sup>	31.3	21.5	21.8	41.8	47.3
Maximum <sup>5</sup>	71.5	72.0	90.0	87.3	90.0
Average	53.9	47.2	61.4	65.4	70.9

<sup>1</sup>Study was conducted in Iowa from April to August 2009.

<sup>2</sup>average minimum daily temperature, °C

<sup>3</sup>average maximum daily temperature, °C

<sup>4</sup>average minimum relative humidity, %

<sup>5</sup>average maximum relative humidity, %

### ***Performance***

Pigs raised in small pens throughout the grow-to-finish period had a higher average daily gain ( $P = 0.004$ ) and overall gain ( $P = 0.05$ ) compared to pigs in the large pen configurations (Table 2).

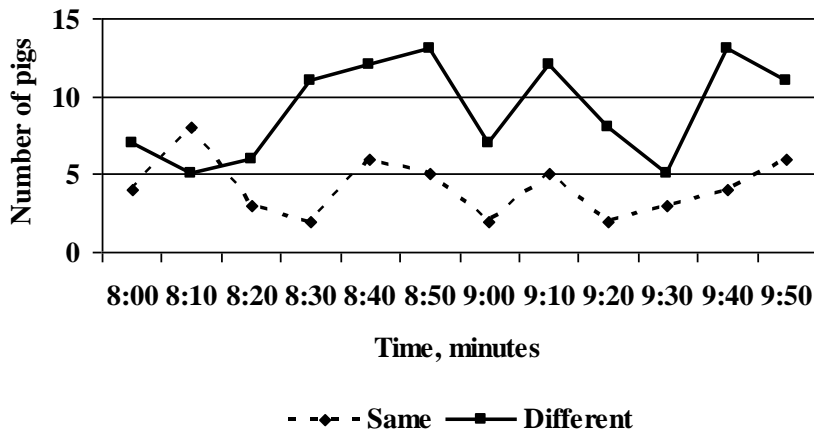
**Table 2. Performance measures for pigs when housed in small versus large pens over the grow-finish phase of production.**

Measure	Treatment		<i>P</i> -value
	Large	Small	
No. pens	12	96	
Start, kg	28.8 ± 4.6	29.2 ± 4.6	0.53
End, kg	102.7 ± 1.8	106.5 ± 1.8	0.02
ADG, kg / d	0.80 ± 0.009	0.83 ± 0.009	0.004
Gain, kg	73.9 ± 3.1	77.3 ± 3.1	0.05

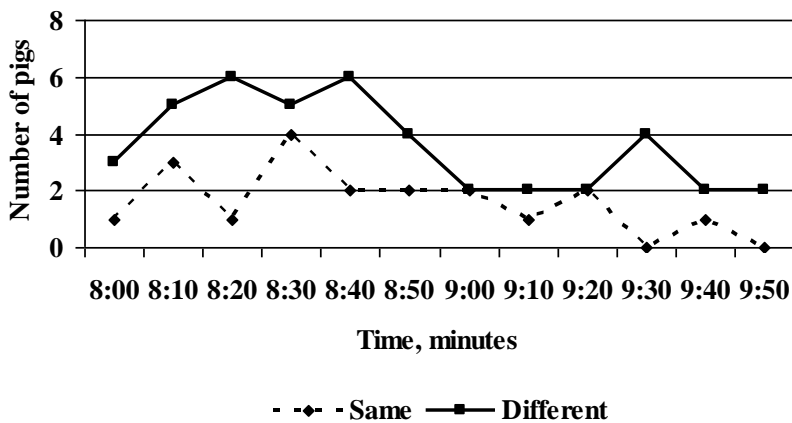
**Behavior**

Within the first 2-h, pigs did not prefer to visit their “home feeder (Figure 3) and drinker (Figure 4). The majority of pigs at each scan sample were engaged in other behavioral activities within their home pen (Figure 5).

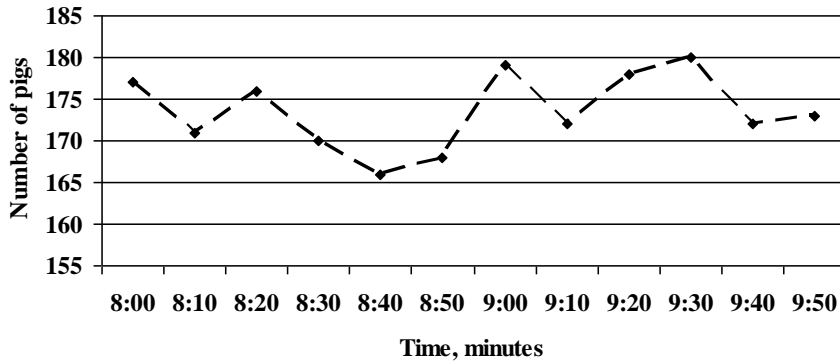
**Figure 3. Feeder activity for growing pigs when small pens were opened up into one large pen.**



**Figure 4. Drinker activity for growing pigs when small pens were opened up into one large pen.**



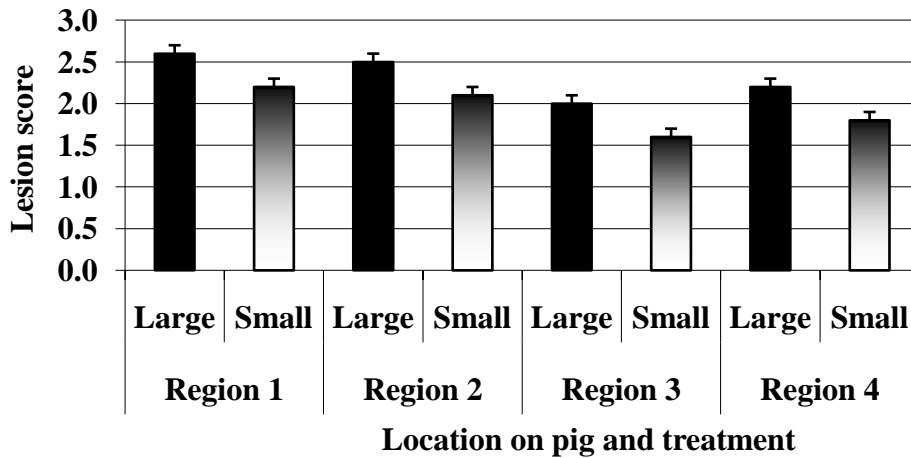
**Figure 5. Other pig behavior within the pen when small pens were opened up to make one large pen.**



***Lameness and injury scores***

When comparing treatment within region, pigs in the large pen design scored higher or more severe lesions over the head (region 1), withers, shoulders and front legs (region 2), trunk of the pig, which included the back, chest, loin, abdomen and flank (region 3) and rump, thigh and back legs (region 4; Figure 6).

**Figure 6. Lesion score severity for pigs when housed in small versus large in the grow-finish phase. Differences ( $P < 0.05$ ) between region and housing system.**



***Health and removal***

A total of 24 pigs died on trial. 15 pigs died in the large pen (0.47%) and 9 pigs died in the small (0.28%). A total of 39 pigs were removed off trial and placed into hospital pens. A total of 23 pigs were removed from the large pen (0.72%) and 16 were removed from the small pens (0.50%).

**Table 3. Drugs used and the cost over the trial for pigs housed in small and large pens.**

	Measure				
	Drug	No. pigs	Dose / pig (cc)	Cost / dose (\$)	Total cost (\$)
<b>Treatment</b>					
<i>Large</i>					
	Excede	110	1.5	0.79	86.90
	Excenel	68	1.5	0.59	40.12
	Penicillin	20	5	0.03	0.60
<i>Small</i>					
	Excede	84	1.5	0.79	66.36
	Excenel	48	1.5	0.59	28.32
	Penicillin	25	5	0.03	0.75
	Duramyclin	1	1.5	0.04	0.04
<b>Total</b>					
<b>Large</b>					127.63
<b>Small</b>					95.47

## Discussion

Industry accounts have suggested that growth performance traits and morbidity / mortality may be compromised when pigs are reared in large pen configurations. A recent study by Street and Gonyou (2008) compared the effects of small (18 pigs) vs. large (108 pigs) group sizes which provided 0.52 m<sup>2</sup>/ pig (crowded) or 0.78 m<sup>2</sup>/pig (uncrowded) of space on production, health, behavior, and physiological variables. Overall, ADG of large-group pigs was 1.035 kg/d, whereas small group pigs gained 1.073 kg/d ( $\pm 0.015$   $P = 0.039$ ). Average daily gain differences between the group sizes were most evident during the first 2 wk of the study. Over the entire study, G:F also differed, with large groups being less efficient ( $P = 0.005$ ) than small groups. In this study, pigs raised in small pens throughout the grow-finish period had a higher ADG and gain compared to pigs raised in large pens. Street and Gonyou (2008) reported that large-group pigs had poorer scores for lameness ( $P = 0.012$ ) and leg scores ( $P = 0.02$ ) throughout the 8-wk period, morbidity levels did not differ ( $P = 0.32$ ) between the group sizes. Minimal changes in postural behavior and feeding patterns were noted in large groups. An interaction ( $P = 0.04$ ) of group size and space allowance for lameness indicated that pigs housed in large groups at restricted space allowances were more susceptible to lameness. Pigs in this study had more severe lesions on their bodies just before marketing when housed in large pens. In addition more pigs died and were removed from the large pen design and had a higher treatment cost compared to pigs housed in the smaller pen

configuration. Opening up small pens to form one large pen configuration did not have an adverse effect on resource usage (allocation access to feed and water). Pigs moved within their own pens and different pens to use the unfamiliar feeders and drinkers. The majority of pigs were engaging in other behavioral activities within the newly created large pen configuration. Applying this knowledge to the commercial swine industry may yield several advantages for the producer; including decreased feed costs and fewer days for pigs to reach market weight.

### **Coming in 2010 - 2011:**

#### ***Media:***

Gesing, L., A. Johnson, J. Selsby, K. Stalder, M. Faga, A. Whiley, S. Abrams, H. Hill, R. Bailey, and M. Ritter. Effects of pen size on the welfare of the grow-finish pig. To be submitted to National Hog Farmer Swine Research Review. October, 2010 for consideration.

#### ***Abstracts:***

Gesing, L., A. Johnson, K. Stalder, M. Ritter, J. Moody, T. Donovan, E. Jablonski, D. Johnson and A. Johnson. 2010. Changing pen configuration from small to large pens: How does this change resource use for the growing pig. To be submitted for possible acceptance to the Midwest ASAS 2011 meetings in Des Moines Iowa.

Gesing, L., A. Johnson, K. Stalder, M. Ritter, J. Moody, T. Donovan, E. Jablonski, D. Johnson and A. Johnson. 2010. The influence of small versus large pens on the performance of the grow-to-finisher pig. To be submitted for possible acceptance to the Midwest ASAS 2011 meetings in Des Moines Iowa.

#### ***Animal Industry Reports:***

Gesing, L., A. Johnson, K. Stalder, M. Ritter, J. Moody, T. Donovan, E. Jablonski, D. Johnson and A. Johnson. 2010. Changing pen configuration from small to large pens: How does this change resource use for the growing pig. To be submitted for possible publication as an Animal Industry Report November 2010.

Gesing, L., A. Johnson, K. Stalder, M. Ritter, J. Moody, T. Donovan, E. Jablonski, D. Johnson and A. Johnson. 2010. The influence of small versus large pens on the performance of the grow-to-finisher pig. To be submitted for possible publication as an Animal Industry Report November 2010.

#### ***Peer Reviewed Paper:***

Gesing, L., A. Johnson, K. Stalder, M. Ritter, J. Moody, T. Donovan, E. Jablonski, D. Johnson and A. Johnson. 2010. The influence of small versus large pens on the welfare of the grow-finisher pig. Professional Animal Scientist.