

# INTERACTION OF NURSERY AND GROW-FINISH SPACE ALLOCATION

**Nathan R. Augspurger and Mike Ellis**  
**Department of Animal Science**  
**University of Illinois, Urbana**

## **Introduction**

This study was carried out as part of a collaborative project coordinated by the NCR-89 Committee on Swine Management. The results for the portion of the study carried out at the University of Illinois are reported here.

Space restriction has been shown to decrease daily gain and feed intake in pigs (Brumm and Miller, 1996; Kornegay and Notter, 1984), but has given variable results for gain to feed ratio (Moser et al., 1985; Randolph et al., 1981; Brumm and Miller, 1996). Space allowance for pigs has been investigated in conjunction with other factors. Gonyou and Stricklin (1998) and Gehlbach et al. (1966) studied the interaction of space allowance and group size. Kornegay, Lindemann, and Ravindran (1993) and Brumm and Miller (1996) studied the interaction of nutrition and space allowance, and Moser et al. (1985) investigated the interaction of a feed additive and space allowance. Other studies have investigated the effects of space allowance with nursery pigs (Kornegay, Lindemann, and Ravindran, 1993; NCR-89, 1989) and grow-finish pigs (Brumm and NCR-89, 1996; Meunier-Salaun et al., 1987; Gonyou and Stricklin, 1998). These studies all investigated the effects of space allowance in one phase of the production cycle only. Brumm and Dahlquist (1995) investigated the interaction between space allowance in the nursery and in the grow-finish phases of production. They found that pigs that were crowded in the nursery showed a reduced response to crowding in the grow-finish compared to those that were not crowded in the nursery.

The objective of this study was to follow up on this initial finding and study the interaction between space allowance in the nursery phase and grow-finish phase on pig performance from weaning to market weight.

## **Experimental Procedure**

Ninety pigs (n=90) of a commercial hybrid genotype (PIC 326 sire x C-22 dam) were randomly allotted to treatments based on litter of origin, weight, and sex. A 2 x 2 factorial arrangement was utilized to investigate the effects of two nursery space allowances and two grow-finish space allowances. Three replicates of the study were conducted. Weaned pigs were housed at either 1.75 ft<sup>2</sup>/pig (crowded) or 2.50 ft<sup>2</sup>/pig (uncrowded), with two pens per space allowance per replicate. Pen size was kept constant across space allowances in the nursery, with the two space allowances being achieved by varying group size between 6 and 9 pigs. Upon transfer to the grow-finish phase, pigs were housed at either 6.5 ft<sup>2</sup>/pig (crowded) or 8.0 ft<sup>2</sup>/pig (uncrowded). Although space allowance was confounded with group size (6 and 9), studies investigating group size and space allowance have found no interaction between number of pigs per pen and floor

space allowance using group sizes of 5 and 10 pigs (Randolph et al., 1981) or 5 and 30 pigs (Kornegay and Notter, 1984). In the event of pig death or removal from study, pen size was adjusted to maintain the same space allowance per animal.

#### *Nursery Phase*

This phase was carried out in a conventional nursery accommodation that was environmentally controlled. Piglets were given *ad libitum* access to feed and water from a four-hole feeder and a nipple drinker, respectively. Pen dimensions were 4 feet by 4 feet. Pigs were weighed at the start of the study and weekly thereafter. Feed intake was measured weekly. Pigs were moved to the grow-finish phase of the study when both pens of uncrowded pigs in each replicate averaged 45 pounds.

Nursery pigs were fed a three-phase diet regime formulated to meet or exceed NRC (1988) requirements for all nutrients.

Data collected for the nursery period included pig weights, feed intake, and days in the nursery, from which average daily gain, average daily feed intake, and gain to feed ratio were calculated.

#### *Grow-finish Phase*

Pigs were moved from the nursery to the grow-finish accommodation while maintaining the same pen groups. The grow-finish accommodation was environmentally controlled and had partially-slatted flooring. Pen dimensions, taking into account feeder space, for groups of 6 pigs were 6.6 by 7.5 ft. for uncrowded pens and 5.4 by 7.5 ft. for crowded pens. Pen dimensions for groups of 9 pigs were 9.8 by 7.5 ft. for uncrowded pens and 8.0 by 7.5 ft. for crowded pens. Pigs were offered *ad libitum* access to a corn/soybean meal diet. Diets were formulated to contain 1.0% lysine for the first week in the grow-finish phase; 0.95% lysine for pigs up to 80 pounds; 0.85% lysine for pigs between 80 and 130 pounds; 0.75% lysine for pigs between 130 and 190 pounds; and 0.60% lysine for pigs between 190 pounds and slaughter (240 pounds). Diets were formulated to meet or exceed NRC (1988) requirements. Diet phases were switched as pen average weights reached the predetermined levels. Each pen contained a two-hole feeder and one nipple drinker. Pen sizes were adjusted in the event of pig death or removal prior to pigs attaining the target end weight, maintaining the same area per pig and ratio of concrete to slats.

Pigs were taken off test when they reached a target end weight of 240 pounds. If more than 50% of the pigs in a pen had been removed from test, the remainder of the pigs stayed on test until they averaged 240 pounds or for 3 weeks, whichever was sooner. As pigs were removed from test, a longitudinal ultrasound scan anterior to the last rib was taken to determine backfat and loin eye depth, and these measurements were used to estimate the percentage of lean in the carcass. Pigs not reaching a minimum weight of 220 pounds were not scanned.

Data collected for the grow-finish period included weekly pig weights, weekly feed intake until the first pig was removed from test, and death loss. These data were used to calculate average daily gain, average daily feed intake, gain to feed ratio, initial lean composition (based on the NPPC formula for lean composition of a 40 to 90 pound pig), percent lean at end, average daily lean gain, and lean gain efficiency.

### *Statistics*

Data was analyzed using the GLM procedures of SAS (1990), using the pen as the experimental unit. The model used included the effects of space allowance treatments in the nursery and grow-finish phase and the interaction.

## **Results and Discussion**

### *Nursery Phase*

Treatment means for the nursery phase are reported in Table 1. Crowding (1.75 ft<sup>2</sup> space allowance) reduced average daily feed intake ( $P < .05$ ) by 12.5% and numerically decreased average daily gain ( $P = .065$ ) by 9.0%. However, the crowding treatment did not affect end weight or gain to feed ratio, which is in agreement with NCR-89 (1989) which reported crowding at 1.33 ft<sup>2</sup>/pig, compared to 2.66 ft<sup>2</sup>/pig, significantly decreased feed intake by 11.2% and daily gain by 11.0%, with no effect on gain to feed ratio. In another study, crowding pigs (1.5 ft<sup>2</sup>/pig) compared to giving the pigs a greater space allowance (3.0 ft<sup>2</sup>/pig) reduced average daily feed intake by 11.6% and average daily gain by 12.1%, with no effect on gain to feed ratio (Kornegay et al., 1993). Thus, the results of the current study, which compared space allowances of 1.75 ft<sup>2</sup>/pig compared to 2.50 ft<sup>2</sup>/pig, caused reductions in pig performance comparable with the studies reported above.

### *Grow-Finish Phase*

Treatment means for grow-finish performance reported by nursery treatment and grow-finish treatment are presented in Table 2. Nursery treatment did not influence growth performance in the grow-finish stage.

In addition, crowding in the grow-finish phase did not affect daily feed intake and daily gain at this stage of production. However, crowding tended to reduce overall gain to feed ratio ( $P = .065$ ). Grow-finish treatment did not affect any other performance measures. Other studies have indicated significant treatment differences in pig performance between crowded and uncrowded conditions. Brumm and Miller (1996) studied space allowances of 6.1 ft<sup>2</sup>/pig (crowded) and 8.4 ft<sup>2</sup>/pig (uncrowded) and showed a 4.8% reduction in average daily gain and a 6.2% reduction in average daily feed intake, with no difference in gain to feed ratio. Brumm and NCR-89 (1996) investigated space allowances of 7.0, 9.0, and 11.0 ft<sup>2</sup>/pig and showed that as space allowances decreased from 9.0 to 7.0 ft<sup>2</sup>/pig, average daily gain was reduced 1.6% and gain to feed ratio was reduced 1.2%. Moser et al. (1985) investigated the influence of space allowances of 3.0, 3.6, and 4.0 ft<sup>2</sup>/pig for growing pigs between 23 and 55 kilograms, and 6.0, 7.1, and 8.0 ft<sup>2</sup>/pig for finishing pigs between 55 and 100 kilograms. Average daily gain and gain to feed ratio for finishing pigs were reduced by 7.0 and 3.5%, respectively, when space allowances were reduced from 8.0 ft<sup>2</sup>/pig to 6.0 ft<sup>2</sup>/pig (Moser et al., 1985). The space allowances in the grow-finish phase of this study of 6.5 and 8.0 ft<sup>2</sup>/pig are similar to those presented above. However, in the current study, restricting space allowance of pigs to 6.5 ft<sup>2</sup>/pig did not reduce growth performance.

Interactions between nursery and grow-finish space allowance treatments were not significant for any performance measure, and therefore, the interaction means are not presented. Thus, in the current study, the floor space allowance in the nursery had no impact on the subsequent

performance of the pigs. This is in contrast to the findings of Brumm and Dahlquist (1995) who found an interaction between nursery and grow-finish space allowance for growth performance in the grow-finish phase. In grow-finish, pigs in crowded pens actually grew faster (+4%) than uncrowded pigs if they had been crowded in the nursery, but grew slower (-9%) if they were from uncrowded nursery pens. This indicates that pigs crowded in the nursery were less affected by crowding in the grow-finish than those pigs given ample space in the nursery. The space allowances used for crowded and uncrowded pigs in the current study (1.75 and 2.50 ft<sup>2</sup>/pig in the nursery and 6.5 and 8.0 ft<sup>2</sup>/pig in the grow-finish, respectively) were similar to those used by Brumm and Dahlquist (1995) of 1.8 and 2.7 ft<sup>2</sup>/pig in the nursery and 6.1 and 8.4 ft<sup>2</sup>/pig in grow-finish, respectively.

### **Conclusions**

1. Crowding pigs in the nursery at 1.75 ft<sup>2</sup>/pig, compared to 2.50 ft<sup>2</sup>/pig, reduced average daily feed intake by 12.5% and average daily gain by 9.0%; but crowding pigs at 6.5 ft<sup>2</sup>/pig, compared to 8.0 ft<sup>2</sup>/pig, in grow-finish did not affect pig performance at this stage of production.
2. There was no interaction between crowding in the nursery and grow-finish phases.
3. This suggests that decisions regarding floor space allowances in nursery and grow-finish phases of production can be made independently.

### **REFERENCES CITED**

- Brumm, M. C., J. Dahlquist. 1995. Nursery and growing-finishing space interactions. U. of NE Coop. Ext. EC 94-219:44.
- Brumm, M. C., P. S. Miller. 1996. Response of pigs to space allocation and diets varying in nutrient density. *J. Anim. Sci.* 74:2730.
- Brumm, M. C., NCR-89 Committee on Management of Swine. 1996. Effect of space allowance on barrow performance to 136 kilograms body weight. *J. Anim. Sci.* 74:745.
- Gehlbach, G. D., et al. 1966. Effects of floor space allowance and number per group on performance on growing-finishing swine. *J. Anim. Sci.* 25:386.
- Gonyou, H. W., W. R. Stricklin. 1998. Effects of floor area allowance and group size on the productivity of growing/finishing pigs. *J. Anim. Sci.* 76:1326.
- Kornegay, E. T., M. D. Lindemann, V. Ravindron. 1993. Effects of dietary lysine levels on performance and immune response of weanling pigs housed at two floor space allowances. *J. Anim. Sci.* 71:552.
- Kornegay, E. T., D. R. Notter. 1984. Effects of floor space and number of pigs per pen on performance. *Pig News and Info.* 5:23.
- Meunier-Saldun, M. C., et al. 1987. Effect of floor area restriction upon performance, behavior

- and physiology of growing-finishing pigs. *J. Anim. Sci.* 64:1371.
- Moser, R. L., et al. 1985. Response of growing-finishing pigs to decreasing floor space allowance and(or) virginiamycin in diet. *J. Anim. Sci.* 61:337.
- NCR-89 Committee on Confinement Management of Swine. 1989. Effect of vitamin C and space allowance on performance of weanling pigs. *J. Anim. Sci.* 67:624.
- Randolph, J. H., et al. 1981. Effects of group size and space allowance on performance and behavior of swine. *J. Anim. Sci.* 53:922.
- SAS. 1990. SAS/STAT<sup>®</sup> User's Guide (Release 6.03). SAS Inst. Inc. Cary, NC

Table 1. Least squares means for nursery phase by treatments.

<i>Trait</i>	<i>Nursery Treatment</i>		<i>Ave. SE</i>
	<i>Uncrowded</i>	<i>Crowded</i>	
Start Weight, kg	4.7	5.0	0.4
End Weight, kg	21.9	20.8	0.85
Average daily gain, kg	0.41	0.38	0.012
Average daily feed intake, kg	0.62 <sup>a</sup>	0.54 <sup>b</sup>	0.025
Gain:Feed	0.68	0.70	0.023

<sup>ab</sup> Means with different superscripts differ (P<.05)

Table 2. Least squares means for pig performance in the grow-finish phase and wean to market by nursery and grow-finish treatments<sup>a</sup>.

<i>Trait</i>	<i>Nursery treatment</i>			<i>Grow-finish treatment</i>		
	<i>UCR</i>	<i>CR</i>	<i>Ave SE</i>	<i>UCR</i>	<i>CR</i>	<i>Ave SE</i>
Performance in Grow-Finish:						
Start weight, kg	22.0	20.5	0.35	21.5	21.0	0.35
End weight, kg	110.6	107.5	1.13	108.5	109.7	1.14
Average daily gain, kg	0.85	0.81	0.024	0.84	0.82	0.024
Average daily feed intake, kg	2.42	2.32	0.061	2.37	2.38	0.061
Gain:feed	0.35	0.35	0.005	0.35	0.35	0.005
End lean, %	53.25	52.41	0.320	52.38	53.29	0.320
Average daily lean gain, kg	0.36	0.36	0.004	0.36	0.36	0.004
Lean gain:feed	0.15	0.16	0.005	0.15	0.15	0.005
Performance from Weaning to Market:						
Average daily gain, kg	0.73	0.68	0.016	0.71	0.70	0.016
Average daily feed intake, kg	1.89	1.80	0.042	1.82	1.86	0.042
Gain:feed	0.39	0.38	0.002	0.39	0.38	0.003

<sup>a</sup> UCR = Uncrowded (2.5 ft<sup>2</sup>/pig in nursery, 8.0 ft<sup>2</sup>/pig in grow-finish)

CR = Crowded (1.75 ft<sup>2</sup>/pig in nursery, 6.5 ft<sup>2</sup>/pig in grow-finish)