Effect of Pen Density on Nursery Pig Performance

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The implementation of improved health management strategies including segregated early weaning and all-in, all-out rearing has resulted in increased post-weaning growth. The improved growth rate in turn results in pigs achieving 60 to 70 lbs. live weight after 6 to 8 weeks in the nursery. Limited research has been conducted evaluating the optimal pen density required to maximize performance of rapidly growing nursery pigs achieving 60 to 70 lbs. live weight by 10 weeks of age.

Materials and Methods

Three hundred seventy-five high health status, maternal cross gilts (weaning age = 15-19 days) were blocked within weaning group by age and weight to five different pen densities (3.08, 2.86, 2.66, 2.5 and 2.35 ft^2/pig) by allocating either 13, 14, 15, 16 or 17 pigs per 40 ft^2 (4 x 10 ft) pen. A total of 5 pens were evaluated at each pen density. The trial was conducted from May through June in southeast Colorado. The pigs were fed a series of four diets during the duration of the trial. The nursery pens were within an 86 x 42 ft mechanically ventilated nursery room which contained four rows of 20 pens each. Thirty-six inch long fence line feeders were shared by adjacent pens. Each pen had two nipple drinkers located at the side of the pen opposite to the feeder. The pens had woven wire flooring.

The pigs were individually weighed at the beginning of test (28 days of age), and after 3 weeks and 7 weeks in the nursery. Total pen pig weights were taken weekly. The average daily gain data for the first 3 weeks, the last 4 weeks, and overall were analyzed using pens as the experimental unit. The linear effect of pen density was evaluated, accounting for the initial weight of the pigs. To evaluate differences in the growth curves of each pen density, the weekly live weight (WT, lb) data for each pen was fit to the nonlinear function

$$WT = e^{b_0 + b_1 Age + b_2 (Age)^2}.$$

This was done using the linear transformation $LN(WT) = b_0 + b_1 Age + b_2 (Age)^2$ where LN(WT) is the natural logarithm (log base e) of WT. This function was used because daily live weight would be expected to increase during the duration of the trial. Also, the natural logarithm transformation equalizes the variation in live weight at each age, a requirement of the least-squares regression analysis. The predicted values for live weight and average daily gain $\left[dWT/dAge = \{(b_1 + 2b_2 Age)WT\}\right]$ were calculated for each pen for each day on test. The mean predicted values for the pens of each density were calculated and graphed.

Results

The mean initial age and weekly live weights for each pen density are presented in Table 1. The pigs were randomly assigned such that initial age and weight were nearly identical. The least-squares means of the three growth periods are shown in Table 2. There was no linear effect (P=.22) of pen

density on growth for first 3 weeks. Pen density had a linear effect to reduce average daily gain for the last 4 weeks (P=.03) and overall (P=.04).

The predicted values for live weight and average daily gain for each density are shown in Figures 1, 2, and 3. The live weight growth of pigs in pens with the greater pig densities (15 pigs or more, 2.66 ft^2/pig or less) had reduced growth rates relative to pigs in pens with lesser pig density (14 pigs or less, 2.86 ft^2/pig or greater) at 50 lbs. live weight or approximately 35 days on test (63 days of age). As live weight increased to 70 lbs., the reduction in average daily gain increased. The growth curve analysis provides a more precise means of estimating treatment effects which change in magnitude during the duration of a trial. Fitting liveweight data to growth curves results in a better evaluation of the impact of pen density on pig growth.

Implications

The research results indicate that 2.9 ft^2 per pig is needed to maximize live weight growth for nursery pigs carried to 70 lbs. live weight. Approximately 2.4 ft^2 per pig is required to maximize pig growth up to 50 lbs. live weight.

Table 1. Mean initial age, initial weight and weekly weights for each pen density.

No. Pigs/Pen	Initial Age, d	Initial Wt., lb.	Week 1 Wt., lb.	Week 2 Wt., lb.	Week 3 Wt., lb.	Week 4 Wt., lb.	Week 5 Wt., lb.	Week 6 Wt., lb.	Week 7 Wt., lb.
13	28.9	14.7	18.5	24.5	31.9	40.1	49.2	61.1	73.4
14	28.3	14.6	17.6	23.1	30.4	38.9	48.3	59.9	70.8
15	28.6	14.7	18.3	24.4	32.2	40.4	49.8	61.0	71.8
16	28.9	14.5	17.9	23.5	30.1	38.2	47.1	58.6	68.8
17	28.6	14.7	18.0	23.7	30.8	39.5	48.5	59.8	70.4
SEM*	.20	.10	.14	.19	.25	.26	.32	.37	.43

* SEM = Standard error of the mean.

Table 2. Average daily gain for each pen density.

	Average Daily Gain		
Pigs/Pen	Weeks 0-3	Weeks 4-7	Weeks 0-7
13	.81	1.48	1.20
14	.75	1.44	1.15
15	.83	1.42	1.17
16	.74	1.38	1.11
17	.76	1.41	1.14
SEM*	.024	.025	.022

* SEM = Standard error of the mean.

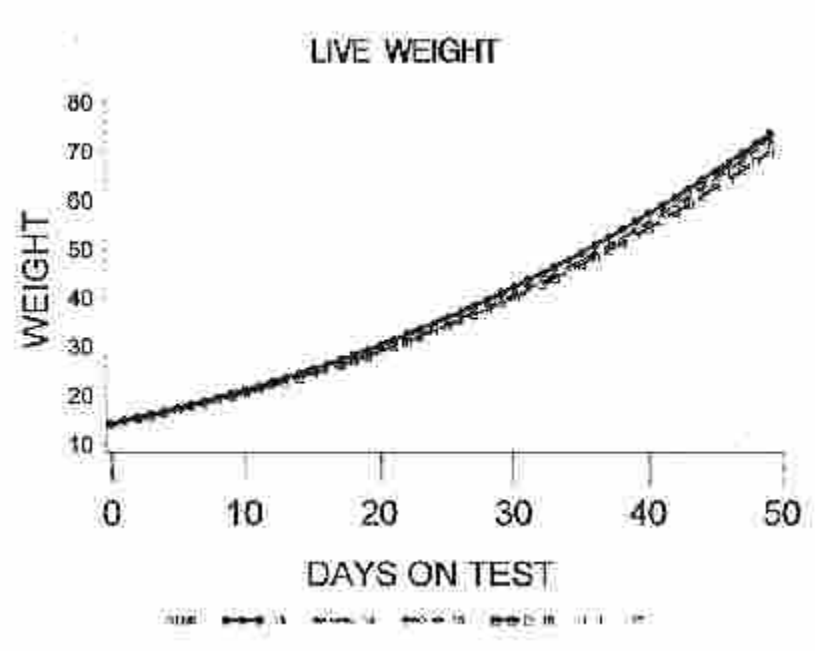

Figure 1. Relationship of live weight (lb.) to days on test.

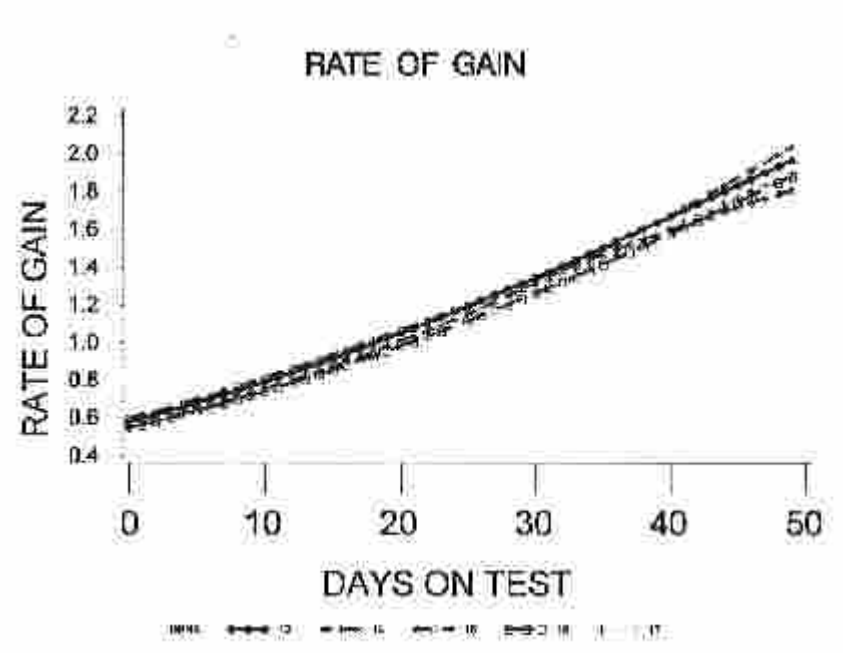

Figure 2. Relationship of average daily gain (lb./day) to days on test.

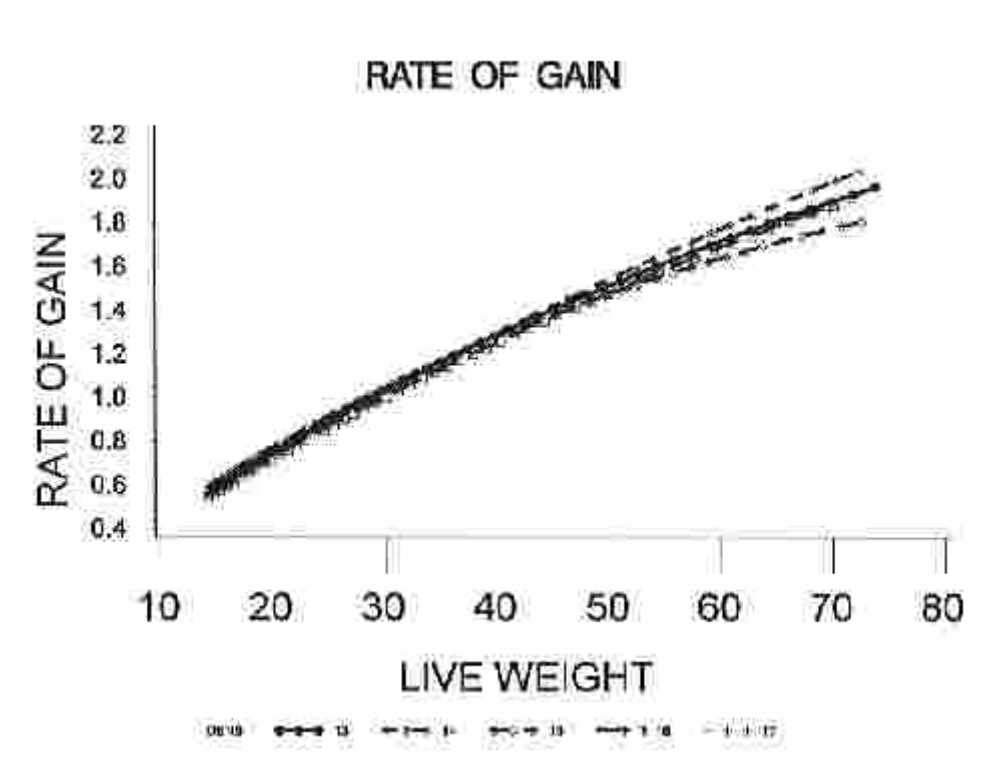

Figure 3. Relationship of average daily gain (lb./day) to live weight (lbs.).