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COMPARISON OF DIFFERENT STYLES OF SWINE FINISHING FACILITIES WITHIN A UNIFORM PRODUCTION SYSTEM[1]

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ABSTRACT

Swine originating from one farrowing and nursery source were finished in five different finishing facility types. Three of the facilities were considered new styles and two were older facilities. The total data set included information collected on 46,408 pigs from 25 groups. The three new styles of finisher included a fully slatted, hybrid ventilated facility; a fully slatted tunnel ventilated facility; and a partially slatted naturally ventilated facility. These were also compared to an old-style finisher and an outdoor feeding lot. No significant differences were observed in production performance of the three styles of new buildings at the $p<0.05$ level. Significant differences were found in feed efficiency, days to market and yield among all (new and old) facility types at the $p<0.05$ level. Average daily gain for the new facilities were found to be significantly different at the $p<0.05$ level by season of the year. The variation in death loss, feed efficiency and ADG appeared to be relatively consistent between the different styles of finishers. A basic cost analysis shows that the production cost differences between the three styles of new finisher is small and therefore decisions on the type of building should be based more on management preferences than cost savings.

KEYWORDS: swine, swine housing, swine growth, feed efficiency, economics

INTRODUCTION

As the swine industry changes and production sites get larger and more sophisticated, the need for information regarding these systems is increasing. Information on building performance and management is needed for proper selection of the style of building from an economic and functionality standpoint. Little information exists on such comparisons. Harmon et al (1998) compared three styles of buildings using limited data and found that a building that was less sophisticated, but managed properly fared better economically. Earlier studies of Fritschen et al (1974) and Fritschen (1982) also examined comparisons but genetics and feeding protocols have vastly changed since that point.

A new 1200 sow system located in northwestern Iowa has offered a unique opportunity to compare different styles of finishing facilities while keeping other components such as genetic makeup of the swine and feeding protocol constant. The swine system is set up with three separate finisher sites with three different styles of finishing facility. One is described as a totally slatted, tunnel ventilated facility, the second site is a totally slatted, double curtain facility with wintertime mechanical ventilation and the third is a partially slatted, naturally ventilated facility.

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The three building types are representative of the majority of newer facilities currently being constructed within the Iowa swine industry. Projections of cost of operation and swine performance factors of the three building systems are not adequately documented. In addition to the three styles of finisher, some groups of pigs were fed in alternative finishers that were also evaluated from the data submitted. Therefore the new system can be compared to older facilities and inside confinement can be compared to outside finishers. The objective of this study was to analyze production costs and performance associated with various types of swine finishing facilities.

MATERIALS AND METHODS

The production system produces pigs from a 1200 sow breeding/gestation/farrowing unit which uses one genetic source and diets formulated on the same nutritional specifications for all pigs finished within the system. Pigs are weaned and transported to a central nursery unit that has a total of eight rooms of 570 pigs. Pigs remain in the central nursery for approximately eight weeks before being placed in the finishing buildings. The finishing facilities on the three main finishing sites use various housing options. The building referred to as "tunnel ventilated" was constructed with a nominal width of 24 m (80 feet) and length of 69 m (225 ft). The building was divided into two rooms, running the length of the building, each held 1125 head on fully slatted flooring over a manure pit. Rooms were ventilated by using fans on the manure pit during the minimum ventilation period. During warmer weather, the building used large fans on one end and a ventilation curtain on the other end to create an artificial wind to keep pigs cool. The two buildings referred to as "hybrid ventilated" were nominally 14 m (41 ft) wide by 67 m (220 ft) long. Each held 1100 head of finishing pigs on fully slatted flooring over a manure pit. Mechanical ventilation was utilized during the winter and mild weather by using fans and self-adjusting inlets mounted in the flat ceiling. Ventilation curtains were opened to use natural cross-ventilation during warmer periods. The buildings referred to as "naturally ventilated" are nominally 14 m (41ft) wide by 67 m (220 ft) long. Each building holds 1100 head and has a partially slatted floor with manure scrapers which transport the manure to outdoor storage. Ventilation is completely natural with sidewall curtains and 70 cm by 70 cm (2 ft by 2 ft) chimneys in the ceiling that are automatically controlled. The "older confinement" was a partially slatted mechanically ventilated facility and the "outside feeding floor" is self explanatory.

Feeder pigs entering the system were large groups of similar weight (Table 1). For the three newer facilities, (tunnel ventilated, hybrid ventilated and naturally ventilated) the average number of head placed and the average weight both on and off test were similar. Performance of the pigs is representative of modern swine network systems as compared with Baas(1999) and PigCHAMP(1999). ADG averaged 0.75 kg/day (1.72 lbs/day) across all groups, feed conversion 2.8 kg feed/kg gain (lb/lb), 3.4% death loss, 14.5 mm (0.67 in) backfat, and 54.3% carcass lean.

Table 1. Numbers and weights of pigs entering the system for each facility type.

	No. of Reps	Avg. No. of head	StdDev No.	Avg Wt Kg (lbs)	StdDev Kg (lbs)
Hybrid Ventilated	8	2212	40	22.8 (50)	0.89 (1.97)
Tunnel Ventilated	5	2345	198	22.7 (50)	0.66 (1.45)
Naturally Ventilated	5	2230	22	22.8 (50)	1.34 (2.95)
Older confinement	4	410	170	25.7 (57)	1.54 (3.38)
Outside feeding floor	3	1399	669	22.0 (49)	0.67 (1.47)

Table 2. Weights of pigs leaving the system for each facility type.

	Average weight Kg (lbs)	StdDev Kg (lbs)
Hybrid Ventilated	117 (258)	4.5 (10)
Tunnel Ventilated	116 (256)	6.7 (15)

Natural Ventilated	115 (253)	8.5 (19)
Older confinement	119 (261)	6.5 (14)
Outside feeding floor	114 (252)	3.4 (8)

Data were collected and recorded on computer spreadsheets. Feed delivery weights and entering and exiting pig weights were taken on certified scales at the local elevator. Data were statistically analyzed using ANOVA techniques.

RESULTS

The standard production traits were evaluated for statistical differences. No significant difference was found between the three newer facilities ($p<0.05$) for all the production traits. Table 3 gives the average production traits for each facility type. Feed efficiency and days to market were found to be statistically dissimilar between all of the facility types ($p<0.05$). This likely indicates that the new and the old facilities performed differently since there were no statistical differences between the new styles when analyzed alone. Care should be taken when examining the data for the older confinement unit because there was a tendency to load this facility with larger pigs during warmer periods of the year.

Table 3. Production traits across all facility types.

	Death Loss $P=.49$	Feed/gain kg $P=0.00015$	ADG kg $P=0.83$	Days to Market $P=0.05$
Hybrid Vent.	4.6%	2.72	.78 (1.72 lbs.)	120.4
Tunnel Vent.	2.7%	2.67	.78 (1.72 lbs.)	119.6
Naturally Vent.	3.2%	2.70	.79 (1.75 lbs.)	115.6
Older Confinement	2.5%	2.78	.81 (1.78 lbs.)	114.4
Outside feeding floor	3.3%	3.41	.75 (1.65 lbs.)	130.7

Carcass traits were also evaluated across facility types. Table 4 indicates that yield is the only trait in which a significant difference occurs at the $p<0.05$ level. This may be due to the fact that it would be harder to withdraw feed from pigs prior to marketing using feeders typical of outdoor units. This would add to the level of gut-fill and change the yield.

Table 4. Carcass traits across all facility types.

	Backfat mm $P=0.67$	Percent Muscle $P=0.77$	Yield $P=0.002$	Sort Loss $P=0.49$
Hybrid Vent.	17.1 (0.68 in)	54.6%	74.3%	$0.56
Tunnel Vent.	17.7 (0.70 in)	54.2%	74.6%	$0.49
Naturally Vent.	17.4 (0.69 in)	54.2%	73.9%	$0.62
Outside feeding floor	15.5 (0.61 in)	54%	72.9%	$0.77

Data was also sorted by season the pigs were placed in the facility, although observations are limited. Season 1 ran from March 1st to May 31st, Season 2 from June 1st to August 31st, season 3 from September 1st to November 30th and season 4 included the time December 1st to February 28th. Table 5 gives feed efficiency, average daily gain (ADG), death loss, yield, backfat and carcass lean by season. ADG is the only trait that was significantly affected by season ($p<0.05$).

Table 5. Feed Efficiency, ADG, Death loss, yield by season pigs were placed in the new finisher styles.

	Feed Eff. $P= 0.40$	ADG kg (lbs)/day $P= 0.02$	Death loss $P= 0.23$	Yield $P= 0.13$	Back fat Mm (in) $P= 0.30$	% Lean $P= 0.35$
Season 1 (3/1 – 5/31)	2.78	0.76 (1.68)	2.3%	74.31%	16.0 (0.63)	53.9%
Season 2 (6/1 – 8/31)	2.68	0.74 (1.63)	4.8%	73.54%	16.5(0.65)	54.1%

Season 3 (9/1 – 11/30)	2.79	0.81 (1.78)	3.6%	74.00%	17.5 (0.69)	54.6%
Season 4 (12/1 – 2/28)	2.66	0.85 (1.85)	3.0%	74.51%	18.8 (0.74)	55%

Tables 6 and 7 shows the feed efficiency and ADG by season for each type of finisher. This data, while interesting, should not be used to draw conclusions based on the low number of replicates for each treatment.

Table 6. Feed Efficiency, feed/gain, by season for each facility type.

	Hybrid Vent.	Tunnel Vent.	Naturally Vent	Older Confinement	Outside feeding floor
Season 1 (3/1 – 5/31)	2.78	2.7	2.96	2.73	3.33
Season 2 (6/1 – 8/31)	2.68	2.84	2.63	2.96	3.26
Season 3 (9/1 – 11/30)	2.79	2.62		2.7	3.63
Season 4 (12/1 – 2/28)	2.66	2.47	2.66		

Table 7. Average daily gain, kg (lbs)/day, by season for each facility type.

	Hybrid Vent.	Tunnel Vent.	Naturally Vent.	Old Confinement	Outside feeding floor
Season 1 (3/1 – 5/31)	0.71 (1.56)	0.74 (1.63)	0.71 (1.57)	0.82 (1.80)	0.82 (1.80)
Season 2 (6/1 – 8/31)	0.72 (1.59)	0.69 (1.52)	0.78 (1.72)	0.72 (1.58)	0.75 (1.66)
Season 3 (9/1 – 11/30)	0.80 (1.77)	0.88 (1.93)		0.89 (1.95)	0.67 (1.48)
Season 4 (12/1 – 2/28)	0.84 (1.84)	0.85 (1.86)	0.85 (1.86)		

Table 8 compares the variability of death loss, feed efficiency and ADG for the different styles of finisher. The variability appears to be relatively consistent from building type to building type,

Table 8. Variability in production traits.

	Death Loss	Feed/gain kg	ADG kg (lbs)/day
Hybrid Vent.	1.7 – 11.8%	2.55 – 2.89	.67 - .88 (1.48 – 1.94 lbs.)
Tunnel Vent.	1.5 – 3.9%	2.47 – 2.87	.69 - .87 (1.52 – 1.93 lbs.)
Naturally Vent.	1.8 – 5.7%	2.52 – 2.96	.71 - .85 (1.57 – 1.88 lbs.)
Older inside facility	0.4 – 5.0%	2.67 – 2.96	.71 - .89 (1.58 – 1.95 lbs.)
Outside feed floor	2.7 – 4.6%	3.26 – 3.63	.67 - .82 (1.48 – 1.80 lbs.)

DISCUSSION

When comparing the three new facilities, none of the production traits were statistically different. The performance differences were too small to be sorted out by the limited number of observations. Decisions concerning the type of facility to construct and put in practice is a matter of management style and cost considerations.

Outlined in Table 9 is the cost comparison based on actual data from the three styles of new facilities. Assumptions were made based on averages from the repetitions even though differences were not statistically significant. Daily labor requirements were not noted as different between the three facility types. Repair cost will be small and not significantly different between the three types of facilities at this point. Costs to pump water will not be different between the three facilities. Fixed cost differences will vary based on conditions during construction and material pricing differences, in this example the differences in construction cost were close to $10/space between building. In other situations the price difference may be more or less. Annual costs are estimated at 17% of investment cost.

This analysis indicates that the cost of production difference is small between the three types of finisher. The naturally ventilated, partially slatted building was estimated to be the least costly to operate with added costs for poorer feed efficiency and added labor to clean between groups of

pigs. The hybrid ventilation, fully slatted building was estimated to cost $1.05 more per pig than the naturally ventilated building. Added costs were assumed for electricity, feed efficiency, and fixed costs. The tunnel ventilated, fully slatted building assumed costs were $1.56 more per pig than the naturally ventilated building due to added electrical costs and fixed costs. Overall, the cost differences were not pronounced enough to greatly influence the decision of the type of building to construct.

Table 9. Cost comparison of the new finisher facilities.

	Hybrid Ventilated	Tunnel Ventilated	Naturally Ventilated
Feed cost analysis Feed @ $.06/lb	F/E = 2.72 4.5 kg (10 lbs) more feed Extra cost **$0.60/hd**	F/E = 2.67	F/E = 2.7 2.7 kg (6 lbs) more feed/hd Extra cost **$0.36/hd**
Operation cost Electricity (not including water)	Electric bill $1603 5896 head **$0.27/head**	Electric bill $4413 2200 *2.68 = 5896 head **$0.75/head**	Negligible
Labor difference only in clean-up			10 extra hours per 1100 5896/1100 * 10 = 54 hours $540 = **$0.09/hd**
Fixed cost difference	$160/space $10/space @17% = $1.70/2.68 turns = **$0.63/hd**	$170/space $20/space @17% = $3.40/2.68 turns = **$1.26/hd**	$150/space
Extra cost TOTALS	=$.60+.27+.63 = $1.50	=$.75 + 1.26 = $2.01	=$.36 + .09 =$.45
TOTAL DIFFERENCE	***= $1.05/HEAD***	***= 1.56/HEAD***	

SUMMARY AND CONCLUSIONS

Swine originating from one farrowing and nursery source were finished in five different finishing facility types. Three of the facilities were considered new styles and two were older facilities. The total data set included information collected on 46,408 pigs from 25 groups. The following conclusions may be drawn based on this research:

1) There were no significant differences in production performance of the three styles of new buildings at the $p<0.05$ level.
2) Significant differences were found in feed efficiency, days to market and yield among all styles of facilities (new and old) at the $p<0.05$ level.
3) Average daily gain for the new facilities were found to be significantly different at the $p<0.05$ level by season of the year.
4) The variation in death loss, feed efficiency and ADG appeared to be relatively consistent between the different styles of finishers.
5) A basic cost analysis shows that the production cost differences between the three styles of new finisher is small and therefore decisions on the type of building should be based more on management preferences than cost savings.

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