

Case Study Comparison of Three Styles of Swine Finishers

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Summary and Implications

Three styles of swine finishing facilities were compared to establish the economic benefit of each style of building. Styles included a curtain-sided finisher, a modified open front finisher, and a cargin unit. Information was collected on energy consumption, water consumption, animal performance, temperature performance, and carcass leanness. Preliminary results indicated the best feed efficiency occurred in the modified open front, whereas the lowest mortality occurred in the curtain-sided finisher. Temperature performance was much tighter in the curtain sided finisher than the other two building styles. A preliminary partial cost comparison indicated that the modified open front facility had the lowest cost with the curtain-sided and the modified open front both out performing the cargin unit.

Introduction

Controlling factors that add to the cost of producing swine are important to a profitable operation. The costs of inputs continue to rise with the market price of pork remaining relatively stable. This shrinks profit margins, causing economic problems for farmers. Facility investments can be high and farmers want to know if the investment will bring an economic return. Facility costs can not just be minimized without taking into account the effect that it will have on other cost factors such as feed efficiency, animal health, labor, and carcass quality. Building designs from the past continue to be used. Without comparative data about animal performance and building operating expenses, producers do not have sufficient information upon which to base decisions about continued use of these older facilities and investment in new facilities. Producers should base building decisions on solid comparative information and not on current trends. Although some of this information is available, Fritschen et al. (3), swine genetics and management practices have changed so much that it is necessary to examine this once again. These problems will be addressed in this paper.

The objectives of this proposed project are as follows:

- ✳ Collect cost information on three different types of swine finishing facilities operated under common management and genetics.

- ✳ Analyze the cost of production to determine the economic feasibility of each system in the Midwest.

Materials and Methods

A farrow-to-finish swine farm near Wellman, IA (southeastern Iowa) was found to have three styles of finishing facilities. This was a unique opportunity to isolate the effect of facility design because all three buildings used the same operator, swine genetics, feed, and outdoor climate. Each facility is described below.

Curtain-sided facility (CS). The curtain-sided finisher was constructed in 1993 and is typical of finishing facilities constructed currently in the Midwest. It contains two rooms, each holding 400 head. The overall building is 41ft by 160 ft with an 8-ft ceiling height. The foundation is of concrete building and extends 18 inches above the slatted, concrete flooring. It has an 8 ft deep manure pit below the floor. The shell of the building is wood frame with steel siding. The flat ceiling is formed with painted steel on the lower chord of the wood trusses. Presumed insulation values are R-11 in sidewalls and R-30 in the ceiling. Uninsulated sidewall curtains are 4.5 ft in height.

Ventilation of the building is accomplished using two manure pit fans and one sidewall fan per room. The fans were 24 in Hired Hand¹ Funnel Flow fans with 1/3-hp electric motors. Sixteen Raydot BF1200 self-regulating inlets were installed in the ceiling of each room and brought air in through the attic during the winter. During warmer weather, the sidewall curtains were lowered to allow natural ventilation due to wind to occur. Each room also was equipped with four Barnstormer 24 in stirring fans with 1/2-hp electric motors to reduce heat stress. Environmental control was handled with a Hired Hand System 1000 controller. One liquefied propane heater was located in each room.

Water was supplied to each pen by two nipple waterers. The original feeders were ordinary bin-type 5-ft long feeders. Part of the way through the monitoring, feeders in the west room were changed for Aqua Tube TF-60 wet/dry feeders that supply feed in a trough with a nipple waterer mounted over the feed pan to reduce water wastage. The flooring was fully slatted concrete gang slats.

Modified open front (MOF). The modified open front finisher was approximately 10 years old and held approximately 400 finishing pigs. The overall building was 28 ft by 120 ft. Each of the 12 pens were approximately 10 ft by 25 ft and were partially slatted in the south 10 ft of each pen. A 3-ft alley ran the length of the building along the south wall. The roof was a monoslope with the north

¹ Mention of vendor or product names in this paper is for presentation clarity and does not imply endorsement by the authors or Iowa State University nor exclusion of other suitable productions.

sidewall being 80 inches and the south sidewall being 142 inches.

Ventilation was completely naturally driven with 2-ft hinged doors on the north side of the building and a 4.5-ft curtain on the south. Insulation level was very low in the ceiling due to rodent damage. No supplemental heat was supplied to the building. The curtain was controlled with a manually operated curtain winch. Ordinary feeders and nipple waterers were used in the building.

Cargill unit. The cargill unit had a monoslope shed of 18 ft by 120 ft with an outside concrete area that was 30 ft. Capacity was 400 head. Feed and water were supplied with circular feeders and frost-free waterers in the outside concrete area. Traditional cargill units generally have more concrete than this unit had.

Data collection. Data collection was facilitated using a Campbell Scientific, Inc., CR-10 data logger with a multiplexer and a switch closure input module. Vaisala HMP35C-L humidity sensors were mounted near the center of both the rooms in the CS building and in the MOF building. Thermocouples were installed in various locations to determine temperature variations within the rooms. Two thermocouples were installed in each CS room, four were installed in the MOF, and 3 were installed in the cargill unit.

To measure utility consumption, a Hersey MTX water meter with a contact closure output was installed in each CS room and in the MOF. The watering system for the cargill unit did not lend itself to easy meter installation so it was not monitored. The LP gas supplied to the CS building was monitored using a American AL-425 gas meter with a contact closure output. Electricity was monitored using a class 200 electric meter with contact closure. The LP gas and electrical usage were both monitored for the entire CS rather than for each room separately.

Thermal measurements were made every 30 seconds and averaged every hour. Daily maximum, minimum, standard deviations, and averages were recorded at midnight. Closure counts were totalized every hour and then a daily total was recorded at midnight.

Pig performance was recorded by the owners and operators of Prairie Pork. Pigs were weighed when they were moved into the finisher and when they were sold using a load cell on the pig-moving cart. Pigs generally arrived weighing approximately 50 lb and were marketed when they weighed 250 lb or more. The amount of feed added to bins for each group also was recorded. Kill sheets for pigs marketed were kept to examine the impact of facility on carcass leanness. Estimates of labor were not available. Farm monitoring started in May 1996 and was completed in April 1998.

Results and Discussion

Pig performance. Table 1 gives average pig performance information for the each group of pigs. As can be seen, the pigs in the MOF facility grew the fastest, with an average

daily gain (ADG) of 1.68 lb/day and had the best feed efficiency (FE) with 2.76 lb feed/lb gain. The CS and cargill facility had nearly equal growth rates (1.62 and 1.61 lb/day but the pigs in the CS facility were more efficient (2.91 lb feed/lb gain vs. 3.09). Differences show trends but are not statistically significant.

Table 1. Summary of production data.

	Curtain Sided	Modified Open Front	Cargill Unit
No. of Trials	8	4	2
ADG (lb/day)	1.62	1.68	1.61
ADF (lb/day)	4.71	4.63	4.97
FE	2.91	2.76	3.09
Mortality	2.6%	2.7%	3.2%

Generally, the expected performance of the CS should be better than the MOF and cargill facilities. The pigs in the CS, however, were marketed at a heavier weight than those in the MOF, 261 lb vs. 253 lb. Pigs become less efficient as they get larger, therefore, the difference between the CS and MOF pigs would be reduced. The pigs in the cargill unit tended to be the least efficient in spite of the fact that it was not started in the harshest winter conditions. The farmer did not like the labor and performance of the cargill unit in the winter and tended to leave it empty during the coldest part of the year. During the test period, only one group was started in the MOF during the coldest time of year.

Fritschen (4) found a similar trend with MOF pigs outperforming pigs in a controlled environment building and an open-front building during summer. During winter he found that the MOF and controlled environment pigs were nearly the same but drastically outperformed the open-lot building.

The feed costs associated with the average production in each type facility based on feed that is 6 cents per lb would be CS -\$0.175/lb gain; MOF -\$0.165/lb gain; and cargill - \$0.185/lb gain.

Temperature performance. Table 2 gives the temperature performance summaries for the groups of pigs by building. The CS facility averaged 73.4°F with an average daily standard deviation (SD) of 2°F and an average daily maximum/minimum span of 7.6°F. The MOF facility averaged 68°F with an average daily SD of 4°F and max/min span of 15.4°F. The cargill unit averaged 58°F with a SD of 6.1°F and a max/min span of 20.5°F. From this it is apparent that the thermal environment in the CS facility was greatly superior to the cargill unit because of the lack of large temperature swings. It also should be noted that the cargill unit was not used during the coldest periods and so in reality the effect would be more pronounced. The MOF facility maintained a cooler and more variable thermal environment than the CS facility but the difference was not drastic.

Table 2. Summary of temperature performance (°F)

	Curtain Sided	Modified Open Front	Cargill Unit
Avg Ambient	47.1	49.1	53.4
Avg Indoor	73.4	68.2	55.8
Indoor S.D.	2.0	4.0	6.1
Avg Daily Maximum	77.0	75.7	67.1
Avg Daily Minimum	69.4	60.3	46.6
Average Differential	-0.1	1.2	6.3

Air quality was not measured but observations indicate more dust and gases are present in MOF buildings than in CS due to the partially slatted floor. A combination of this and temperature performance could lead to increased medical costs and possibly worker health concerns.

Utility consumption. Table 3 gives the gross utility usage during the 1.8 years of monitoring. Consumption is broken down into consumption per pig space in each building. This assumes that the building was operating at nominal capacity the entire year. In actuality, there were fluctuations as would occur on a normally operating farm.

Table 3. Nominal utility consumption.

	Curtain Sided (800 head)	Modified Open Front (400 head)
Water Consumption	295,000 gallons/yr	233,000 gal/yr
	368 gal/space-yr	582 gal/space-yr
Electrical Usage	8707 kWh/yr	—
	10.9 kWh/space-yr	—
LP Gas Usage	480 gallons/yr	None
	0.6 gal/space-yr	none

To estimate the utility cost in the CS building per lb of gain, it is assumed that three groups of pigs are finished each year and that they gain 200 lb during finishing. Assuming 10 cents per kWh, this translates into an electrical cost of \$0.36 per pig finished or \$0.002/lb gain. The cost of LP gas is also low. Assuming 70 cents per gallon, the cost is \$0.14 per pig finished or \$0.0007 per lb gain. The cost of water was not computed but is assumed to be low. This means that each pig produced has a utility cost of 50 cents during the finishing period. This appears to be slightly low when compared with Baas (1) with \$1.56 per pig and Baas (2) with \$1.18. Baas (1,2) included telephone and electricity for farmstead usage, whereas this study did not.

Economic comparison. To completely compare the economics of the three housing systems, other cost factors need to be considered. These include facilities costs, medical costs, labor costs, manure spreading costs, and market premiums due to carcass

traits. From this study, feed costs and utility costs were found.

Harmon and Lawrence (5) assumed an initial investment of \$160 per head, \$120 per head, and \$80 per head in the CS, MOF, and Cargill unit, respectively. The facilities cost would be approximately 2.9 cents/lb gain for the CS, 2.3 cents/lb gain for the MOF, and 1.7 cents per lb for the Cargill unit. Harmon and Lawrence (5) also assumed some labor costs based on \$7 per hour and labor per pig marketed of 0.25 hours for CS, 0.35 for MOF, and 0.7 for the Cargill unit. These estimates are combined in Table 4 to yield the approximate cost per lb of gain for the three types of systems. Based on these figures, the MOF building seems to have the lowest cost. Medical cost and carcass discounts and premiums, however, need to be added. To help make facility choice decisions, these would then be combined into a present value equation to evaluate the decision on which housing system would produce the most profit. Harmon and Lawrence (5) explained this comparison technique more fully. Further analysis is planned but will not be completed here.

Table 4. Partial comparison of cost of production.

	Curtain Sided	Modified Open Front	Cargill Unit
Feed Cost	17.5 cents	16.5 cents	18.5 cents
Utilities	0.2 cents	---	---
Facility (est)	2.9 cents	2.3 cents	1.7 cents
Labor (est)	0.9 cents	1.2 cents	2.5 cents
TOTAL	21.5 cents	20.0 cents	22.7 cents

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