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Peter J. Lammers
Iowa State University

Mark S. Honeyman
Iowa State University, honeyman@iastate.edu

James B. Kliebenstein
Iowa State University

Jay D. Harmon
Iowa State University, jharmon@iastate.edu

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Impact of Gestation Housing System on Weaned Pig Production Cost

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Pete Lammers, research assistant; Mark Honeyman, professor, department of animal science; Jim Kliebenstein, professor, department of economics; Jay Harmon, professor, department of agriculture and biosystems engineering

Summary and Implications

Construction and operating costs for two gestation housing systems—1) individual gestation stalls in a mechanically ventilated confinement building with slatted floor and 2) group pens with individual feed stalls in deep-bedded naturally ventilated hoop barns and their impact on cost per weaned pig produced were compared. Iowa work has shown that reproductive performance of group-housed sows in hoop barns is equal to individually stalled sows and for some measures may be improved. Assuming equal prolificacy, feed cost per pig weaned is 7% more for sows gestated in hoop barns, but total cost per pig weaned is 3% less for pigs produced by sows gestated as groups in hoop barns compared with pigs from individual stall gestation systems. When the observed increase in live pigs born for litters following hoop gestation was included in the cost analysis, the group housing in hoop barns for gestation resulted in a weaned pig cost that was 11% less than the cost of a weaned pig from the individual stall confinement system. In the upper Midwest United States, group housing of gestation sows in deep-bedded hoop barns may produce pigs at a lower cost than individual gestation stalls in confinement facilities if the bedded group housing system is managed optimally.

Introduction

Sows perform well across a wide range of environmental conditions. While the facility costs of buildings used for farrowing are the greatest on most farms producing weaned pigs, the cost of gestation facilities is not inconsequential. As part of the sow herd, a female will spend more than 85% of her time in gestation housing. Less capital intense systems that meet the needs of the animals may provide production cost advantages.

The purpose of this study was to compare construction and operating costs for two gestation housing systems—individual gestation stalls in a mechanically ventilated confinement building with slatted floor and group pens with individual feed stalls in deep-bedded naturally ventilated hoop barns. The costs associated with gestation were then included in a weaned pig production cost analysis.

Materials and Methods

Construction Costs

General contractors familiar with agricultural construction in the Midwest U.S. and suppliers of equipment and materials were surveyed during January 2006. Due to the competitive nature of construction, all firms participated on the condition of anonymity and thus are not identified. The material list for the mechanically ventilated individual gestation stall facility is based on a 1,700 sow capacity facility with a totally slatted floor and a 2.4 m (8 ft) pit below the entire barn. The material list for the deep-bedded hoop barns are based on two 9.1 × 27.4 m (30 × 90 ft) hoop barns with space for 52 sows each were constructed in January 2006 at the Iowa State University Swine Breeding Farm near Madrid, Iowa. Frost-free waterers and an automatic feeding system were included in the hoop building cost. A raised, concrete feeding platform with individual feed stalls with closing rear gates was installed. The lounging area had a 10.2 cm (4.2 in.) thick reinforced concrete floor. With increasing number of spaces, construction costs may decline due to economies of scale. To minimize variation in this analysis, the value of concrete was held constant at \$59.28 per m³.

Operating Costs

Two comparisons were made with the weaned pig cost for the system that utilized individual gestation stalls based upon Kansas State University Extension farrow-to-wean pig cost-return budgets. The first comparison assumed gestation would occur in a deep-bedded hoop barn and that productivity would be the same for both systems. The second comparison considered the improved productivity of gestating sows kept in hoop barns that was demonstrated earlier. Fixed and operating expenses related to the farrowing facility were held constant.

Feed cost per litter was increased for the sows gestated in hoop barns to match what had been fed in an earlier study comparing reproductive performance of sows gestated in either deep-bedded hoop barns or individual gestation stalls. Temperature was not controlled in the hoop barns, and feed allotment to sows gestating in hoop barns was increased by 20% in winter (November-March) to offset the colder environment. Management and skill sets are different for group housing systems than gestation facilities utilizing individual gestation stalls. However, group-housing systems do not require more labor per animal than individual gestation stalls and in some cases may require less. The analysis assumes that labor for the two systems is equal on a per litter basis. Breeding and genetic charges, transportation and marketing costs, and professional fees were kept equal for the two systems. For this analysis it is assumed that

veterinary costs and related supplies are equal for the two systems on a per litter basis.

Bedding costs were calculated and added to the hoop budget. Corn stalks are commonly used as bedding in the Midwest U.S. In Iowa, large bales of corn stalks cost \$0.02–0.04 per kg. This analysis assumes 2 kg (4.4 lb) of corn stalk bedding per day of gestation housing at a price of \$0.03 per kg. Utilities, repairs, depreciation, insurance, interest, and taxes were adjusted to reflect the differences between the two gestation systems. This analysis assumes that utility use for the farrowing facility is the same for both gestation systems. Utility use during gestation by the sows housed in hoop barns is assumed to be 10% of the utility use of the sows housed in individual gestation stalls. Fixed costs—depreciation, interest, repairs, taxes, and insurance on buildings and equipment—are functions of construction cost and expected useful life. Hoop barn manufacturers offer 15-year warranties on the tarp. Given production conditions and the rapidly evolving pig industry, a confinement facility with individual gestation stalls is likely to need major repair or retrofitting after a similar time period. Useful life was assumed to be the same for both types of gestation housing.

Results and Discussion

General contractors' survey responses were used to generate component and total cost estimates per sow space. The survey responses are summarized in Table 1. The construction cost per gestating sow space for individual confinement stalls was 32% more than for group housing in hoop barns (Table 1). Projected cost per weaned pig for the two systems with equal prolificacy is reported in Table 2. This projection assumes that both systems have equal reproductive performance and ultimately produce 21 weaned pigs annually from 2.36 litters per sow.

The construction cost per sow space for individual confinement stalls was 32% more than for group housing in hoop barns. In this analysis sows housed in hoops in winter (November-March) consumed more feed during gestation than stalled sows resulting in 7% higher annual feed cost per

weaned pig for the group housing system. Weaned pigs from sows gestated in hoop barns required 1.4% more operating capital than weaned pigs from sows gestated in individual stalls. Fixed costs were greater for confinement stalls than for hoop barns. Total fixed costs for hoop gestation were 83% of the total fixed costs for stall gestation. Assuming equal prolificacy, group housing in hoop barns during gestation resulted in a weaned pig total cost that was 3% less than the total cost of a weaned pig in the individual stall confinement system (Table 2).

Iowa work has demonstrated sows housed in hoop barns for gestation farrowed 7.5% or 0.7 more live pigs per litter and had equal pre-wean mortality rates as sows housed in individual gestation stalls. Projected costs per weaned pig that take into consideration the increase in litter size for group housed sows are reported in Table 3. Estimated cost of production per weaned pig for the sows gestated in individual stalls remained the same. Estimated costs of production per weaned pig for the sows gestated in deep-bedded hoop barns presented in Table 2 were decreased by 7.5% to reflect the expected increase in number of weaned pigs. When differences in prolificacy are included in the analysis, production cost per pig weaned is reduced for sows housed in deep-bedded hoop barns. Six percent less operating capital is required to produce a weaned pig from a sow gestated in deep-bedded hoop barns. Total cost per pig weaned is 11% less for pigs from sows gestated in deep-bedded hoop barns compared with pigs from sows gestated in individual gestation stalls in confinement buildings.

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Table 1. Estimated cost of selected components per sow space for two gestation systems in Iowa.

Component	Stall ^{ab}	Hoop ^{ac}	Hoop:Stall
Building structure	\$265.00	\$249.94	94.3%
Ventilation system	\$150.00	<i>na</i>	<i>na</i>
Flooring and manure storage	\$135.61	\$78.13	57.6%
Feed and water system	\$71.20	\$58.77	82.5%
Other expenses	\$193.19	\$165.16	85.5%
Total building cost	\$815.00	\$552.00	67.7%

^aStall = individual gestation stalls in confinement facility

Hoop = group pens in hoop barns with individual feed stalls

^bEstimates based on survey of Midwest U.S. builders for a 1,700 sow capacity facility with a totally slatted floor, 2.4 m pit, and individual gestation stalls, January 2006

^cCosts taken directly from construction of two, 52 sow capacity gestation hoop barns with individual feed stalls, January 2006

Table 2. Estimated cost per weaned pig for two gestation system with equal prolificacy.^a

Variable Costs		
Feed	\$7.59	\$8.12 ^d
Labor	\$6.94	\$6.94 ^e
Breeding/genetic charge	\$5.13	\$5.13 ^e
Bedding	\$0.00	\$0.90 ^f
Utilities, fuel, and oil	\$1.79	\$0.71 ^g
Transportation and marketing costs	\$1.75	\$1.75 ^e
Veterinary, drugs, supplies	\$1.10	\$1.10 ^e
Professional fees	\$0.48	\$0.48 ^e
Variable cost subtotal	\$24.78	\$25.13
Interest on 1/2 operating costs	\$0.37	\$0.37 ^h
Total variable costs	\$25.15	\$25.50
Fixed Costs		
Depreciation on buildings and equipment	\$3.28	\$2.73 ^{ij}
Interest on buildings and equipment	\$3.10	\$2.58 ^{ij}
Insurance and taxes on buildings and equipment	\$0.94	\$0.78 ^{ij}
Building and equipment repairs	\$1.81	\$1.50 ^{ij}
Total fixed costs	\$9.13	\$7.59
Total cost per weaned pig sold	\$34.28	\$33.09

Table 2 footnotes:^a Assumes 21 weaned pigs sold per sow annually^b Stall = individual gestation stalls in confinement building;

Hoop = group gestation pens in deep-bedded hoop barns with individual feed stalls

^c Stall values are taken directly from KSU MF-2153. Hoop values adjusted assuming equal prolificacy between the 2 systems and 2.36 litters per sow annually; both systems utilize identical farrowing facilities—farrowing crates in mechanically ventilated confinement building^d Feed calculation: November–March (winter) (150 d) hoop received net 20% more feed if in gestation facility; no difference in lactational feed intake

21 d lactation × 2.36 litters per year = 50 d of lactation feed intake

150 d of potential 20% more feed in winter/365 d in year = potential to receive 20% more feed 41% of the time if in gestation

365 d per year – 50 d of lactation = 315 d of gestation feeding

315 d in gestation × 41% = 129 d of receiving 20% more feed

315 d in gestation – 129 d of 20% more feed = 186 d of same gestation feed allowance

50 days of same lactation feed allowance

186 d + 50 d = 236 d hoop sows receives same feed as stall sows

Feed allowance for stall = 365 × 1 = 365

Feed allowance for hoop = (236 × 1) + (129 × 1.2) = 391

Hoop : Stall = 391 : 365 = 1.07:1 = hoop received 7% more feed

^e Assumed to be identical for the two systems^f Bedding calculation: 2 kg bedding per sow daily

2 kg of bedding/day × 315 d in gestation housing = 630 kg of bedding annually

630 kg of bedding annually/21 pigs = 30 kg of bedding per weaned pig sold

30 kg of bedding per weaned pig sold × \$0.03/kg = \$0.90 bedding cost per weaned pig

^g Majority of use in gestation is for ventilation system and 33% of energy use in breed-to-wean used in farrowing stage of production;

Farrowing utilities: \$1.79 × 33% = \$0.59 per weaned pig sold

Gestation utilities: assume 10% of conf gestation utilities = (\$1.79 – \$0.59) × 10% = \$0.12

Hoop utilities: farrowing utilities+ gestation utilities = \$0.59 + \$0.12 = \$0.71

^h Calculated interest on operating cost: Stall = Interest : Operating Cost = 0.37 : 24.7 = 0.0149; Hoop = Interest : Operating Cost = y : 25.13 ; y = 25.13 × 0.0149 = 0.37

ⁱ KSU MF-2153 assumes farrowing facility and equipment to be \$825,000, gestation facility and equipment to match \$910,000; total building and equipment costs of \$1,735,000.

Farrowing facility : total building cost = 825 : 1735 = 47.6%;

Gestation facility : total building cost = 910 : 1735 = 52.4%

Note: a particular space within the farrowing facility will have more weaned pigs allocated to it in a year than a particular space within the gestation facility

Hoop gestation construction cost 67.7% of Stall gestation construction cost

Adjustment for lower construction cost: $52.4 \times 67.7\% = 35.5$

Hoop gestation + Farrowing Facility = $35.5 + 47.6 = 83.1$

Fixed cost ratio Hoop: Stall = 83.1 : 100

^j 83.1 % of value given by KSU MF-2153

Table 3. Estimated cost of production per weaned pig for two gestation systems with different prolificacies.^a

	Stall ^{bc}	Hoop ^{bc}
Variable Costs		
Feed	\$7.59	\$7.51
Labor	\$6.94	\$6.42
Breeding/genetic charge	\$5.13	\$4.75
Bedding	\$0.00	\$0.84
Utilities, fuel, and oil	\$1.79	\$0.66
Transportation and marketing costs	\$1.75	\$1.62
Veterinary, drugs, supplies	\$1.10	\$1.02
Professional fees	\$0.48	\$0.44
Variable cost subtotal	\$24.78	\$23.26
Interest on 1/2 operating costs	\$0.37	\$0.34
Total variable costs	\$25.15	\$23.60
Fixed Costs		
Depreciation on buildings and equipment	\$3.28	\$2.52
Interest on buildings and equipment	\$3.10	\$2.38
Insurance and taxes on buildings and equipment	\$0.94	\$0.72
Building and equipment repairs	\$1.81	\$1.39
	\$9.13	\$7.01
Total cost per weaned pig sold	\$34.28	30.61

^a Based on KSU MF-2153; assume 2.36 litters per sow annually

^b Stall = individual gestation stalls in confinement building, 21 weaned pigs annually;

Hoop = group pens in deep-bedded hoop barns with individual feed stalls, 22.6 weaned pigs annually

^c Stall values are taken directly from KSU MF-2153 Hoop values adjusted from Table 2 to reflect 7.5% increase in prolificacy;

both systems utilize identical farrowing facilities—farrowing crates in mechanically ventilated confinement building