

Housing options for farrowing: Considerations for animal welfare and economics

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Introduction

Housing systems for farrowing sows have changed very little in the past 30 years. At the mid 20th century, two farrowing environments were common – the outdoor hut in a pasture or lot, and an indoor farrowing pen. The farrowing pens were in low-cost buildings and thus the cost per square foot of building space was relatively low compared to today's buildings. Farrowing sows indoors has proved to be beneficial for both the producer and the sow and her piglets. However, recent criticism of the traditional farrowing crate has led to increased efforts to find suitable alternatives that still provide maximum production efficiency.

Objectives

- Discuss Critical Control Points (CCPs) for evaluating farrowing options
- Evaluate the features of the modern farrowing crate
- Propose alternatives to the farrowing crate

Background

Sows were brought indoors for three primary reasons. First, the indoor environment was more comfortable for both people and pigs. Second, the indoor environment allowed for the elimination of parasites in that the floors could be disinfected and the parasite life cycle broken. Third, the indoor system provided uniform, year-round production through-put. The farm could develop a steady cash flow with farrowings at first twice per year and later on a weekly schedule.

One can conclude that the reasons sows moved indoors included to improve the welfare of the sow and piglets and to improve the farm economics. Thirty years ago, this is a case where economics and welfare were associated in a meaningful way. Clearly, sow and piglet welfare was improved by the move from outdoor lots to indoor pens. Clearly, the farm produced more pigs per year that helped pay the mortgage on the farm. When sows moved indoors, the move was associated, almost simultaneously, with a move from pens to farrowing crates. Farrowing crates saved baby pigs from being crushed. Pork producers were willing to restrict the movements of the sow to save baby pigs from being crushed, as the piglets' welfare was deemed more important than the sow's temporary inconvenience.

Because the move indoors was closely timed with the move from pens to crates, the industry did not consider how the pens might be designed to reduce piglet crushing. But this work has taken place and some alternatives to the standard farrowing crate are available.

Humane activist and advocate groups have demanded an alternative to the farrowing crate. For example in the USA, both the Niman Ranch (<http://www.nimanranch.com/index.htm>) and Humane Farm Animal Care (HFAC, <http://www.certifiedhumane.com/>) discourage or prohibit the use of farrowing crates.

Critical Control Points (CCP) to evaluate farrowing options

The key to evaluating any system is to find the critical control points – measures that are key to understanding and improving a system. In the farrowing area, there are two production, three anatomical, and three behavioral critical control points.

Anatomical CCPs in farrowing

- Ability of the sow to stand up and lie down comfortably (in terms of sow length and width)
- Freedom from injury (both sows and piglets)
- Maintenance of sow body condition (to prevent future problems in welfare & reproduction)

Production CCPs in farrowing

- Stillbirth pigs per litter, number of stillbirths per litter
- Preweaning mortality, % [$100 \times (\text{number weaned} / \text{number born alive})$]

Behavioral CCPs in farrowing

- Ability to comfortably nurse (both sows and piglets)
- Ability to make full postural adjustments including turning*
- Ability to build a functional nest*

Items marked with an asterisk (*) are requirements of some systems such as the Niman and HFAC systems. These requirements may be imposed in the future in Europe and the USA, but today, they are a part of only some niche marketing systems.

One of the main ways to tell if a system is performing well in terms of both economics and welfare is to assess each CCP. As the old adage goes, “if you don’t measure it, you can’t manage it”. Each CCP, by definition, is critical. Data should be collected, analyzed, and the information used in a continuous improvement program.

Not all newer systems have each CCP evaluated. Some new systems we can speculate on certain CCPs and that may be adequate for now. In this summary, we will examine each major farrowing house system for available information on each CCP.

The Farrowing Crate

The farrowing crate is by far the most common farrowing barn system in use in the USA today. Estimates are that in the USA, well over 90% of pigs are farrowed in crates. Crates vary in size and construction. Surprisingly few controlled studies have compared different farrowing crate features.

One feature of the farrowing crate is its allowance of the anatomical CCPs. In the National Pork Board PQA+ program, swine producers that earn PQA+ Certification may then choose to have an operation site assessment. A portion of the site assessment includes visual observation of pig space allowance. For swine located in farrowing crates, adequate space is defined as greater than 90% of the observed swine must be able to lie down fully on its side (full lateral recumbency) without the head having to rest on a raised feeder and the rear quarters coming in contact with the back of the stall at the same time. For operations that do not meet this standard, an action plan must be developed and implemented.

To get a sense of how long the farrowing crate must be, we evaluated the length of hundreds of sows in a commercial setting [1]. In the sample, 95% of sows were shorter than 78.7 inches (200 cm) or 6.6 feet – and some genetic lines of sows were longer by 2-6 inches on average. Thus, the crate must be at least 6 feet 7 inches long, not counting the raised feeder for these sows to lie fully on their side without touching the front or rear of the crate. If the feeder extends 12 inches inside the farrowing crate, then the crate is not long enough for sows to lie in full recumbency without the head having to rest on the feeder. If the

sow has a length of 7 feet (213 cm) to lay down, then most sows will fit comfortably. Because the sow width can typically reach under the bottom bar or fingers, farrowing crate width is usually not an issue. In addition, if the crate has sharp edges in the pen materials, feeder or flooring, then it could cause injury and would not be positive for sow welfare. As with all lactation environments, sows should be fed to maintain body condition. In the NPB PQA+ program, sows with a body condition score 1 (backbone clearly visible due to insufficient backfat) are not desirable. This happens often due to a lack of sow feed intake relative to milk production and piglet milk intake. Farrowing crate feeder and water devices must be designed to allow easy access to available fresh feed and water resources.

In terms of production CCPs, an extensive evaluation of crate features was conducted by Curtis et al., [2]. In this work, they evaluated, among many other measures, the rates of stillborn pigs and pre-weaning mortality. They examined 16 farrowing crate design features including crate width (narrow or wide; 56 vs. 61 cm or 22 vs. 24"), crate length (short vs. long; 183 vs. 198 cm or 72 vs. 78") and lower side type (fingered, bowed or straight rails at 20 vs. 25 cm off the floor; 8 vs. 10"). They found that the stillbirth rate was increased by 0.2 pigs per litter (0.3 Narrow vs. 0.5 Wide) and the pre-weaning mortality was greater by 2 % (4% Narrow vs. 6% Wide) due to crushing for wide crates compared with narrow crates. Use of low-height lower rails (8 vs. 10") increased the number of pigs per litter with knee abrasions. None of the crate lengths were considered long by today's standards – sows had access to 6' or 6.5' of length. Something over 5% of sows would be longer than the space they provided in their long crate (6.5') and 30% of the sows would be too long for the short crate (6'). To meet the anatomical CCP of sow length, today's sows, depending on genetic line, require a crate length of either 6.5 or 7 feet in length.

Fraser et al., [3] examined features of the farrowing crate including sloped side rails (called the Ottawa crate), flared rails, straight and finger rails. Generally, there were few production differences among crate design features. Straight-rail crates tended to have larger within-litter variation in piglet body weight gain. These studies support the idea that farrowing crates should not have straight-rails penning materials. Fingers or bowed rails may have a slight advantage in terms of litter productivity.

Alternatives to the Farrowing Crate

Turn-around crate/pen

Sows are motivated to turn around. The standard farrowing crate does not allow sows to turn around. To evaluate sow motivation to turn around, McFarlane et al., [4] gave gilts modified gestation crates that made it difficult to turn around. If the feed and water were located on the same end of a modified crate, gilts still turned around over 100 times per day. When the modified crate was made more narrow turning rates were reduced to 8 to 11 turns per day. The authors concluded that turning is a behavioral need, but not a very strong one (they gave no reason for this conclusion as relative motivations were not assessed).

To accommodate turning in as little space as is possible, the turn-around crate was developed by several producers around the USA. One turn-around farrowing system was evaluated and reported by McGlone and Blecha [5]. The pen was triangular-shaped and its outside dimensions were 5 X 8.5'. The turn-around farrowing pen was a modified crate in that the side walls were flared outwards, but were fixed in place on either side of the feeder. The stillbirth rate was a little lower and the pre-weaning mortality was significantly lower for sows in the turn-around crate compared with the standard crate (Table 2).

Sloped pen

The sloped pen was found on commercial farms decades ago. The logic of this indoor farrowing pen was that when sows farrowed in rolling hill country, they often had no problem with nursing on a slope – some producers even thought they did better when nursing on a hill. The sloped has been called the Hillside or Sloped pen. It was popular on commercial farms 30 to 50 years ago.

An early evaluation of the Hillside crate was made by Collins et al., [6] and a more complete evaluation was performed by McGlone and Morrow-Tesch, [7]. While the sloped floor improved pre-weaning survival of litters in pens, piglet survival was reduced when the crate was sloped. Sloping the floor of a farrowing pen causes the sow to stand and lie more carefully and it encourages piglets to rest at the bottom of the slope. Sows often lay with their teats parallel to the creep area which facilitates suckling.

Family pen

The family pen concept includes an area where the sow can be with her piglets and an area that allows the sow to get away from her piglets. The idea is that sows are motivated to be close to their piglets the first few days of their life and then they gradually spend more and more time away from their piglets. After about one week of age, the piglets are highly motivated to explore with the rate of exploration increasing with age. The family pen attempts to accommodate ever changing piglet and sow motivations. The family pen concept evolved out of work done by Stolb and Wood-Gush [8] on the behavior of sows and piglets in what was described as a 'semi-natural habitat'. The sows can be isolated in their own pen during the periparturition period and then she can socialize with other sows after a few days (when she is motivated to do so).

While some reports show very poor production with this system, further refinements lead to good sow and litter performance. Arey and Sancha [9] reported stillbirth rates and pre-weaning mortality rates in the family pen as comparable to those from the farrowing crate. If this system includes bedding, it would be considered the most enriched environment among the indoor farrowing systems. Some commercial models are also available that include electronic sow feeders and gates.

Werribee farrowing pen

The Werribee farrowing pen was developed by Cronin in Australia as an alternative to the farrowing crate based primarily on welfare concerns [10]. The Werribee pen includes a sow and piglet area (called a nest) and a dunging area (or non-nest area). The Werribee farrowing pen occupies about twice the floor space as a standard farrowing crate. Attempts to reduce the floor space area in the Werribee farrowing pen caused a sharp increase in piglet pre-weaning mortality [11]. In its standard format, the Werribee farrowing pen occupies 147% more floor space than the standard farrowing crate, but with statistically similar rates of stillbirths and pre-weaning mortality as the standard farrowing crate.

Ellipsoid farrowing crate

The ellipsoid farrowing crate was developed to give the lactating sow the ability to turn around while still protecting piglets. The side walls are concave with the top and bottom of side rails closer to the sow at the top and bottom of the rail. The ellipsoid crate gives sows improved access to piglets in terms of both visual and tactile interactions with only a minimal increase in space when compared with standard farrowing crates.

Lou and Hurnik [12] reported that the ellipsoid farrowing crate was 9% larger in floor area than the standard farrowing crate. Sows turned 3600 an average of 40 times per day in the ellipsoid farrowing crate. The ellipsoid crate significantly reduced the rate of stillbirths compared to the standard farrowing crate. Pre-weaning mortality and number of pigs weaned per sow were similar in the ellipsoid and standard farrowing crates.

Outdoor English-style farrowing hut

All of the previously mentioned systems consider indoor alternatives to the farrowing crate. Among outdoor systems, significant differences were reported in pre-weaning mortality among farrowing huts. McGlone and Hicks [13] reported that the Quonset-style (American) farrowing hut had 19.7% pre-weaning mortality while the English-arc style farrowing hut had 11.2% pre-weaning mortality (a significant reduction).

Johnson et al., [14] compared sow and piglet behavior and performance for sows farrowing in the English-style arc outdoor hut with sows and piglets in a standard indoor farrowing crate system. They observed no difference in stillbirth rates or pre-weaning mortality in the two diverse systems. Therefore, although the diverse environments caused significant behavioral differences (sows were much more active outdoor compared with indoors, for example), the outdoor English-style arc hut and the indoor farrowing crate resulted in similar sow and piglet performance.

Other alternative systems

Other proposed alternatives to the farrowing crate have been published. In some cases, higher pre-weaning mortality was reported [15] in the alternative system compared with the standard farrowing crate. Reduced sow or piglet performance would not make an alternative a viable alternative since others successful alternatives are published (Table 2). New systems will continue to be developed and they may be

viable if sow and piglet productivity are similar among litters in the alternative and standard farrowing crate.

Economics

The economics of successful alternative farrowing systems does not relate to sow and piglet productivity because successful alternatives have comparable sow and litter performance as a standard crate. What is different among the published successful farrowing systems is that they require more floor space. In addition to space differences, the cost of construction materials, accessories, and utility expense must be evaluated in the context of determining the full cost of alternative farrowing systems.

Shown in Table 1 are the dimensions of the successful alternative systems that have been reported. Floor space of the alternatives averaged 48% more space when compared with the standard farrowing crate. The range in added space needed is from 9 to 147% more space for the alternatives.

Clearly, building cost is a significant cost of production. With productivity being the same, an alternative system that requires more space will increase the cost of production compared with the less space-occupying standard farrowing crates.

Table 1. Size of successful alternative farrowing systems.

Alternative	Size in Feet (meters)	Increase in floor space needed*	Reference
Turn-around	5 X 8.5 (1.5 X 2.6)	21%	McClone & Blecha, 1987
Sloped Pen	7 X 7 (2.1 X 2.1)	40%	McClone & Morrow-Tesch, 1990
Family Pen	5.5 X 7.5 + 1.3 X 3.25 (1.7 X 2.3 + 0.4 X 1.0)	30%	Arey & Sancha, 1996
Werribee Pen	7.6 X 11.4 (2.33 X 3.5)	147%	Cronin et al., 2000
Ellipsoid Crate	5.6 X 6.5 (2.0 X 7.5)	21%	Lou & Hurnik, 1994
Outdoor English-style Hut	9 X 5.4 (2.79 X 1.65)	9%	Johnson et al., 2001
Average	----	48%	----

* Compared with a farrowing crate that provides 35 ft² (3.3 m²).

Table 2. Production values for studies that compared crates with successful alternative non-crate farrowing systems.

Alternative*	Stillborn, number/litter		Pre-weaning, mortality, %		Reference
	Crate	Alternative	Crate	Alternative	
Turn-around	0.74	0.61	29.3	9.4	McClone & Blecha, 1987
Sloped Pen	1.08	0.96	10.8	9.1	McClone & Morrow-Tesch, 1990
Family Pen	1.50	0.70	22.1	26.9	Arey & Sancha, 1996
Werribee Pen	0.80	0.70	18.7	15.8	Cronin et al., 2000
Ellipsoid Crate	1.57	0.81	28.4	22.3	Lou & Hurnik, 1994
Outdoor English-style Hut	0.90	0.70	11.0	11.8	Johnson et al., 2001
Average	1.10	0.75	20.0	15.9	----

Summary

Overall, farrowing facility alternatives are comparable to the farrowing crate in terms of production numbers. However, producers must keep in mind that all farrowing alternatives will have a great space requirement than the farrowing crate. The ideal farrowing alternative must be able to sufficiently increase

production to compensate for the decrease in number of sows farrowed per building. Furthermore, the ideal alternative must be able to efficiently conform to the dimensions of current farrowing buildings used in the industry. Overall, producers need to be aware that outside pressure from animal humane societies may force the swine industry to find alternatives to the modern farrowing crate.

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