factsheet
Pork Information Gateway

Alternative farrowing options in the swine industry

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Introduction

Over the past decade there has been increased awareness from the public on animal welfare issues related to commercial swine. More specifically, in the United States, much time and discussion has focused on housing conditions of sows during farrowing and lactation. Restricted sow movement in the traditional farrowing stall has been identified as a significant concern with growing pressure towards the elimination of this system. Recognizing changes in consumer demand and the desire to improve sow welfare by meeting her biological needs during farrowing, alternative farrowing options need to be assessed. The purpose of this factsheet is to identify alternative farrowing options and discuss the impacts of these facilities on the biological needs of the sow, piglet welfare and impact on worker safety, efficiency and labor costs.

Objectives

- Farrowing facility impact on the biological needs of the sow during farrowing
- Farrowing facility impact on piglet welfare and survivability
- Farrowing facility impact on the safety and labor of farm workers

Introduction

Currently in the United States, approximately 83% of sows are housed in traditional farrowing stalls (average floor space for sow: 13.6ft^2; Vosough Ahmadi et al, 2011; Figure 1). These stalls became popular in the 1960's by U.S. swine farmers because they provided a more efficient means to individually manage and care for sows. In addition, these stalls were also implemented as an attempt to reduce piglet mortality due to sow crushing and in turn improve piglet welfare (average pen area for piglet: 36.6 ft^2; Vosough Ahmadi et al, 2011; Robertson et al., 1966). Sows are usually moved to a farrowing stall up to a week prior to their expected farrowing date and will remain in the stall until the piglets are weaned between 21-28 days depending on individual farm protocols (Varley, 2010).

Figure 1. Traditional farrowing stall typically 6.6ft x 2ft composed of metal bars that run the length of the stall. ***Photo courtesy of Steve Moeller, The Ohio State University, 2015***

Although the traditional farrowing stall can allow farmers the ability to individually manage sows, this type of facility limits the ability for the sow to perform nest building, a complex set of behaviors driven by hormonal regulation (Jensen, 1993; Algers and Uvnas-Moberg, 2007; Johnson and Marchant-Forde, 2011a) and environmental feedback (Burne et al, 2000). Nest building behavior begins approximately 24 hours prior to parturition with peak activity occurring 6 to 12 hours before farrowing (Wischner et al, 2009). Nest building occurs as a means to provide offspring with shelter, comfort and thermal regulation (Varley and Stedmann, 1994). Studies evaluating sows in semi-natural environments found that during this time sows would travel 4 miles over

6 hours to find an ideal farrowing location (Jensen, 1986; Baxter, 1991). Thus, nest building is a highly active behavior and sows are extremely motivated to perform prior to farrowing (Jensen, 1993; Johnson and Marchant-Forde, 2011b). In traditional farrowing stalls, a combination of no nesting materials and a lack of physical space may result in incomplete presentation of nest seeking and building behaviors and postures (Heckt et al, 1988; Damm et al, 2000, 2003.)

Recognizing the limitations imposed on the sow in the traditional farrowing stall, an effort has been made to redesign this facility while maintaining a safe environment for piglets and a safe and efficient work area for the farmer and those working with the sows. Successful farrowing facilities rely on balancing the needs of the sow, piglet and farmer. This balance has been identified by Baxter and colleagues (2012) as the 'triangle of needs' and promotes maximizing the welfare of the pigs and the productivity of the farm. This article will discuss four alternative farrowing facilities (1. Modified stalls 2. Pens 3. Group Systems and 4. Outdoor systems) and the impact that each facility design has on the biological needs of the sow, piglet welfare and farm labor and safety.

Modified Stalls

Modified stalls expanded off the traditional farrowing stall design but increase the width of the stall to allow for increased sow mobility (McGlone & Blecha, 1987). The internal traditional stall structure has been maintained to provide protection for the piglet whilst allowing the farmer to individually manage the sow and restrain her as needed. Examples of modified stalls include the Ellipsoid stall and Turn-around stall (average floor space per sow: 21.6-50.7 ft^2).

Biological needs of the sow: The main goal of the modified stall design compared to the traditional stall design is to provide the sow with more space to turn around while maintaining a protective area for the piglet. However, according to Baxter and colleagues (2012), when evaluating the biological needs of the sow alone, this increase in space equates to only a marginal increase for the welfare of the sow. This is due in part by the fact that the sow is still confined during the active phase of nest building and that these stalls are often housed on slatted floors preventing the use of substrate (straw) for nest building (Wischner et al, 2009).

Piglet Welfare: Total piglet mortality in modified stalls ranged from 16.3-17.4% based on results from Baxter and colleagues (2012). These results are very similar to that of the traditional farrowing stall with piglet mortality around 18.3% (Baxter et al, 2012). A study conducted by Lou and Hurnik (1994) found that sows farrowing in ellipsoid stalls had no significant differences in piglet born alive number, death by crushing or average weight loss from day 1-21 when compared to a traditional stall (Modified stall vs. traditional stall: 8.91 vs. 8.40 born alive; 5.2% vs. 4.6% death by crushing; 0.52 lb./day vs. 0.49 lb./day). This in turn suggests that the modified stall provides the same protection for the piglet as a traditional farrowing stall although crushing of the piglet still does occur at a rate of approximately 4.6%.

Farm labor and safety: Housing sows in a modified stall may be beneficial for the worker as the sow can be restrained for worker safety in times where the sow or piglet needs to be treated or processed. In addition, individual nutritional evaluation for each sows allows the worker to cater to the sow's need and provide more or less feed depending on her body condition score and lactation stage (Robertson et al, 1966). Financial considerations for the traditional farrowing stall are presented in Table 1.

Table 1. Facility and labor costs per sow for specified farrowing systems. Adapted from Baxter and colleagues[a]

System		Facility cost[b]	Labor cost[c]
Conventional crate		$2820	6.9 ± 1.1
Modified crate	Turnaround/ Ellipsoid	$4478	NA
Pen system	Slope/ Hill-side	$1996	NA
	Mushroom pen	$3147	NA
	Designed pen	$3328	7.17 ± 1.17
Group System[d]		$4595	28.5 ± 0.68
Outdoor system		$1559	NA

[a]Baxter, E.M., A.B. Lawrence, and S.A. Edwards. 2012. Alternative farrowing accommodation: welfare and economic aspects of existing farrowing and lactation systems for pigs. *Anim.* 6:96-117.

[b]Costs for facility was calculated based on average direct cost for physical material of system on a per sow basis. Calculation does not take into account costs for external building, draining, ventilation, or plumbing.

[c]Costs for labor calculated on hours per sow per year basis ± standard error means.

[d] Facility costs for group system based on averaging facility costs across the following systems: Ljungstrom, Thorstennson, Free access then group crated for farrowing, and family pen.

Pens

In pen systems, sows are removed from the stall and housed in a larger area for increased movement. These pens often provide additional components such as rubber protrusions or a slanted floor to encourage the piglets to gravitate away from the sow and encourage the sow to lie down in a particular location of the pen. Examples of pen systems include the sloped/hillside pen and mushroom pen (average floor space per sow: 113 ft^2, Vosough Ahmadi et al, 2011). In addition, designed pens such as the Werribee and Schmid pen provide the sow with defined regions to perform specific behaviors (average floor space per sow: 76 ft^2, Vosough Ahmadi et al, 2011; Figure 2). These regions include a "nest" area designed to attract sows to this site for farrowing while promoting piglet welfare and survival, and a "non-nest" area designed to encourage elimination and maintenance behaviors (Cronin et al, 2000).

Figure 2. Werribee Farrowing pen is a non-crate farrowing system designed by 6ft x 8ft Cronin and colleagues (2000). ***Photo courtesy of Greg Cronin, 20154.***

Biological needs of the sow: In simple pen systems such as the mushroom pen and sloped/hillside pens, sows are provided with more physical space and substrate material as compared to modified and traditional stalls. Sows housed in pens with straw performed more nest building behavior (Cronin et al, 1994) and walked more frequently during the 24 hours prior to farrowing as compared to the traditional farrowing stall (Hartsock and Barczewski, 1997). The addition of straw to the pen also encouraged nest building behavior to begin sooner and last for a longer duration (Thodberg et al, 2002). Increased space provision also encouraged an increase in maternal behavior performed, which could result in improved maternal care defined as increased piglet directed rooting and sniffing combined with controlled postural adjustments. These improved maternal care behaviors and postures may then result in reduced piglet crushing (Jarvis et al, 2004). However, it should be noted that there are not reported provisions of substrates provided to farrowing pen systems housed on slatted floors. In situations where pen systems lack external stimuli to promote nest building (i.e. substrate), the biological advantage to the sow is decreased as the only advantage to this system for the sow is increased space (Gundlach, 1968).

Piglet Welfare: Total mortality averaged for pen systems was 20.7% and designed pens at 16.6% (designed pens are pen systems with defined regions to perform specific behaviors) according to Baxter and colleagues (2012). Cronin and colleagues in 2000 compared the Werribee pen to the traditional farrowing stall and found that the number of piglets weaned per sow and piglet mortality was similar. This data, along with other studies by Weber (2000) suggest that piglet production and survival can be as good in designed pen systems as compared to the stall. However, it was noted by Cronin and colleagues (2000) that 3 gilts of 66 total females enrolled on trial farrowed outside of the nesting area resulting in chilling and death of 9 piglets. Use of pen systems may require additional training and management especially when used by first time farrowing gilts.

Farm labor and safety: In the Werribee pen, staff were less likely to assist sows during farrowing and 3 sows of 66 total females enrolled on trial were defined as aggressive and overly protective of piglets (Cronin et al, 2000). This increases the concern of caretaker safety, especially if manipulation of the sow or piglet is needed for medical or processing purposes. As mentioned above, some gilts may not know how to use the nesting space provided in the pens, resulting in additional labor from the caretaker and concern regarding piglet welfare. In addition, as compared to group systems, farrowing out sows in individual pens allows for easier control and management of the sows, reducing caretaker labor costs. However, the major disadvantage of the pen system results in large floor space requirements compared to the traditional farrowing stall (Average floor space per sow: 26.2-126 ft^2 vs. farrowing stall: 13.2 ft^2). As piglet survival and productivity are similar to traditional farrowing stalls, cost associated with additional floor space cannot be offset by production (Baxter et al, 2012). Financial considerations for pen systems can be found in Table 1.

Group Systems

In group systems, sows and litters mix allowing for multi-suckling accommodations. Farrowing sows may either begin farrowing in a group setting or be initially housed in either pens or stalls and then integrated into a group 10-21 days post-farrowing. Individual nesting boxes are an option that producers can employ

in these systems to allow sows the ability to farrow in partial isolation (average floor space per sow: 94.7-448.9 ft^2; Figure 3).

Figure 3. Group systems usually consist of an individual farrow area for each sow and free access to a group area. ***Photo courtesy Dr. Yuzhi Li, University of Minnesota, 2015***

Biological needs of the sow: There are no advantages from a biological needs standpoint in group systems compared to the traditional or modified stall when the sow remains in a farrowing stall until 10-21 days post farrowing. For a group system to be successful, the following factors need to be addressed:

Group dynamic: In semi-natural environments, sows are motivated to seek isolation from the group in the days prior to and following farrowing. Therefore, in a group setting, this desire to isolate may be difficult and lead to increased aggressive interactions between sows (Gotz & Troxler, 1993). To minimize aggression, caretakers should attempt to create a stable group of familiar sows to farrow together. This should minimize aggression as the hierarchy among the group should be established prior to farrowing (Stolba & Wood-Gush, 1984).

Nest sites: Nest sites are also critical for the implementation of group system farrowing. Nest sites are important as they provide a physical space for the sow to isolate from the group. In addition, nest features should include the ability for the sow to have visual access of the environment and in gilts and young sows, provide a nesting area with solid walls and an overhead cover is preferred as it may provide a greater feeling of security and isolation generally more fearful younger sows (Sancha & Arey, 1995). Size of the nest site should be large enough to allow the sow to turn around, but small enough to prevent multiple sows from farrowing in one pen. Two entrances to the nest may be beneficial to maximize space efficiency by eliminating the need to turn around but preventing multiple sows from utilizing one nest. However, it should be noted that the sow demonstrated no preferences for one entrance vs. two entrances and two entrances have been cited as more difficult to manage (Cooke, 1995).

Piglet Welfare: In group systems, maternal behavior and breed disposition plays a key role in the success of group system as it relates to piglets survival (Arey, 1997; Canario et al, 2006). Group systems settings provide an environment where the sow can interact with the piglet and encourage maternal vigilance and care. However, group systems and more importantly group size can negatively impact piglet survival. In a study conducted by Ebner in 1993, sows farrowing in groups of 10-12 performed better than sows farrowing in groups of 16-20. This is most likely due to a number of factors including competition for nest area, aggression among sows and towards piglets, and constraints on the caretaker's ability to manage the group. In general, group systems have the largest piglet mortality averaging around 23% (excluding systems that use the farrowing stall first; Baxter et al, 2012).

Farm labor and safety: Group systems tend to rank as one of the least desirable systems from a management standpoint as the design can significantly impact the safety of the caretaker and their ability to perform the job, resulting in the highest labor costs and requirements for a farrowing system (Kerr et al, 1988). Piglet mortality, labor input and capital investment (financial considerations presented in Table 1) make group systems difficult to manage and result in high financial investments and compromised piglet welfare (Jensen, 1986). For these systems to be successful, genetic selection for maternal behavior and excellent managerial skills are required.

Outdoor Systems

Commercial outdoor farrowing systems are often comprised of individual farrowing paddocks or runs in which sows will have individual access to a farrowing site but share a portion of pasture with other sows. Multiple farrowing facilities exist for outdoor farrowing systems and can range in size from 36-50 ft^2 per sow. In more extreme climates, farrowing facilities may be located in a combined outdoor/indoor facility. This would provide piglets and sows protection from extreme climate but ability to access pasture as desired (Figure 4).

Outdoor systems for farrowing have been cited as the gold standard of farrowing systems as they facilitate high standards of welfare while still remaining economically efficient (Baxter et al, 2012). Outdoor systems satisfy the biological needs of both the mother and offspring by allowing for key natural behaviors to be performed during the time prior to farrowing and throughout lactation (Baxter et al, 2009). Countries requiring sows to farrow in outdoor systems demonstrate competitive production levels as compared to those housed indoors (Outdoor production levels: Average litter size: 11.8, Born alive: 10, Total mortality: 18.7%, Live-born mortality: 15.9% vs. Traditional farrowing stall: Average litter size: 11.1, Born alive: 10.4, Total mortality: 18.3%, Live-born mortality: 11.5%; Meat and Livestock Commission/BPEX, 2009). From a financial standpoint, outdoor systems are run at low capital investment with little additional costs for maintenance (financial considerations presented in Table 1). In addition, management of sows may be more difficult but utilization of on-farm equipment (trailers, temporary holding pens, farrowing huts) can allow the care taker to perform necessary processing and handling of pigs in a safe environment. However, because the sow and piglet are exposed to environmental conditions, outdoor systems are more appropriate in geographical locations that are minimally affected by extreme weather systems and the farmer must take into account the additional costs for environmental protection and biosecurity (Callaway et al, 2005).

Figure 4. Outdoor Systems allow the sow free-access to pasture usually shared by other sows with access to individually farrowing huts. *Photo courtesy of Monique Pairis-Garcia, The Ohio State University, 2015*

Summary

An optimal farrowing system addresses and balances the needs of the sow, piglet and farmer in an effort to maximize the welfare of the pigs and the productivity of the system (Johnson and Marchant-Forde, 2011c). To meet the biological needs of the sow, space and substrate are required to allow her to perform nest-building behaviors in the days prior to and up to farrowing. To maintain piglet survival, an area or zone of protection or a design that encourages piglets to get away from the sow will minimize deaths associated with crushing. Lastly, the caretaker plays a huge role in the success of a farrowing system. Successful management and dedicated caretakers can make any farrowing system productive and welfare-friendly regardless of the physical restraints of the facility, however facility design needs to take into account worker safety and efficiency.

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