Alternatives to Gestation Stalls: Experiences at the Prairie Swine Centre

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Introduction

The housing for gestating sows is one of the most controversial issues in farm animal welfare and swine production. The welfare status of animals in the various systems available is widely debated among swine producers, consumer and animal interest groups, and scientists. The approaches taken by different jurisdictions to implement changes in commercial production practices also differ widely and sometimes confuse the primary issue of ensuring animal welfare. In this presentation I will outline what I perceive to be the key welfare issues concerning sow gestation housing, and my experiences with various alternatives to conventional stalls.

Key Welfare Issues

Although freedom of movement is generally cited as the key welfare issue for gestating sows, this freedom is open to some interpretation itself, and several other welfare issues must also be considered in recommending a housing system.

Freedom of Movement: The Brambell Report (Command Paper 2836, 1965) stated the committee's opinion that 'An animal should at least have sufficient freedom of movement to be able without difficulty, to turn round, groom itself, get up, lie down and stretch its limbs.' This statement refers to what is often termed 'dynamic' space, or that space necessary to change postures and perform certain behaviours in place. Although this statement is made in the context of a discussion on natural behaviour, the emphasis arising from this listing of 'freedoms' is that of postural changes.

The Farm Animal Welfare Council (Webster, 1993) later expanded on this concept of space by stating that an animal should have the 'Freedom to express normal behaviour by providing sufficient space, proper facilities, and company of the animal's own kind.' It is important to note the shift from postural change to a more comprehensive expression of behaviour. I have suggested that the importance of freedom of movement arises from three needs of the animal: a sense of control over the environment; the opportunity to select the most comfortable micro-environment; and, benefits arising from increased exercise (Gonyou, 1996). Marchant and Broom (1996) demonstrated the later by examining specific muscles and bones in sow housed for several parities in either stalls and group housing. The muscles of sows kept in stalls were smaller, and their bone breaking strength weaker, than for those in group housing that provided for freedom of movement.

Freedom from Aggression: Non-stall systems generally require animals to live in groups and to be re-grouped with unfamiliar pigs several times during their lifetime. Aggression among sows arises for three major reasons. The first is the aggression associated with re-grouping. Pigs, to a greater degree than other farmed animals, will fight with unfamiliar animals in an attempt to either exclude them from the social group or to establish dominance over them. The second form of aggression is competition over limited resources, specifically feed. Sows are restricted to a limited amount of feed each day and competition can be severe. There is also a continuing low level of aggression within a group as animals maintain social order within the pen.

The aggression associated with re-grouping and feed competition is a major concern to producers. To a large degree the industry adopted gestation stalls to eliminate these types of aggression. Sows are frequently injured, usually in the form of scratches, during this aggression, but the damage is short-lived. Studies typically demonstrate a high level of scratches in group-systems for several days or weeks after re-grouping, but these heal by mid-gestation. Aggression associated with competition for feed will result in mild injuries throughout the gestation period, but more importantly will affect access to feed.

Control Over Individual Feed Intake: Over the past few decades we have amassed a considerable amount of knowledge on how to best feed sows. To achieve both high productivity and longevity it is necessary to limit the amount of feed that sows consume and maintain a certain level of body condition. Both fat and thin sows create problems. To achieve the desired level of body condition, typically expressed in terms of back-fat thickness, animals are periodically assessed and levels of energy and protein intake adjusted (Young et al., 2004).

To avoid the aggression associated with feeding, and to achieve control over individual feed intake in sows, the industry moved to first feeding, and then gestation, stalls. Producers remain committed to the importance of controlling feed intake, perhaps even more so with the high levels of productivity expected on today's farms. Overly thin sows are recognized as a welfare problem. To be acceptable, a housing system must ensure that timid animals are able to access sufficient feed.

Environmental Enrichment: The European Union has issued a directive that pigs should have access to manipulable material (Council Directive 2001/88/EC). In most cases this is straw. There are many benefits to providing straw or other forms of bedding to pigs, including thermoregulation, reducing hunger, protection from the floor, and increased activity. Had the EU not already required an end to stall housing, the need to provide environmental enrichment would have shifted their industry in that direction as well.

Much of North American pig industry exists in regions with little straw. Corn is the most common feed grain in North America and its stover is a poor bedding substrate. As a result the industry has moved to liquid manure systems, precluding the use of significant amounts of bedding. To incorporate environmental enrichment into sow housing, in the form of bedding, involves both supply issues and a change in manure handling.

Static Space: The Food Marketing Institute and National Council of Chain Restaurants have re-introduced the concept of static space as a welfare requirement (FMI-NCCR, 2002). Although they advocate freedom of movement as outlined earlier, they also state requirements in terms of space to lie comfortably and safely. Specifically, they indicate that sows in stalls should be able to lie on their sides without their udder extending into the adjacent stall.

During their productive life, sows may double in body weight. They also increase in size as their pregnancy progresses. Narrower stalls may be sufficient to meet the static space requirements suggested during a sow's early parities, or the first part of each gestation, but be unable to do so as she increases in size.

Alternative Housing Systems

Suggesting that we can classify housing systems as stall vs group is overly simplistic. Various housing systems have been developed to address the issues described above. Stalls are able to meet the needs of controlling aggression and feed intake, but fail in terms of space for natural behaviours. All group housing systems are challenged by their inability to completely eliminate aggression, but some types will accommodate the need to control intake and provide enrichment. My discussion will be focused on four systems that differ in how feed is presented to the sows. If you include management options such as floor type (slatted, partial slatted, and bedded), social grouping strategy (static vs dynamic groups), and the timing of re-grouping (weaning, pre-, and post-implantation) there are 72 combinations to consider. These should not be lumped together as ‘group’ systems in an analysis of sow housing options.

Floor Feeding: Many producers assume that group housing means floor feeding as this was the system they remember from before stalls. The group of animals is fed by spreading their feed on the floor or outside lot. This is a very competitive situation, with dominant sows able to monopolize the feed and subordinate animals encountering both social and nutritional stress. Control over individual feed intake is never very good, but some management options can be used to improve the situation. Forming groups of similar sized animals will result in more even competition for and distribution of feed. It is therefore important that all animals have similar feed requirements as well. To achieve these conditions, it is necessary to allocate animals into several groups, and the resulting group size is small. Floor feeding groups are generally managed on a static basis (animals are not added to already existing groups). Providing more space in the feeding area, and ensuring that the feed is widely spread, will make it more difficult for sows to claim a disproportionate amount of the feed. However, this additional space increases the cost of the system, and low cost is the greatest advantage of floor feeding.

A recent article in National Hog Farmer described a floor feeding system used on a large commercial farm (Miller, 2004). Some of the key components were that the sows were stalled for about 5 weeks before entering the group pens. This ensured that embryonic implantation was complete before re-grouping, and allowed the manager to feed the animals individually for several weeks. The animals were penned in groups of 5 animals sorted by size and parity to minimize the negative aspects of feed associated aggression.

The competition involved in feeding can be intense, and 10-15% of the sows may need to be pulled from such a system. European legislation is already suggesting that highly competitive systems will not be acceptable (Council Directive 2001/88/EC). Our industry has embraced the importance of good sow nutrition, and this can only be achieved when control over individual feed intake is possible. If we are required to adopt group housing, then floor feeding will be used by producers who are concerned about capital costs in the transition. But in the long run, systems that provide better control over feed intake will be necessary in order to achieve the productivity that we have come to expect on modern farms.

Short Feeding Stalls or Trickle Feeding: In the trickle system, sows are fed in partial stalls, providing protection to their head and shoulders, but not extending further into the pen area. This arrangement conserves space compared to feeding stall systems, yet still attempts to achieve uniform distribution of feed among sows within a pen. In each feeding space, feed in metered in at a set rate, representing the eating speed of the animals in the pen. Because feed is distributed at the same rate that the sow can eat it, no feed accumulates and it does not benefit a sow to move from space to space attempting to steal from other animals. The system may be operated with a single drop of feed, in which case it is called a short-stall system. Animals must be sorted by eating rate (sows eat much faster than gilts) and by feed requirement. The result is a number of small, uniform groups. Trickle feeding depends on social management of the animals. It has not been used extensively on large farms. Although popular for a time in the U.K., it is not widely used within the rest of Europe. Conventional stall barns have been renovated to incorporate an inexpensive, modified trickle feeding system. It is not clear that such modified systems can adjust the rate of feed drop in different groups, and the importance of this to the system has yet to be determined.

Individual Feed Stalls: Before our industry adopted gestation stalls, many farms used feeding stalls as a means to control individual feed intake. Although housed in a loafing area for most of the day, animals are moved into stalls for feeding. The system can easily achieve uniform intake among all members of a group, and sows requiring additional feed can be topped up by hand. Traditionally, sows have been housed in relatively small groups and the feeding stalls have been located within each pen. Larger groups are feasible, although provision must then be made for individual supplementary feeding. The greatest drawback to within pen feeding stalls is the requirement for both stall and loafing space. In our indoor systems, this added expense is substantial.

The feeding stall system can be made more efficient in terms of space and capital costs by 'time-sharing' the feeding stalls among several groups of sows. Each pen of sows is released from their loafing area in rotation and has access to the feeding stalls once a day. Although some mechanization of sow movement is possible, essentially you trade space and capital cost for labour. Sharing of feeding stalls in this way allows stockpersons to observe each group of animals as they go to eat, and various procedures, from treatment to pregnancy-checking or breeding can be accomplished easily while the sows are confined. Large herds can be managed in this way, using static social groups. However, sow movement to the feeding stalls resembles a stampede and facilities must be design for both animal and stockperson safety. Preliminary results from a study using large social groups and time-shared feeding stalls indicates that sows in groups had less lameness and fewer abrasions than did sows in conventional stalls, but had more scratches (Karlan et al., 2003, 2004). It is not clear if the reduction in lameness was due to the daily movement to the feeding area, or to the bedded loafing area for the sows in groups.

Electronic Sow Feeder: Electronic sow feeders provide the greatest control over individual feed intake of all group-housing systems. Each pen of animals has one or more feeding stations which animals cycle through and obtain their specific daily allowance. Each animal can be fed a different amount of feed, and may even be fed different diets or a blended ration of two basal diets. Daily feed allowances can be programmed to change as an animal progresses through pregnancy. Theoretically, all size and body condition combinations can be housed together as each can have a separate feeding program.

The electronic sow feeding system is a technically complex one, involving computer programming, electronic identification, and the mechanics of station gates and feeders. Early systems had many problems but most companies have now developed reliable equipment and support services. Nevertheless, a producer who is not adept at computer records should recognize that they would have to develop those skills to operate such a system effectively.

The relative cost of an electronic sow feeding system is highly dependent upon the number of sows fed from a station. The larger the number of sows, the lower the cost per sow. It is recommended that the entire group of animals be able to complete feeding in 14-18 hours. For mature sows, this limits the number of animals per station to 55-65. Gilts eat more slowly than sows, and the number of animals may have to be reduced if a group contains a large number of gilts. Increasing the number of sows beyond this point may result in increased competition and aggression at the feeder entrance, and more animals will miss a feeding. Attention must be paid to training animals to use the system, and to the daily checking of feed records to detect animals going off feed.

We operate an ESF system on partially slatted floors, without bedding. We are comparing static and dynamic (new animals added to existing group every 5 weeks) groups. We also add animals to the pens either pre- (within a week of breeding) or post- (6 weeks after breeding) embryonic implantation. We have found few differences between the static and dynamic social management options. It should be noted that dynamic groups do not have new animals added weekly, as some commercial operations would, but rather at 5 week intervals to reduce the frequency of re-grouping prior to implantation.

The pre-implantation treatment has reduced farrowing rates (by about 5%) compared to the post-implantation animals. Overall productivity, combining farrowing rate and litter size, is reduced in pre-implantation animals, but does not differ among animals in stalls and those grouped after implantation. We attribute the reduction in farrowing rate to the stress of aggression following regrouping, and that this occurs during a sensitive period prior to embryonic implantation. There has not been any interaction of these main factors with the parity of the sow, indicating that young animals are not at a disadvantage in the ESF system.

Wider Stalls: Conventional gestation stalls are criticized for denying freedom of movement to sows. Although it may seem obvious that stalls will never provide freedom of movement as defined by some welfare advocates, as an industry we have done little to avoid criticism. When a 'turn-around' stall was developed in the 1980's (McFarlane et al., 1988), the industry failed to adopt it. Yet this stall did allow animals to 'without difficulty, turn around'. Also, even though mature sow size has increased over the years, until recently we have narrowed gestation stalls rather than widened them.

The Canadian Code of Practice suggests that sows should be housed in wider stalls as they increase in size with each parity (AAFC, 1993). Few producers manage their sows in this way. I suspect that many studies involving stalls have looked at animals only as gilts and young sows. Are we confident that productivity in older sows is not limited by stall size?

We are studying the relationship between sow and stall size and sow behaviour, and have initiated a long-term project looking at stall size and productivity this past summer. In our initial study we observed females from gilts to mature sows in stalls from 55-70 cm (22-28in) in width. Using the criteria suggested by the Food Marketing institute and National Council of Chain Restaurants, that sows should be able to lie on their sides without their udder extending into the adjoining stall (FMI-NCCR, 2002), we assessed the posture of sows during the 14th week of gestation.

We found that sows spent 50-60% of the time lying laterally, that is, on one side. The proportion of that time that their udder protruded into the adjoining stall was dependent upon both sow size and stall width. No definitive guideline has been given on the criteria for 'protruding into the adjoining stall'. If we used a value of 50% of lateral lying time then a 70 cm stall would be sufficient for all animals, but a 65 cm stall would only be sufficient for the gilts and small (1st parity) sows. Whatever percentage is used as a criteria of acceptability, it is clear that this guideline would require wider stalls for larger sows.

Our studies will continue to look at productivity, behaviour and stress levels of sows in different widths of stall, but the industry should consider what they must do if they want to retain gestation stalls in a high welfare environment. Increasing the width of stalls, particularly for larger sows, would seem to be an appropriate action.

Importance of Management

We experienced a number of management problems within our ESF system. Our sows were going lame at an unacceptable rate. We identified the problem as being slippery floors. We made some changes to the penning that shifted the dunging patterns off of the solid area, and installed sprinklers to facilitate cleaning of the slats. The problem was not one of the electronic feeding system, but of our management of the partially slatted floor.

We also encountered problems getting our gilts adequately trained prior to breeding. Our solution, taking into account the pig flow within our unit, was to wait until after implantation had occurred in our gilts before training them to the ESF system. These two experiences demonstrate that implementing a new system is often accompanied by other problems. Problems need to be analyzed and the appropriate changes made. The problems are often not with the group system per se, but with some peripheral component of the system.

Systems and Issues

None of the systems outlined completely address all of the issues identified. If ‘freedom of movement’ is considered essential, ‘trumping’ all other concerns, then a non-stall system would be required. Similarly, if ‘freedom from aggression’ were considered to ‘trump’ other issues, then stalls would be the only satisfactory solution. Basing the selection of a gestation housing system on a single welfare issue may lead to significant reduction in welfare according to other issues. Some 37 characteristics of housing systems have been identified that relate to sow welfare, and weighting factors for these have been proposed to allow comparison of different systems (Bracke et al., 2002). However, these weighting factors are very dependent upon the values of the scientists and experts setting them, and there will be considerable disagreement. Some modifications within a system may be appropriate to better address critical issues for that system; e.g. wider stalls to allow greater freedom of movement, or low aggression social management for ESF systems.

The Future

Concern about the welfare of farm animals will ebb and flow with other societal issues. But it will not disappear. It would be prudent to thoroughly investigate alternatives and remain open to new systems that prove themselves both economical and welfare-friendly. A consensus among interested parties (producers, animal advocate groups, consumers) will be needed. Not all group housing systems are equal, and the industry should be careful not to accept single issue solutions.

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Table 1. Farrowing rate (% of bred sows that farrow) of gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

		Pre-implant		Post-implant	
	Stalls	Static	Dynamic	Static	Dynamic
Gilt	81.8	71.4	71.7	74.1	75.5
1st parity	84.7	81.7	85.6	87.6	86.7
2nd parity	83.8	81.4	81.7	80.0	89.2
Mature	87.8	83.7	79.5	86.1	88.3
Adjusted[2]	85.0	79.8	79.1	82.3	84.9
Adjusted sows[3]	86.0	82.6	81.7	85.1	88.1

[1]Results of five reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).
[3]Based on a theoretical sow herd run without gilts, as we have done for 3 cycles, with 27% 1st parity, 23% 2nd parity and 50% mature (approximates a 15% culling rate to a maximum of 6 parities).

Table 2. Litter size (liveborn piglets) of gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

	Stalls	Pre-implant		Post-implant	
		Static	Dynamic	Static	Dynamic
Gilt	9.7	9.5	9.5	9.9	10.1
1st parity	10.6	10.7	10.1	10.6	10.5
2nd parity	11.0	10.8	11.7	11.2	11.3
Mature	10.8	10.7	11.2	11.4	11.1
Adjusted[2]	10.5	10.4	10.6	10.8	10.8
Adjusted sows[3]	10.8	10.7	11.0	11.1	11.0

[1]Results of five reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).
[3]Based on a theoretical sow herd run without gilts, as we have done for 3 cycles, with 27% 1st parity, 23% 2nd parity and 50% mature (approximates a 15% culling rate to a maximum of 6 parities).

Table 3. Liveborn piglets per 100 sows bred for gilts and sows in Stalls and various management programs within an Electronic Sow Feeder system[1].

		Pre-implant		Post-implant	
	Stalls	Static	Dynamic	Static	Dynamic
Gilt	793	678	681	734	763
1st parity	898	874	865	929	910
2nd parity	922	879	956	896	1008
Mature	948	896	896	982	980
Adjusted[2]	895	834	845	894	917
Adjusted sows[3]	929	886	898	948	968

[1]Results of five reproductive cycles with new gilts added each cycle.
[2]Based on a theoretical herd demographic of 25% gilts, 20% 1st parity, 18% 2nd parity and 37% mature (approximates a 15% culling rate per cycle to a maximum 6th parity).
[3]Based on a theoretical sow herd run without gilts, as we have done for 3 cycles, with 27% 1st parity, 23% 2nd parity and 50% mature (approximates a 15% culling rate to a maximum of 6 parities).

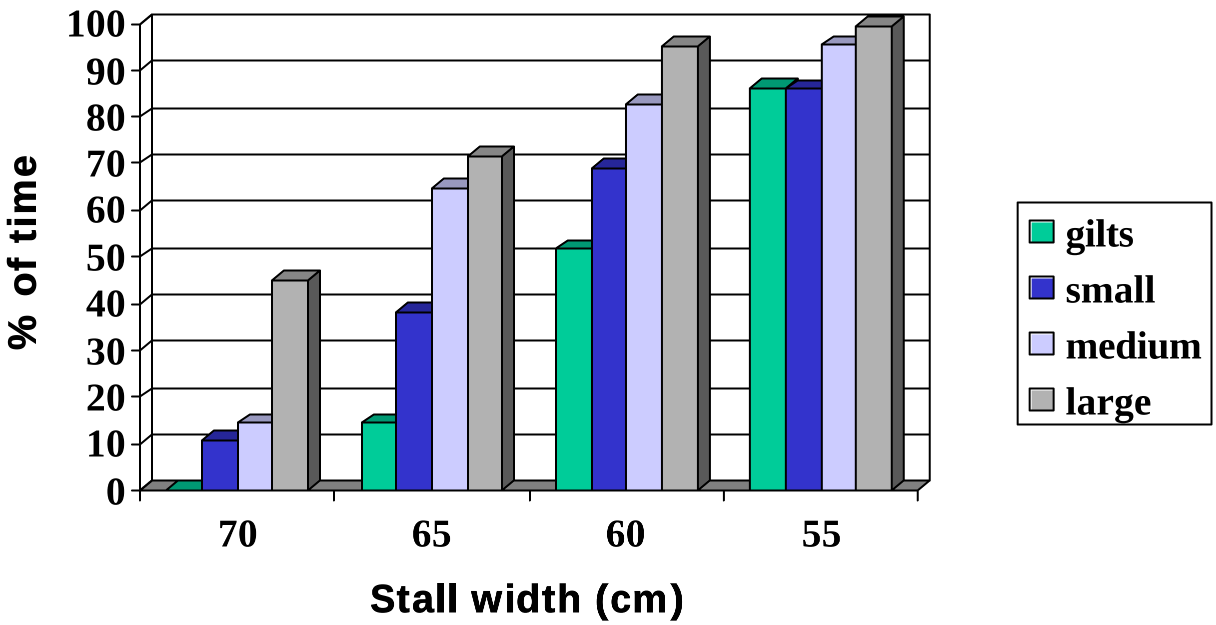

Figure 1: Proportion of time, of that spent lying laterally, during which teats extended into an adjacent stall for different sized sows in stalls of various widths in the 14th week of gestation.