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Non-Competitive Feeding Systems: Gated Stalls

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In our previous article, we have defined a non-competitive feeding system as one in which a sow is not able to obtain more feed by winning a fight. Fights may occur in such a system, but the winning sow does not steal food from the loser. This is accomplished by protecting the sow in a fully enclosed stall while she eats. There are two basic types of non-competitive feeding system, the gated stall and the electronic sow feeder (ESF). In an ESF system, there will only be one feeding station for a group of sows. However, in the gated stall system, all of the sows in a group eat at the same time, and there must be a stall for each sow. Gated stalls, or free-access stalls, are the most common system used in several European countries, including Belgium where 31% of farms and 37% of sows use the system. Within that country it is the most popular choice when making conversions (Tuyttens et al., 2011).

Gated Stall Systems

The original gated stall system, in use before the industry adopted gestation stalls, has manually operated gates used to lock the sows into the stall only during feeding. At other times the gates are open and sows are free to come and go. This system is sometimes called a lock-in system.

Figure 1: Photo of sow exiting free access stall. Pressure against the back gate releases the lock and allows it to be pushed back and upwards to an open position.

In order to eliminate the need to have someone present during feeding, gating systems have been developed that can be controlled by the sow herself. If no sow is in the stall, the gate is open and any animal in the group can enter. Upon entering the stall, the gate is engaged and closes behind the animal by a cantilever mechanism. The gate locks and cannot be opened by any sow outside the stall, thus preventing the chance of food stealing or displacements. The sow inside the stall can open the gate, usually by backing against it, and is free to leave. These stalls are sometimes also called free-access or walk-in/lock-in stalls.

Unless otherwise specified, our comments in this article refer to these walk-in/lock-in stalls.

A third arrangement of gated stalls has arisen in order to reduce the space and cost of the system. In a cafeteria arrangement all of the sows in a group eat at the same time from a bank of lock-in stalls. When one group has finished feeding, they are moved out and a second group of sows is fed from the same bank of stalls. Rather than providing a feeding stall for each sow in a herd of 100, a single bank of 20 could be used to feed 5 groups of 20 during the day. This arrangement involves reduced installation costs, and provides protection whilst feeding, however, obviously there is an increased labour cost. A large scale cafeteria system has been studied in Australia (Karlen et al., 2007).

An Automated Cafeteria System

Most cafeteria systems involve manually opening gates and moving groups of sows to and from the bank of feeding stalls. Although this labour requirement provides an excellent opportunity to health check each sow every day, it is too labour intensive for many commercial operations. With this in mind an automated cafeteria system was developed at the University of Guelph (Ridgetown campus) in the early 1990's (Morris and Hurnik, 1990). Pens using the common set of feeding stalls were timed to open and close as each pen of animals took their turn eating. Although the system used small groups of sows, it could be adapted to the larger groups on today's commercial farms.

The study ran for several years and provided data on the productivity and longevity of sows in the system compared to comparable animals in gestation sows. Litter performance was similar for both treatments, but there was a higher attrition rate, particularly in the first gestation, for animals in the gestations stalls. In addition, more sows remained in the herd beyond six parities in the cafeteria system. The end result was that sows in the Hurnik-Morris system had higher lifetime productivity than the conventional stalls (Morris et al., 1998).

Although the system could run with equal amounts of feed provided to each sow within a pen, and for each pen of animals, the researchers realized that they could upgrade the feeding stalls to identify each sow as it entered a feeding stall and adjust its feed according to its need. Essentially they could increase their investment in each feeding stall because it was used by several sows. The same principle applies to electronic feeding stalls (ESF) which we will consider in our next article.

Control Over Feed Intake

Because we limit feed sows, we are also very concerned about how well we can manage their feed intake. Competitive systems allow us to control the amount of feed that a pen of animals consumes, but not the amount that each individual sow will eat. With gated stalls, we know how much feed each animal will consume. But because we do not know which sow will be in which stall at feeding, the best we can do is to divide the feed evenly among the sows. All animals will eat the same amount. This brings about two important management methods for adjusting feed according to the requireme,ys of different sows. The first is to form groups based on desired feeding level: thin sows together and fat sows together. The second is to regularly provide additional feed, by hand feeding, to those sows needing more. For example, thin sows can be identified using stock marker, allowing the stockperson to top up those stalls very quickly.

Communal Loafing Space

Typically, free access stalls are arranged in one of several possible configurations. The two primary ones are the 'I-pen' or 'I', and the 'T-pen' or 'T' configurations. The 'I-pen' consists of an alley with slatted flooring running between two lanes of stalls from which open to the alley. The alley is typically 3 m (10 ft) wide. The length of the alley depends on the number of width of the feeding stalls. The 'T-pen' configuration consists of an identical alley with an additional solid floor area at one end of the pen. The 'T' typically adds at least 3 m (10 ft) to the overall length of the pen. The 'T' area may be bedded with straw, and is sometimes lower than the 'I' portion of the loafing area to retain straw on its solid floor.

Some producers may be tempted to reduce with width of the free space area between the two rows of stalls, however this is counter intuitive. It is not only important that we provide free space outside of the stalls, but the space must be of sufficient quality i.e. adequate flooring, adequate space to avoid aggressive encounters etc, and to increase usage, it would also be advised to provide some sort of enrichment, and water drinkers etc. It is very important that two sows from either row of stalls can exit their stalls without having to maneuver around one another and possibly having to avoid an aggressive encounter.

Use of the Communal Loafing Space

Part of the rationale for group housing systems is that the animals benefit from increased exercise and social interactions. Studies demonstrated that sows in an ESF system were found to have increased bone strength and decreased muscular atrophy than those housed an equal period of time in gestation stalls (Marchant and Broom, 1996). Yet one of the greatest criticisms of the walk-in/lock-in stall system is that sows spend most of their time within the stall. Our own observations, in a typical non-bedded free access system, is that using the loafing area is highly variable among the sows (Lang et al., 2010). Although the average amount of time spent outside the stall is approximately 4 hours, some sows may not leave the stall at all during the day and others will be out more than 20 hours. The sows least likely to be outside the stall are the smaller, younger sows, while larger, older (dominant) sows, spend the most time in the loafing area. We hypothesize three possible reasons for this. The smaller sows may be intimidated by the larger, dominant sows; the larger sows may be more uncomfortable in the gestation stalls; and, the smaller sows may have difficulty opening the back gate of the stall due to their size or lack of training.

How Much Space?

We have little research data on the amount of space required for free access stall systems. We are left to estimate how much space is needed, but in this regard the system is more complex than most other group housing. We can consider the system as having two parts: the feeding stall and the loafing area. The feeding stall is generally designed to accommodate the animal for both feeding and resting. To allow large sows to rest comfortably in the stall we would provide a minimum of 60 cm (24 in) width, with a 210 cm (7 ft) length for a total of 1.3 sqm (14 sqft) per sow (Nielsen, 2008). Cafeteria systems, in which the sow only uses the stall only for feeding, can use a narrower and shorter stall that is wide enough for her to stand in but not wide enough to lie down. At 50 cm (20 in) wide and 190 cm (6.3 ft) long, such a stall would require about 1.0 sqm (10.5 sqft) per sow (Nielsen, 2008).

The 'I' configuration, with just a slatted floor between two rows of stalls, in seen as the minimum loafing area. It is generally 3 m (10 ft) across to facilitate sow movement, which provides an additional 0.9 sqm (10 sqft) per sow when using 60 cm (24 in) stalls. This is sufficient area for approximately 50% of the sows to use at one time (assuming a need for 1.7 sqm or 19 sqft per mature sow), but it is unlikely that such would be the case as slatted floors are relatively uncomfortable and discourage sows from using the loafing area. For producers who simply want to provide sows the opportunity to leave the stalls, the 'I' configuration with about 2.2 sqm (24 sqft) per sow would be sufficient.

But if the intent is to provide a more comfortable loafing area in order to encourage sows to use it for an extended period, both quantity and quality of space should be increased. To allow all sows to use the loafing area simultaneously, approximately 3.0 sqm (33 sqft) of space is needed for both stall and loafing. To achieve this level of use the loafing area would have to be more comfortable than the stall, requiring solid floor and bedding (or rubber mats).

The cafeteria system, in which several groups of sows share a bank of feeding stalls, has the potential to reduce space needs. If six groups of sows share a set of 'feed only' stalls, the stall requirement is less than 0.2 sqm (2 sqft) per sow. Providing a loafing area of 1.7 sqm (19 sqft) per sow would result in only 1.9 sqm (21 sqft) per animal in stall and loafing area. However, a cafeteria system also includes extensive alleys to move sows to and from the feeding stalls. Some of the space savings would be lost to these alleys.

Even at its minimum, a gated stall system requires more space than most other group housing. Achieving high usage of the loafing area would require even more space. The high space requirement is the greatest drawback of gated stalls, and producers should consider using low-cost buildings for this system.

Use or non-use of the loafing area will be dependent upon the relative costs and benefits of leaving the stall. The costs will include the social tension of interacting with other animals, while the benefits may include issues of comfort and access to resources. Many existing free access systems provide little incentive to use the loafing area. All resources (food and water) are provided in the stall, and the loafing area consists of spindle walls, slatted floors and no bedding or enrichment devices. Why would a sow spend a great deal of time in what would be a relatively uncomfortable environment?

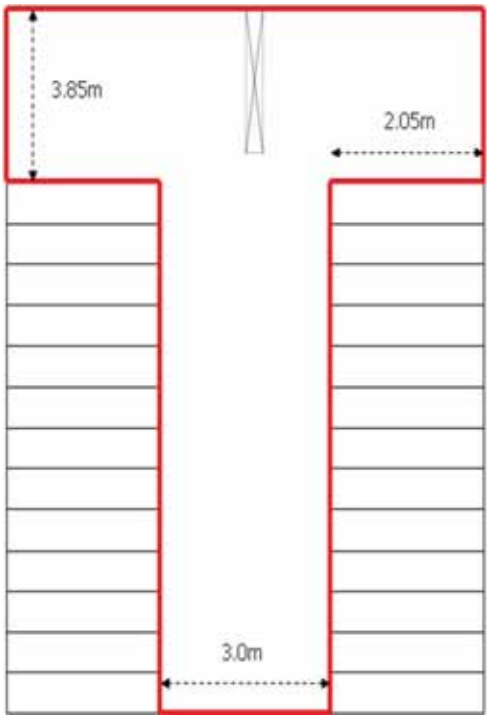

Figure 2: Diagram of a 'T-pen' showing feeding stalls with an alley between two rows of stalls and a solid floor loafing area at the end of the pen. An 'I-pen' is identical except it does not have a pen-wide loafing area at the end.

Two general methods may be used to encourage sows to increase the use of the loafing area, and thus increase the exercise that they experience. The first is to provide resources outside the stall such that animals will exit at least once a day to access them. An obvious choice would be to provide water in the loafing area but not in the stall. This would require that we have a great deal of confidence in the gate locking system that sows could easily leave the stall at any time. As mentioned above, there is some concern that not all systems are easy to open by small sows. Another resource that sows would likely access would be sources of fibre, such as chopped straw or a hay rack.

A second means to increase use of the loafing area would be to improve comfort in the area. For example, sows prefer to rest against solid walls rather than spindle penning and solid floors are preferred to slatted. In many 'T' systems, the 'T'section is bedded with straw. Nielsen (2008) indicates that 50-75% of sows use the 'T' section, but is it unclear if this refers to the average proportion of sows using it at any time, or those that use it at least once per day.

What Role Does Competition Play?

Gated stalls are the least competitive of all the group housing systems. A sow need only enter the feeding stall and she is protected from the remaining sows in the group. This is true both during feeding, and during social interactions in the loafing area. The stalls provide an escape from aggression. But competition remains for other resources within the pen. If water, a straw rack or some form of enrichment is available in the loafing area, the dominant sows will have preferred access to it. Dominant sows will make use of preferred lying areas, whether they are against the wall of the loafing area or areas with straw or rubber mats. Subordinate sows will be relegated to slatted areas and thus may have a higher incidence of 'discomfort' injuries such as lameness or calluses. In some groups, the dominant animal may be a despot and attack all other sows with little regard to the cost of such behaviour. It may be advantageous to remove a despot so that a new dominant sow can be established that does not upset the entire social group. But the bottom line is that gated stalls virtually eliminate competition related production losses.

Rubber Mats

One way to increase the comfort of the loafing area is with the addition of rubber flooring. Rubber flooring has been extensively used in agriculture, particularly in dairy barns. It has been suggested that comfortable flooring may impact many aspects of an animal's state of well being, including lying behaviour and ability to change position, as well as the incidence of lameness and lesions (Boyle et al., 2000; Rushen et al., 2007; Tuyttens et al., 2008). The problem, until now, has been to find a product durable enough to withstand manipulation by sows. Such a product is now available and studies have began to assess the benefits (if any).

A study recently completed at the Prairie Swine Centre investigated whether it is possible to increase the amount of time sows spend in the communal area by adding rubber mats to increase comfort, and by grouping sows by age to reduce fear in younger (subordinate) sows. The results indicate that in both 'young' and 'old' sow groups, pigs spent significantly more time in the free space areas with rubber flooring than concrete flooring, in both pen configurations (I-pens and T-pens). There was also increased lateral lying on the rubber flooring, suggesting increased comfort. Sows housed in pens with rubber flooring were also significantly cleaner than sows housed on concrete flooring. Grouping older and younger sows separately was found to increase the usage of the loafing area by younger sows compared to previous studies with mixed age/parity groupings. The ability to identify optimum flooring and social management options will improve producers' decision making capabilities when making the transition to group housing. These results suggest that using rubber flooring will encourage gestating sows to use the free space areas more frequently, and is likely to promote the associated benefits of increased activity, including increased muscle and bone strength. Housing groups of young and old sows separately should also increase the utilization of the free space.

Figure 3: A gated stall system with rubber mats installed over the slatted floor of the loafing area.

Keys to Success

Gated systems are an opportunity to buy success through design rather than management. Nonetheless, a few management practices will contribute to the smooth operation of the system:

1. Maintain the gates so that they are easily opened by all sows when exiting the stall. Training of new sows may be helpful.
2. Make the loafing area as conducive to sow use as possible, by providing adequate space, water, fibre, and comfortable floors.
3. In large herds, sort the sows by age so that younger animals use the loafing area as well.
4. Remove despot sows that constantly attack other animals in the loafing area.

Literature Cited

Boyle L. A., Regan, D., Leonard, F. C., Lynch P. B., and Brophy P., 2000. The effect of mats on the welfare of sows and piglets in the farrowing house. Anim. Welf. 9:39-48.

Karlen, G.A.M., Hemsworth, P.H., Gonyou, H.W., Fabrega, E., Strom, A.D. and Smits, R.J. 2007. The welfare of gestating sows in conventional stalls and large groups on deep litter. Appl. Anim. Behav. Sci. 105:87-101.

Lang, F., Hayne, S., Heron, V. and Gonyou, H. 2010. Free space utilization of sows in free access stalls. Prairie Swine Centre. Centred on Swine, Spring 2010, 8-11.

Marchant, J.N. and Broom, D.M. 1996. Effects of dry sow housing conditions on muscle weight and bone strength. Anim. Sci. 62: 105-113.

Morris, J.R. and Hurnik, J.F. 1990. An alternative housing system for breeding gestating swine. Can. J. Anim. Sci. 70:957.

Nielsen, N.-P. 2008. Loose housing of sows – current systems. Acta Vet. Scand. 50(Suppl. 1):S8.

Rushen J., Haley, D., de Passille A.M., 2007.Effect of softer flooring in tie stalls on resting behaviour and leg injuries of lactating cows, 2007. J. Dairy Sci. 90:3647-3651.

Tuyttens F. A. M., Wouters, F., Stuelens, E., Sonck, B., Duchateau, L., 2008. Synthetic lying mats may improve comfort of gestating sows. Appl. Anim. Behav. Sci. 114:76-85.

Tuyttens, F.A.M., Van Gansbeke, S. and Ampe, B. 2011. Survey among Belgian pig producers about the introduction of group housing systems for gestating sows. J. Anim. Sci. 89: 845-855.