

## Animal Well-Being



# Group Housing Systems: Choices and Designs

The statements and opinions expressed in this article are those of the author(s).

## Objectives

1. Briefly describe the common aspects among sow-group-housing systems
2. Briefly describe the five most common sow-group-housing systems by feeding method
3. Briefly provide positive and negative aspects about each sow-group-housing system

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## Introduction

There are many components that need to be considered when housing sows in groups, including but not limited to: number of sows per group; floor space per sow; size and shape of pens; type of flooring; use of bedding; type of feeding system; group management (dynamic versus static); ventilation, heating and cooling system; area for urination and defecation; area for sleeping; area for eating, and many more components. Other factsheets within this series provide specific details related to the previous mentioned topics.

## Considerations common to all group-housing methods

*Establishment of relief pens.* With any method that houses sows in groups, it is inevitable that a few sows will get sick, get injured or be bullied by other sows in the group. Consequently, a number of relief pens are required that house sows individually or in small groups. The requirement for relief pens will vary from farm to farm. Relief pens should be in high traffic areas where stock people observe the occupants of the pens several times per day. Relief pens should be specifically designed to improve a pig's chances of recovery. They should be in a draft-free area and may need supplemental heat or bedding to help sick pigs stay warm and comfortable. Although there are no published guidelines on designing and managing relief pens in the United States, Denmark [1-2] and the United Kingdom [3] have published relief pen guidelines.

*Establishment of heat-check boar pens.* To enhance reproductive efficiency of the breeding herd, it is important that mature boars are available to detect sows returning to estrus after mating. Worker safety needs to be considered when moving and handling heat-check boars. It is best to use boars that have high libido; however,

these boars can be aggressive and unpredictable when moving and handling them to heat-check sows. Heat-check boars need to be properly trained and periodically allowed to mount and breed or ejaculate by hand-pressure. Well trained boars will generally return to their respective quarters without a struggle. Boars should be housed away from sows to be heat-checked and artificially inseminated. Too close of contact can cause the sows to be non-receptive to boar stimuli. [4] Guidelines concerning the housing of heat-check boars in the breeding and gestating area are presented in another publication of this series titled, Group Housing Systems: New and Conversion Construction. [5]

*Establishment of space allowance and pen design.* An important aspect with any group-housing method is the amount of floor space provided per animal within the pen. When sow-group-housing systems result in sows being crowded there is potential for poor sow welfare because of inadequate space for sows at time of mixing, eating, resting, estrous activities, and avoiding aggressive encounters. Careful attention needs to be given to the location and design of the eating, drinking, dunging and lying areas to reduce aggressive interaction among sows housed as a group. For example when floor feeding, a large floor feeding area reduces competition for feed but may result in sows dunging on the solid floor. In any group system, partitioning the space can provide ways for sows to avoid aggression and for subgroups to have secure lying areas. Guidelines concerning space requirements for group-housed sows are presented in another publication of this series titled, Group Housing Systems: Floor-Space Allowance and Group Size. [6]

*Sufficiency/modification of ventilation, heating and cooling system.* When existing stall gestation facilities are remodeled to house sows

in groups, there will most likely be a reduction in the number of sows housed in the facility. Therefore, the ventilation, heating and cooling system has to be evaluated to determine whether it is sufficient or modifications are required. Guidelines concerning ventilation changes are presented in another publication of this series titled, Group Housing Systems: New and Conversion Construction. [5]

*Modification to flooring and(or) manure handling system.* The quality of the flooring in sow group-pens will have a major influence on the incidence of injuries to leg-joints and claws and to hoof lesions [7-9] and thus impact sow lameness and longevity. When retrofitting existing barns with slatted floors, consideration must be given to the layout of the solid and slatted areas and to the condition of the existing slatted flooring. The layout of solid and slatted areas in current gestation stall barns may limit options for retrofit designs without excavating the floors and/or pits, as well. In any event, slats with sharp or damaged edges should be replaced. Sows prefer wider slats and a solid floor area for lying. Gaps between slats need to allow manure to pass without increasing the risk of sows catching their claws and/or twisting their legs, particularly during aggressive interactions at mixing. Generally,  $\frac{3}{4}$  inch gaps meet these requirements. Attention to the slope of solid-floor areas, whether bare or covered with rubber mats or straw, is important to avoid wet or slippery surfaces that may result in injury or discomfort.

*Aggressive interactions.* Aggression cannot be totally avoided when mixing unfamiliar animals because they have to fight to establish a dominance hierarchy. [7, 10-12] After the dominance hierarchy is established, it is possible to keep aggression to a minimum in well designed group-housing systems. The aspects needed for low ranking sows to have enough space to avoid aggressive encounters or the opportunity to hide from higher ranking animals should be considered when designing a group-housing system. Guidelines on mixing sows and minimizing aggression are presented in another publication of this series titled, Group Housing Systems: Forming Gilt and Sow Groups. [13]

*Housing and management of replacement gilts.* The manner in which replacement gilts are managed in a group-housing system influences their reproductive performance and longevity. Gilts need to have excellent health, walking/locomotory ability and body condition at time of entering the breeding herd. Research has shown that housing gilts and sows on partial or totally slatted flooring contributes to lameness. [14-15] Training gilts before mating to the housing and feeding system they will encounter during gestation helps reduce detrimental effects on reproductive performance. Training is especially important when using electronic sow feeding stations. [1, 16]

Gilts need to develop excellent social skills during rearing to ensure that they do not experience levels of stress that might be detrimental to reproduction and/or welfare when entering the breeding herd. Gilts learn these skills during development by

having enough space to perform normal types of social behavior such as showing submission by fleeing from socially dominant pen-mates. Although it is normally recommended to minimize re-mixing, it may be useful for replacement gilts to be re-mixed at 6 months of age to better prepare them for group-housing during breeding and gestation. [17]

*Husbandry skills of stockpeople for managing group-housing of sows.* In addition to a well-designed group-housing system, the critical factors for optimizing reproductive performance and animal welfare include workers who are highly trained in animal husbandry practices; are highly self-motivated; are willing to learn; have excellent observation skills; and have a good temperament, attitude and empathy towards animals. In some cases, stockmanship skills may need to be learned or relearned for workers who have a limited amount of experience working with sows in a group-housing system.

## Housing methods

Group-housing systems allow sows freedom to move around and explore their environment; to perform normal social interactions with their pen-mates, to choose an area for urination and defecation; and to choose an area for sleeping. However, in poorly designed group-housing systems there is great potential for very poor sow welfare (e.g. as lameness) if the sows have to fight for access to feed, have difficulty avoiding aggressive encounters or do not have an appropriate place to rest. The main criteria for choosing a certain group-housing system will most likely involve investment costs, ability to maintain a high level of the sow's health and welfare, ease of management, labor requirement, feeding system and overall simplicity of the system [18-19].

The method of group-housing sows is primarily focused on how the sows will be fed and whether sows are kept in static or dynamic groups. In static groups, once the gestating sows have been mixed no new sows enter the group and no sow leaves the group (unless injured or returns to estrus) until the entire group is moved to the farrowing facility. Depending on the production schedule and facility design, static groups of gestating sows are formed during the first 5 days after insemination, or during days 28 to 35 of gestation after removed from individual breeding stalls. Static groups **should not** be formed when sows receive the initial pregnancy signal (10 to 12 days after insemination [20]) or during the period when embryos attach to the uterus (13 to 28 days after insemination [21-22]). Static housing allows for the dominance hierarchy to remain stable once it has been established. In dynamic groups, serviced sows are entering the group every one, two or three weeks; plus, sows due to farrow are exiting. Sows in large dynamic groups are therefore continuously exposed to the stresses of re-mixing. Generally, with large groups of sows there needs to be adequate space for subordinate sows to avoid the aggressive encounters arising at the frequent introduction of new sows. Dynamic groups may provide an easier way to handle sows returning to estrus compared to static groups.

Sows are fed in a competitive [23] or non-competitive manner [24-25]. Non-competitive feeding systems use free-access stalls with rear gates or electronic sow feeders. Competitive feeding systems feed sows: (a) on the solid floor surface of the pen, (b) in feeding stalls without a rear gate (head length, shoulder length, one-half body length partitions), or (c) in full-body length free-access stalls without a rear gate. Methods of dispensing feed in a competitive feeding system include: (a) slowly trickling feed into the feed trough or on the solid portion of feeding stall for each sow; (b) dropping once per day the entire daily feed allotment from an individual feed box into the individual feed trough for each sow; or (c) dropping feed once or several times per day directly on the floor at several locations within the pen of group-housed sows.

*Group-housing with electronic sow feeder (ESF).* An ESF is a non-competitive feeding system when the sow is eating. Some farms have combined the use of breeding stalls with the ESF system to control aggression at time of weaning and simplify the estrous detection and artificial insemination process (Figure 1). If the electronic feeder is not properly designed and managed, aggression and vulva biting can occur while the sows are waiting to enter the feeding station. [26] Improvements in the design and management of electronic sow feeders have minimized aggressive interactions and vulva lesions of sows waiting to enter the feeding station. The basic components of an ESF include: (a) sows wearing an electronic ear tag, (b) a radio frequency system to identify individual sows by their electronic ear tag number, (c) a computer system that controls the dispensing of feed to each individual sow, (d) a lockable entry gate, (e) a protected eating stall, and (f) a lockable exit gate with or without a sorting mechanism. The computer

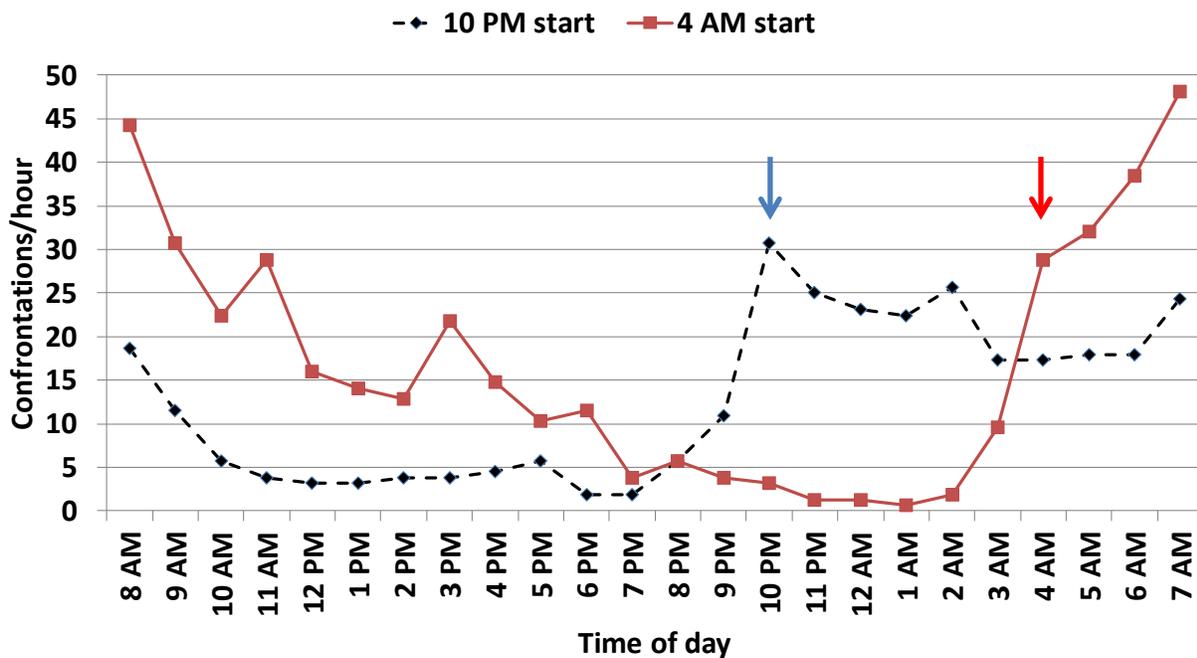
**Figure 1. Electronic sow feeding system**



**Photo: Courtesy of Dr. John Deen, University of Minnesota College of Veterinary Medicine.**

dispenses small portions of feed over a limited period of time until a pre-programmed amount of feed has been delivered. Sows can return to the feeding station and receive more feed if they did not previously eat all of their feed allotment. Some feeding stations mix the feed with water to improve palatability and allow sows to eat more efficiently. By using previously developed feed curves within the computer, the manager enters a specific feed curve for each sow. The feeding level can be based on the sow's body condition score, body weight, age, or backfat measurement. The volume of feed dispensed is automatically adapted to the different stages of gestation, based on the feed curve chosen. The computer records

**Figure 2. Influence of starting new feeding cycle on number of confrontations per hour during a 24-hour period of time. [27]**



the amount of feed dispensed during each feeding event. If the sow exits the feeding station without eating her daily allotment, she will be given feed the next time she enters the feeding station.

A new allotment of feed is made available to each sow every 24 hours. It was shown that starting the new feed cycle at 10:00 PM reduced the number of confrontations among sows while queuing behind the feeder during the night feeding and over a 24-hour period compared to starting the new cycle at 4:00 AM (Figure 2). [27] Starting the new feeding cycle at 3:00 to 4:00 PM allows the majority of sows to eat during the nighttime; plus, workers can be sure the system is working before they leave for the day. Because all sows should have eaten by early the following work-day, there is still a good portion of the work-day for workers to generate appropriate daily reports, deal with problem sows (sick sows, lame sows, lost ear tags, sows not entering feeder), move sorted/marked sows to farrowing, and perform other work tasks. It is generally recommended that a separate feeding station be used for training gilts to enter the feeder. Training gilts may be done in the breeding area prior to their first breeding.

Depending on the design and management of the ESF system, the number of sows per feeding station ranges from 40 to 80. [28-29] Typically, 60 to 70 sows maximize the use of the electronic sow feeder [30-31]. The ability of sows and gilts to compete for access to the electronic feeding station is dependent upon social rank and experience with the feeding system. [32-33] Dominate sows gain access to the feeding station earlier in the daily feeding cycle than subordinate sows. Gilts are generally subordinate to sows; thus, they are forced to eat later in the daily feeding cycle. Because of social pressure some gilts may potentially miss receiving their feed before the new daily feeding cycle begins, especially if the feeding station is over-stocked. Generally, it is best to group gilts together when they are fed with an electronic feeding station. Various publications provide additional details on how to design and manage an ESF system [6, 25, 34-35].

#### *Positive aspects of an electronic sow feeder system.*

- ESF system provides for specific individualized feeding, individualized rationing, and protection while eating.
- ESF can accommodate large dynamic sow groups.
- ESF system can be used with total slatted floor, partial slatted floor, solid concrete floor, or deep-bedded barns.
- Computer-directed sorting of sows into a selection/holding pen can be done for such activities as vaccination or moving to farrowing facility. Sick or injured sows are identified when they do not go through the feeder.
- Sows appear contented/docile when stockperson checks pens because they do not associate stockperson with feeding. Sows have freedom of movement and social interaction. Sows can find their own comfort zone for resting.
- Some ESF systems have methods for electronic estrous detection, ultrasonic pregnancy examination, and top dressing of nutritional supplements. Estrous sows or any sows designated by the stockperson can be color marked which saves labor for

locating individual sows.

- With appropriate layout there are distinct areas for sows to eat, lay, drink, and defecate/urinate.
- Existing barns can be retro-fitted to use ESF systems. The total quantity of space required per sow is reduced when using an ESF system to feed 40 or more sows per feeding station [6].

#### *Negative aspects of an electronic sow feeder system*

- The cost of ESF equipment (computers and automated feeder) is expensive.
- Maintenance of equipment and the electronic system is critical because the problem has to be fixed as soon as possible for the sows to be fed.
- In case of an electrical outage, the farm has to have a back-up generator or another effective method of feeding the sows.
- A separate breeding area is usually required before sows are mixed into their gestation group immediately after breeding or after pregnancy confirmed (d 28 to 35 after breeding)
- Aggressive interactions occur at time of mixing. Fighting among newly introduced sows on slatted floors may result in a high incidence of injuries and lameness.
- Aggressive behavior and vulva biting can occur when sows are waiting to enter the ESF, particularly in non-bedded systems.
- A specific area is needed for training gilts to use the ESF. A small percentage of gilts cannot be trained.
- Gilts take longer to eat than sows. Depending on herd size, it may be best to pen gilts separately or with parity 1 sows than in a multiparous sow group.
- An office area is needed to protect the computer system from environmental factors and animals. Wiring from the computer to the feeding stations must be well protected from the environmental elements, pigs and rodents.
- Stockpeople have to monitor computer readouts to ensure all sows are eating. Stockpeople need to spend time locating sows that have not eaten or have lost their electronic ear tag.
- Use of holding/selection pens increases building cost due to additional space, gating and water availability.
- If sows are housed in large groups (i.e. greater than 120 per pen) and selection pens are not used, it can be time consuming to locate, inspect and remove individual sows.
- Stockpeople managing the ESF system have to be highly skilled and dedicated to ensure the system works. They have to be competent with computer software and electronics.
- Design of the ESF and its location/layout in the pen are critical for success.

*Group-housing with free-access rear gate locking stalls (FAS).* Free-access stalls are defined as a non-competitive feeding environment whereby a rear gate is either operated by the sow or a worker. [24] Sow operated free-access stalls are designed to have the rear gate close when the sow enters the stall and opens when the sow backs out. Some designs of the sow operated free-access stalls allow the worker to lock the rear gates. Free-access stalls have also been designed whereby the rear gate is only locked by workers during feeding time or left open, if competition is not a problem.

Free-access stalls are longer than the full-body length of sows. Therefore, when sows are lying in the stall their head is not lying on the feed trough and their rear is not jammed against the rear gate. One free-access stall must be provided for every sow within the pen to allow all sows to eat at the same time. When sows are first exposed to sow-operated free-access stalls, a few sows may

have to be trained on entering the stall and how to back out of the stall into the open area.

Free-access stall pens have four layout configurations. First - an “I” configuration has an open slatted alley behind the two rows of stalls (Figure 3). There is no established lying area outside of

**Figure 3. Free-access stalls with an “I” configuration**



**Photo: Courtesy of Prairie Swine Center, Saskatoon, Saskatchewan (Canada).**

**Figure 4. Free-access stalls with “T” configuration**



**Photo: Courtesy of Egebjerg International, Sjaelland, Denmark.**

**Figure 5. Free-access stalls with “L” configuration**



**Photo: Courtesy of Dr. Niels-Peder Nielsen, Pig Research Center, Danish Agriculture & Food Council, Copenhagen, Denmark.**

**Figure 6. One row of manual-locking free-access stalls with communal rear alley.**



**Photo: Courtesy of Dr. Laurie Connor, University of Manitoba, Winnipeg, Manitoba (Canada).**

the feeding stall. Second - a “T” configuration has an open slatted alley behind the stalls that leads down to a communal resting area across the end of both rows of stalls (Figure 4). The resting area is either a partially slatted floor or a solid concrete floor which may be bedded with straw or shavings. Third - an “L” configuration has an alley (total slats or solid floor with bedding) behind the stalls that leads down to a communal resting area across the end of one row of stalls (Figure 5). Ideally, the minimum distance between the back of the two rows of stalls should allow a sow to

back straight out of the stall so that her head is clear of the stall before she turns. In Denmark the distance between the back of the two rows of crates is 9’ 10”. [36] A wide alley may also enable sows to pass each other without threat. Fourth - an “I” configuration that has an exercise/lying area behind a single row of stalls. The lying area may be slatted or solid floor with bedding (Figure 6). This configuration may be suitable to utilize space, depending on the layout in the rest of the barn. Research has indicated that an alley width of 3’, 7’, or 10’ behind a single row of FAS did not

affect sow health or productivity. However, the use of a 3' alley did limit the sow's expression of normal behavior. [37] The use of an alley in front of the stalls allows one worker to more easily remove specific sows from the group without assistance because the sows can be locked in the stall during feeding. It is also easier to get a sow out the front gate if two sows are trying to get in the same FAS. Because the use of a front gate is not extensively used and adds costs for the gate and alley, FAS generally do not have a front gate. Because the sows are mechanically fed with a feed drop box and any sow can enter any feeding stall, groups of animals should be formed on the basis of body condition (thin sows, fat sows, and normal sows), body size/weight, and parity.

Because some subordinate sows may be bullied and not able to cope in a large pen of sows, an alternative arrangement needs to be made for these sows. One option would be to have a few pens with a small number of sows per pen. Another problem to consider is how to successfully manage variation in batch sizes due to numerous factors (e.g. heat-stress) affecting the number of weaned sows cycling on schedule to fill the breeding group and breeding extra sows during the summer months to help ensure all the farrowing crates are filled. The number of additional FAS will need to be estimated. Relief pens will also be required.

#### *Positive aspects of a free-access rear gate locking stall system.*

- FAS are longer than the full body length of the sow. The rear gate of FAS can be locked by either the sow or stockperson so that sows are protected during feeding. If the FAS are sufficiently wide, they can also be used by sows for resting.
- FAS provide for individual feeding and inspection/monitoring.
- The floor of the FAS can be partial slats (no more than 56" should be solid), or total slats. Sows prefer lying on solid floor [9].
- The sows have a choice about the type of social interaction. Free-access stalls allow the sow to choose whether to mingle in an open communal space or have the relative privacy of a stall for eating or lying. Subordinate or injured sows can seek protection in the FAS.
- Stockpeople can lock-in a problem sow for short periods of time, such as overly aggressive or submissive sows at mixing or during estrus.
- Feed can be mechanically delivered by a feed drop box, trickle feeding or liquid feeding method. The feed can be dropped on a solid floor or into a feed trough.
- All sows can eat simultaneously.
- The FAS system can be used for breeding and for gestation, therefore decreasing re-grouping during gestation.
- Compared to ESF, the number of sows per pen can be smaller.
- Existing barns can be retro-fitted to use a FAS system.

#### *Negative aspects of a free-access rear gate locking stall system.*

- Generally, there is a small area of shared, free space; thus, there can be intense aggressive interaction at time of mixing. Sows can get injured due to riding by other sows during estrus. Totally slatted floor in the loose-sow area can lead to claw/foot injuries

during high activity times, such as at mixing or during estrus.

- There is no specific individualized rationing according to body condition score. All sows within a group receive the same amount of feed when using a mechanical drop box delivery system, unless the stockperson top dresses for specific animals. A front alley simplifies the process for providing a top dressing.
- Uniformity of animal size within a group is important.
- When housing sows in a static group, space is wasted if sows are removed from the group.
- A few gilts may need training on how to use the FAS.
- Maintenance (fixing and welding) of FAS will be required.

*Group-housing with trickle feeding.* Trickle feeding is a non-gated, competitive feeding system [23]. Trickle feeding systems generally use feed troughs whereby the feed can be delivered to a defined area (Figure 7). However, feed has been trickled onto a small solid portion of the floor in remodeled gestation barns. A key component is the distinct division of the feed trough/eating area whereby individual allotments of feed can be delivered to an area the width of the barriers. The distinct division of the eating area is established by installing head length (19 inches), shoulder length (24 to 32 inches long) or full body length (6 feet long) barriers. Head and shoulder length barriers do not fully protect subordinate animals from dominate sows while eating. Longer stalls provide more protection while eating; however some displacement may still occur. [38] Depending on the size of pen and number of animals per pen, trickle feeders are typically located on either one side or both sides of the pen. A feed box for each individual feeding location is filled with a top auger. The feed box is designed to meter feed into a second auger located at the bottom of the feed box. The second auger rotates very slowly when dispensing the feed. The rate of dispensing feed ranges from 0.17 to 0.44 pounds (80 to 200 grams) per minute. [9, 39-40] Ideally, the rate of feed dispensing should be as slow as the slowest eating sow. Generally, the duration of time allowed for eating ranges from 15 to 30 minutes. The slow rate of feed dispensing encourages all sows to remain in their eating space while feed is dispensed. Because any sow can eat at any feeding location, trickle feeding only allows control of the amount of feed that a pen of animals will consume. Therefore, groups of animals should be formed on the basis of body condition (thin sows, fat sows, and normal sows), body size/weight, and parity. It is best to pen groups of gilts separately from sows because gilts eat slower than sows. Generally, trickle feeding works best with small group sizes of relatively uniform sows.

Because some sows may be bullied and not able to cope in a large pen of sows, an alternative arrangement needs to be made for these sows. One option would be to have a few pens with a small number of sows per pen. Another problem to consider is how to successfully manage variation in batch sizes due to numerous factors (e.g. heat-stress) affecting the number of weaned sows cycling on schedule to fill the breeding group and breeding extra sows during the summer months to help ensure all the farrowing crates are filled. The number of additional trickle feeding stations will need to be estimated. Relief pens will also be required.

**Figure 7. Trickle feeding system**



*Positive aspects of a trickle feeding system.*

- Sows are fed simultaneously.
- Sows can be fed a dry diet; thus, a higher fiber diet can be used.
- The use of shoulder length barriers or non-lockable, body length feeding stalls reduce aggression during eating.
- Slowly dropping feed on a 19" solid portion of the floor with a head divider, helps reduce feed wastage when solid portion is adjacent to the slatted section of floor.
- Feed is offered slowly at a fixed rate to each feeding place; thus, keeping all sows occupied.
- If feeding rate is set correctly, trickle feeding helps reduce the problem of bullying and feed stealing as no feed should accumulate to be stolen.
- Trickle feeding works better with smaller groups of sows.
- Existing barns can be retro-fitted to use trickle feeding systems.

*Negative aspects of a trickle feeding system.*

- Trickle feeding is a competitive feeding system. Aggressive interaction may occur regardless of whether non-gated feeding stalls are used.
- Feeding rate may frustrate some sows; thus, a substantial amount of aggression can occur during eating periods.
- Slower eating sows are at risk of being displaced by faster eating sows. When 13 sows were individually fed in a locked feeding stall, the average length of time to consume 4.9 pounds of feed ranged from 10.0 minutes to 13.8 minutes. [41] When sows and

gilts were given the same volume of feed, a study in Germany found that the eating speed for sows ranged from 4.33 to 4.57 minutes compared to 6.36 to 6.57 minutes for gilts. [42]

- Trickle feeding requires additional costs for equipment and repairs when compared to a traditional drop box feeding system.
- There is no individualized rationing according to body condition score when trickle feeding sows.
- Trickle feeding requires a high level of stockperson skills to manage sows and feeding system effectively. Some people advocate that sows should be sorted by eating speed; thus, all sows in the pen will eat at about the same speed. This management strategy is difficult to accomplish.

*Group-housing with floor feeding.* Floor feeding is a competitive feeding system that dispenses feed on the solid portion of the floor in a manner whereby all sows in the pen have access to the same piles of feed. Floor feeding allows dominate sows to eat more feed and gain more body weight than subordinate sows. [43] Subordinate sows that cannot compete for feed will lose body condition and have to be removed from the pen. The various strategies used to enhance the opportunity for subordinate sows to get more feed include: (1) dispensing feed once per day in as many drop sites as possible within the pen, (2) creating feeding zones by installing short stub walls (Figure 8), (3) using a two auger system and having the first auger drop feed in feeding zone A 15 seconds before the second auger drops feed in feeding

**Figure 8. Floor feeding by dropping feed into different bays**



**Photo: Courtesy of Prairie Swine Center, Saskatoon, Saskatchewan (Canada).**

zone B; thus, the first drop would attract the dominate sows and the second drop would attract the subordinate sows [44], and (4) dispensing a small amount of feed several times per day; thus, dominate sows eat during the first drops and subordinate sows eat during the later drops [45]. Increasing the feeding frequency from 2 to 6 times per day did not have a dramatic negative or positive impact on performance or welfare of group-housed gilts and sows. [45] Groups of animals should be formed on the basis of body condition (thin sows, fat sows, and normal sows), body size/weight, and parity. It is best to pen groups of gilts separately from sows because gilts eat slower than sows and will fail to consume adequate amounts of feed.

Depending on the number of sows per pen and solid floor area, sows are fed by using several drop boxes per pen or large volume dump feeders. Because of safety reasons, workers should not be among the sows when feed is being dispensed. Because some sows may not be able to cope in a large pen of sows, an alternative arrangement needs to be made for these sows. One option would be to have a few pens with a small number of sows per pen. Relief pens will also be required.

*Positive aspects of a floor feeding system.*

- Sows are fed a dry diet on the floor; thus, a higher fiber diet can be used. However, anything that prolongs eating (e.g. high

- fiber diets) will increase aggression in a floor feeding system.
- All sows are simultaneously fed.
- There is no need to train gilts to the feeding method.
- Sows have freedom to walk around within the pen. Sows can socialize among themselves.
- With appropriate layout of the floor plan there is a distinct dunging/urination area (i.e. slatted floor) and lying/feeding area (solid floor). Generally, sows prefer to lie on the solid floor segment during non-feeding periods.
- Facility and equipment maintenance requirements are low.
- Existing barns can be retro-fitted to use floor feeding systems.

*Negative aspects of a floor feeding system.*

- Small areas of shared space lead to intense aggressive interactions at mixing. There is no place for subordinate animals to hide or have protection. If the area is large enough to establish bays with solid partitions, there is an opportunity for sows to escape.
- Aggressive interactions can occur between sows to gain access to feed during eating periods. Dominate sows will get more feed than subordinate sows. Intensive competition at feeding may continue long after a dominance hierarchy has been established.
- Feed wastage is more likely if more feed is used to keep sows calm or if feed ends up pushed onto the slatted area of the pen as sows are eating.

- There is no individualized rationing according to body condition score. Groups of animals should be formed on the basis of body condition (thin sows, fat sows, and normal sows), body size/weight, and parity.
- If static groups are used, space is wasted when sows are removed from the pen for any reason.
- High levels of sow management are required when floor feeding groups of sows.

*Group-housing with feeding stalls used by multiple groups (cafeteria feeding).* A method for decreasing the purchase of an expensive, rear gate-locking feeding stall for each gestating sow is to feed several groups of sows in the same bank of feeding stalls [46]. This non-competitive feeding system is called “cafeteria” feeding. The cafeteria feeding system provides a method for efficiently using building space for housing and feeding gestating sows. This design allows sows to be housed in larger groups because the layout is not constrained by the dimensions of the feeding stall. It is best to pen groups of gilts separately from sows. Each group of sows is generally allowed access to the cafeteria for 20 to 30 minutes once per day. The order of moving sow-groups to the cafeteria has been controversial. Some pork producers believe it is best to use a loud horn to train the sows to eat at a particular time each day. Thus, the sows do not get excited until very close to the time they hear a specific sound (e.g. one blast for first group, two blasts for second group, etc.) for release from their pen. [47] Other pork producers believe that aggression and excitement is reduced with a random order of moving sows to the cafeteria. Thus, the sows cannot anticipate when they will be fed. [48]

Cafeteria feeding has a high labor input for moving sows to and from the feeding stalls. The workers have to be very skilled in moving sows in a safe manner for both animals and humans. Daily movement of animals to and from the cafeteria does increase the risk of injury, especially feet and leg injury. Workers need to be well trained in procedures for handling and managing sows that have difficulty walking to and from the cafeteria. A sufficient number of relief pens have to be available.

Although sows are fed with individual drop boxes, each sow may not be specifically fed for her body condition. All sows within the group receive the same amount of feed because they can enter any of the feeding stalls. Therefore, groups of animals should be formed on the basis of body condition (thin sows, fat sows, and normal sows), body size/weight, and parity. If the bank of feeding stalls has a front alley, workers can give additional feed by hand to individual sows. The individual feeding boxes are mechanically filled for the next feeding group while the current group is eating. Although time consuming, the worker does have the opportunity to reset the volume of feed for all the feed boxes if the next group of sows require a larger volume of feed. Workers also need to manage the dispensing of feed because not all groups will have the same number of sows.

*Positive aspects of cafeteria feeding system.*

- Capital investment in feeding stalls and floor space for stalls is spread over more sows.

- More sows can be housed within the area designated for sow housing.
- Feeding stalls provide safety for sows during eating.
- Feeding stalls accommodates slow eating sows.
- Sows can be inspected daily for walking ability and new injuries.
- Sows can receive medical treatment while locked in feeding stall.

*Negative aspects of cafeteria feeding system.*

- A lot of labor is needed to move sows to and from feeding stalls.
- There is no individualized rationing according to body condition score when only using mechanical feed drop boxes.
- There is potential injury of animals and workers when sows are moved daily to and from the cafeteria area.
- Different group sizes means not all stalls will be used by each group. With a drop box system, this can create extra time and labor to close or open one or more drops. Also, sows entering a feed stall without feed will become anxious and in trying to access feed, may bite at other sows already in stalls with feed.
- High use of feeding stalls will require additional maintenance.

## Summary

A gestation facility that houses sows in a group needs to be well designed and managed whereby sow lifetime performance and sow longevity are optimized. In addition, careful consideration must be given to sow welfare. The type of feeding system and whether a static or dynamic group will be used are two important factors to consider when deciding which group-housing system to implement. Pork producers need to carefully consider the positive and negative aspects for the five main sow group-housing and feeding systems. In conclusion there is not one single ideal group-housing system for sows. The main criteria for choosing a certain group-housing system will most likely involve investment costs, ability to maintain a high level of the sow’s health and welfare, ease of management, labor requirement, feeding system, overall simplicity of the system, and personal preference.

**Disclaimer:** Reference to commercial products or trade names is made with the understanding that no discrimination is intended of those not mentioned and no endorsement by the authors or National Pork Board is implied for those mentioned.

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