

Managing Sows in Groups

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The use of individual gestation stalls or crates in environmentally controlled barns has generally become the accepted standard method for sow management, gradually replacing earlier group methods such as pasture gestation or small pen gestation of groups of 6 to 10 sows. Although gestation crates solve many management problems by eliminating agonistic sow interactions, crates are far from perfect, e.g. control of feed intake is insufficient to prevent excessive variability in sow condition, and recently in Europe gestation crates have become unacceptable owing to public perceptions of sow well-being.¹ Beginning about 15 years ago, many studies attempted to understand how feeding of sows in groups could be managed with automated systems. Electronic sow feeding (ESF), one of these methods, uses a feeding station that isolates each animal as they are sequentially fed by an automatic feed dispenser. Many reviews of these studies exist.² These studies were mostly directed to the use of ESF with small groups of sows or with single large groups with dynamic mixing. Osborne initiated a study of ESF about 15 years ago to understand sow behavior and performance in large groups of sows without mixing (static groups). The study included the development and evaluation of appropriate equipment, methods, and facilities design for this system. This work was conducted on the Osborne Demonstration Farm and in cooperation with about 100 early adopters of ESF in North America. This report summarizes the key issues that effect facilities design for effective use of ESF and associated automatic systems for group management of sows. General guidelines and recommendations for facility design are based on experience and observation both at the Demonstration Farm and at customer farms over the past 15 years.

History of Electronic Sow Feeding

The use of ESF to manage sows in groups arose in Europe as a response to sudden and intense public pressure to end the use of gestation crates. The ESF method was one of several alternatives that were proposed. Studies of ESF methods coincided with,

and often followed, this rapid adoption of ESF by European producers. Serious problems immediately arose with equipment, facilities design, and agonistic



sow behaviors, mostly owing to inadequate equipment and facility designs. Early system failures were common, but more recently proper equipment, facility design, and sow handling methodology has enabled ESF to stage a comeback in Europe while alternatives to ESF have lost favor for a variety of reasons.

Osborne established its Demonstration Farm in 1993 to study all aspects of automated management of sows, using radio frequency identification (RFID) on each sow to identify it to ESF stations, one of several types of workstations. A workstation is any RFID-enabled device that performs a chore automatically based on the individual requirements for each animal. The Farm was divided into two equal-sized 150-sow groups. One group was managed in



gestation crates with feed drops over a trough that supplied both feed (gravimetric or volumetric dispensing) and water. A second group was



managed in open pens equipped with ESF stations. Three years of production results using a popular crossbred animal were reported by Bates, et al.^{3,4} Then, the genetic type was changed and results were evaluated for another 3 years for a commercial hybrid animal. A comparison between genotypes was made to understand if differences in genotypic temperament have an effect on the use of these methods.⁵ Then, for the past 4 years the Farm has operated only with group management with one-half of the animals in rooms with partial slats and one-half in rooms on total slats.

During this ten-year period Osborne has kept in close contact with about 100 producers in North America who are early adopters of ESF systems. These users present a wide variety of genetics, facilities, herd sizes, and management styles. Many successfully adopted our recommended methods and facility designs, which helped to reinforce confidence in our results from the Farm. Their production results were reviewed and compared with results from the Farm wherever possible.

What we have learned

Successful group management of sows requires the adoption of a complete system. The system includes the equipment, the facilities, and sow

management methods. As with any system, if any part of the system is absent or faulty, then problems arise and production suffers. With the system, operating under stable control, certain key performance indicator (KPI) values improve compared with crated gestation methods. No negative effect on any KPI value was found. This result has been anecdotally confirmed by the reported experience of our ESF customers over the past 15 years. More recently several long-term studies have been initiated that are similar to our study in method.^{6,7}

1.1 Mechanical systems must be robust and well designed in detail

The mechanical parts of ESF equipment experience very high rates of use in large groups and must be mechanically robust. Mechanical failure creates unacceptable habits of sow behavior very quickly and these habits persist even after correction to failures. Repair must be easy and quick to avoid establishing bad habits. Poor or weak mechanical



design attracts destructive attention of sows in groups and must be avoided. In particular, the feed dispenser must be accurate without vibration or sow-induced spillage. Feed must be delivered at a rate that closely matches eating speed. This is done automatically by assigning each animal to a feed curve, which establishes daily quantity and speed of feed delivery appropriate to its parity and production

state. Addition of water to the feed bowl with each feed drop is important to increase eating rate and reduce feed waste. The total weight of water should be adjustable, about equal the total

TEAM® ESF Groups vs. Gestation Crates				
A Three-Year Study at the Osborne Demonstration Farm*				
<i>Key Perf Indicator</i>	<i>TEAM</i>	<i>Crates</i>	<i>Diff</i>	<i>.P-Value</i>
Return to estrus, %	94.5	91.7	2.8	< 0.05
Return to estrus, %				
7 days post-wean	72.0	68.4	3.6	< 0.05
Farrowing rate, %	94.3	89.4	4.9	< 0.05
Litter birth wt (lbs)	39.0	36.8	2.2	< 0.001
Litter wean wt (lbs)	125.8	123.8	2.0	< 0.001

*Ref: Bates, Edwards and Korthals, 2003, *Lvstck. Prod. Sci.* 79, 29-

weight of feed, and be dispensed uniformly with the feed.

The ESF system must be self-contained and capable of operating without continuous supervision of a personal computer. The software that controls the ESF system must reliably manage the equipment and the data that the system generates. The electronics that connects the mechanical equipment to power and conveys data to and from the software or handheld dataloggers in the barn must also be robust. The electronic parts of the system must be protected from corrosive environments and from harmful power fluctuations. The electronics design must enable quick repair by semi-skilled service personnel. Solutions to these problems have been developed, tested, and applied successfully for years with commercial users.

1.2 Sow behavior dictates best group size

Facilities design depends directly on issues of sow management. Sow management techniques must be consistent with sow social behavior in large groups. Group interactions are observed to change as group size increases from 6-12 animals to 12-30 animals and again from about 30-65 animals in static, stable groups. In very small groups, social organization is usually quickly established during group formation. Hierarchy in small groups is rarely challenged after initial formation and is rigidly enforced. For groups of 12-30 animals, social organization is not quickly established nor easily maintained. Agonistic confrontations are more frequent and rate of injuries are higher than in smaller groups. For groups of 30-65 animals, the intensity of social organization and agonistic encounters diminishes proportionate to group size.

Although smaller static groups can be managed successfully, our results suggest that large static groups of about 65 animals are the best size for ESF management. Larger groups are also possible, but disadvantages of larger groups suggest that 65 animals is optimum. For example, finding animals in groups larger than 65 and pig flow without mixing or sorting for larger groups are more difficult.

The average eating time for 65 animals also suggests that this is the optimum group size. Measuring actual total time of ESF station use for any 24-hour period may suggest that open time exists on the feed station and that larger groups can be fed. This

conclusion ignores periods during which animals have no desire to eat and the time required for entry and exit from the feed station.

The formation of static groups of 62 animals fits well with farm-size multiples of 1,200 sows. At a farrowing rate of about 80%, static groups of about 50 animals each are moved to farrowing. If farrowing rate falls below 80%, extra animals can be bred and group size can be temporarily enlarged somewhat without critically exceeding the capacity of the ESF system if the facilities are designed for groups of 65 animals. Alternatively, extra animals can be bred and held in crates until post-implantation as replacements for early returns-to-estrus to maintain group size.

1.3 Facilities design must include a gilt replacement strategy

In addition to group size, facility design also depends on the detailed plan for management of replacement gilts and their entry into the breeding herd. Gilt conditioning and training to use an ESF station must be completed prior to breeding. ESF enables close, accurate control over conditioning gilts, which has been shown to be very important to total sow productivity.⁸ Allow no less than 2 weeks for training. At a restocking rate of 40% for 1,200 sows, one pen for up to 65 gilts provides up to 6 weeks of conditioning on an ESF station. Sixty days of gilt conditioning on the Farm during isolation has enabled us to study gilt development on an ESF station closely, using electronic estrous detection (EED) to follow estrus. Three to 4 heat cycles are observed and breeding occurs on the third or fourth cycle. If an isolation barn is not available for training, then adequate pen space in the gestation barn must be reserved for a training period.

1.4 Methods of formation of gestation groups is important

The method of formation of gestation groups also dictates facilities design. Group formation can be completed before embryo implantation immediately after breeding or after implantation. Regardless of timing of group formation, weaned sows should be maintained in their original farrowing groups if possible to reduce the stress of social reorganization.

For immediate group formation after breeding, a set of gestation crates (about 1.5 times the group size equals the number of crates required) is used to hold

sows and gilts during breeding. As soon as breeding is complete, a sow group is moved to the pen. Additions of gilts or recycling sows occur as soon as breeding is complete and a minimum group of 4 replacements is ready. Using careful methods of introduction of these replacements, no adverse impact on litter size or sow welfare has been observed. These same methods permit gilts to be successfully added into groups containing multiparous sows.

For delayed group formation, sufficient crates are required for the desired delay, which is usually about six weeks. This reduces the number of pens and ESF stations required. Although delayed group formation is practiced in Europe, we have had no



experience with this method in North America and have not studied it in our work. We

do know that delayed group formation has no effect on the ability of sows or bred gilts to immediately resume using the ESF station. But the method of actually reforming delayed groups may be important and has not been studied.

Facilities design

Barn design for group management with ESF is very simple and quite flexible, especially for large farms organized to manage static groups of sows. In Europe, smaller sow farms often manage dynamic groups in which multiple farrowing groups are mixed. Continuous mixing of animals in various stages of gestation occurs as they enter and leave the group. This dynamic mixing creates continuous agnostic encounters and social reordering in the group. Entering animals must learn their position in the hierarchy. Leaving animals remove order from the hierarchy, which must be restored by reordering. Maintaining static groups avoids changes to groups as much as possible.

Ingenious facility designs have been devised to make dynamic groups successful, including planned escape routes, lying barriers for subgroups, use of bedding to mitigate aggression, generous space allowances for each animal, complicated travel routes to and

from feed and water, and strategic location of ESF stations in the layout. Successful facility layouts require the advice of a very experienced expert. However, these considerations are largely irrelevant if static groups are maintained.

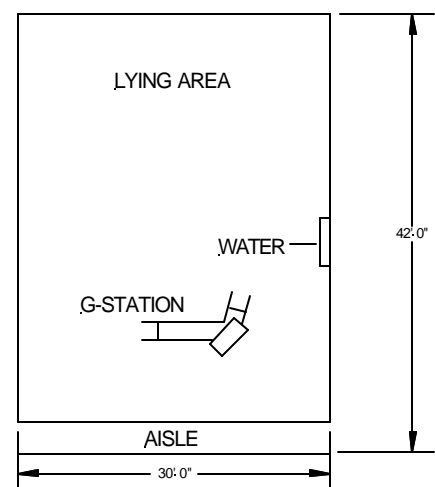
2.1 Space allocation

The most important issue for static groups is adequate space allocation. We have found that 18 sq-ft (1.67 sq-m) per sow is a minimum. More space may be beneficial, but less than 18 sq-ft can cause animals to miss meals and increases agonistic behavior. Because most animals spend their day resting in lying groups, pen space often appears excessive, even at only 18 sq-ft. A permanent increase of group size to utilize this space is false economy and may result in increased variability in sow condition owing to increased aggression and accelerated depreciation of equipment which bears the brunt of aggressive behaviors fostered by excessive crowding.

2.2 Pen shape

Using a 1,200-sow farm as a typical system and immediate group formation following breeding, then 16 pens for about 65 animals are needed. These pens can be organized on both sides of a central aisle or, preferably, spanning the barn with a side aisle. The latter layout creates rectangular pens in typical barns. These pens include all climate zones across the width of the building. This enables each sow to optimize its microclimates within the range found within the barn. With naturally ventilated barns, this is a particular advantage.

In general, rectangular pens are preferred with the ESF station located centrally about one-third of the pen length with the station entry generally near the aisle for convenience to the manager. This layout creates a natural laying area at the opposite end of the pen from the feeding area. Although no large



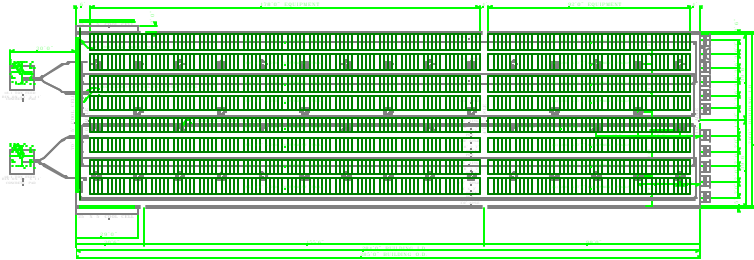
addition of animals to the group is always done at the end of the feeding day as described in the method for group formation.

Moving the group to farrowing is easy because they are accustomed to moving and exploring. The group is weaned together into a pen with *ad libitum* feed

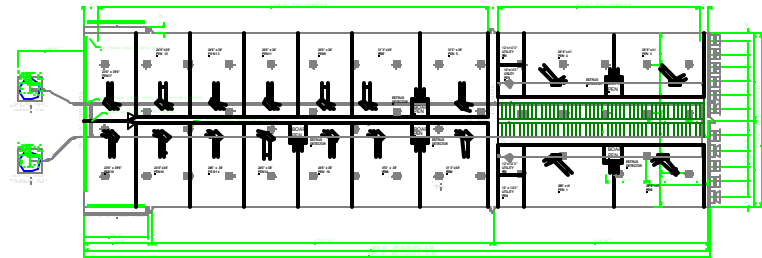
Facilities conversion for group managed sows

3.1 Renovating existing barns

In most conventional gestation barns, about 75% of the space is utilized for sows. The remaining space is used for aisles to move animals. Such barns can be easily converted into loose-sow housing within



Becomes



Conversion of crated barns to pens is practical

1. *Eliminating aisles makes more space for pigs.*
2. *More pig spaces in existing B/G foot print with pens than with crates.*
3. *Convert finish barns to B/G barns quickly.*
4. *Check floor quality closely to avoid foot problems.*
5. *Partial slats are OK. Pigs are dirtier, but no effect on health*
6. *Fewer water and feed lines.*

and an EED station to assist in recognizing estrus. Culled animals are replaced by recycling sows or gilts as needed, but only after the main group is bred and reorganized. Bred gilts and new members to the group are added from breeding crates into a temporary pen, formed with a divider in one corner of the group pen, early in the day, if possible. After all of the veteran sows in the group have eaten and had time to associate with the new additions to the group through the temporary divider, the temporary divider is opened to allow the new additions to have access to the ESF feeder and to join the group.

2.7 Facility cost

The investment for equipment for a new loose-sow facility equipped with ESF stations, pens, and sow management software is usually about equivalent to the same facility cost for gestation crates, volumetric feed drops, troughs and water. The loose-sow facility is usually a less complicated structure, however, and therefore is often less expensive to construct. The loose-sow facility also can be converted to other production applications if needs change.

the four walls of the existing building because the combination of part of the aisle space in front and behind each gestation crate and the space occupied by the crate itself equals the recommended minimum space for each sow, 18 sq-ft. Sufficient space remains for use as the access aisle for the barn. Sufficient crates are reserved to hold animals during breeding if immediate group formation is used (about 1.5 x number in breeding group) or for bred animals for the first six-weeks of gestation (about 6.5 x number in breeding group) if delayed group formation is adopted.

Most gestation barns with crates have partial slats. This means that animals do not stay as clean as they would on full slats and ventilation load is higher, but our results and those of other commercial users with solid or partially solid floors do not show any obvious performance penalty. Locating the entrance to the ESF station so that waiting animals stand on the slatted portions of the floor and placing waterers over slatted areas is recommended. Both details assist in keeping pens cleaner.

Finishing barns with full slats can also be easily converted into gestation barns if the floors are in good condition. In fact, a wide variety of barn styles have been successfully converted during the 15 years of our involvement with group management of sows. Conversely, gestation barns with fully slatted floors and with group management pens equipped with ESF stations can be quickly converted to finishing barns if the need arises. ESF stations and associated equipment are quickly and easily removed and transported to a new site, or if the business changes, they have a significant resale value.

3.2 Hoop barns

Hoop barns have become popular in recent years. These barns have been used successfully for group management of sows, using ESF stations. Special precautions must be taken to protect the water supply to the station from freezing, or alternatively, the water can be omitted during cold weather and eating times lengthened. Automated adjustment of feed



allowance enables feed budgets to be easily adjusted for changes in temperature, which is more variable in

hoop barns. Sows in groups can compensate and adjust their thermal environment, however, by huddling in deep bedding. No KPI comparisons are available between gestation of loose-sows in hoop barns and sows in environmentally controlled confinement barns.

Summary

Facilities design for group management of gestating sows is not overly complex if static groups are maintained. Group management has been shown to be a viable alternative to gestation crates. Adhering to a few tested management and facilities guidelines

can help to assure success to anyone who adopts large static group management. Equipment for group-managed facilities requires no greater investment than crated barns and perhaps some potential savings. A wide range of existing facilities can be converted to group management easily and efficiently.

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