



Pen Gestation for Dry Sows

Collected Research

by Sean M. Francey

White Paper

May 2012

Executive Summary

Animal husbandry is changing. Consumers are increasingly disconnected from the source of their food,¹ and more people are being fed by fewer farmers today than ever before.² At the same time there is an increasing focus by animal welfare groups to bring attention to the living conditions – real and perceived – of food animals to consumers. Greater consumer attention to food production practices has led some retailers to focus marketing efforts on differentiation in food production practices as a way to drive sales, customer loyalty, and increase margins by increasing perceived value. Combined – animal welfare groups, retailers, and consumers – are leading governments to promote policies dictating food production practices, changing the requirements on the few farmers remaining to provide the feed for all the other groups. One of these issues is the use of stalls for housing dry sows during gestation and the current push towards using loose sow housing, or pen gestation, to house sows from approximately 35 days post-breeding until 1 week pre-farrowing.

Stalls have been a known quantity since the '70's and have been used extensively throughout modern sow production until recently. Current legislation in the EU bans the use of stalls beginning Jan 1st, 2013. Many states in the US have adopted legislation to phase out stalls over the next 5-10 yrs, and some major retailers are pushing for all suppliers to be stall-free by 2017.

In stall housing, as compared to loose sow housing, there are a more limited number of variables in play that can affect performance; loose housing significantly increases the amount of variables and their interactions affecting the total productivity of the sow by adding social interaction – including possible agonistic encounters resulting in lesions, lameness, and disparities in feed intakes among sows. The requirements on the stockperson may also be increased due to the difficulty of individual sow observation and care in loose-housed sow groups versus stalls. It is important to be very cognizant of how many of the changes in macro-environment (e.g. diet, feeding system, ventilation, parities of sows present) may affect the micro-environment of sow interactions at the level of the individual sow grouping and how these interactions may affect total performance.

Although this paper focuses on group housing of dry sows, it should be noted that the American Veterinary Medical Association (AVMA) conducted their own thorough research into dry sow housing and stated in their findings that, “There are advantages and disadvantages to any sow housing system”, and, “To address animal welfare in the long term, advantages of current housing systems should be retained while making improvements in design to overcome problems identified.”³ The AVMA does not specifically endorse or censure any current dry sow housing practice.

¹ Vileisis, A. *Kitchen Literacy*. Washington, D.C.: Island Press, 2008

² Grove, M. “Farmers Feeding the World More With Less.” *WCF Courier*. 7 Sep. 2011

³ AVMA. “Pregnant Sow Housing.” 2011. Print.

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Chapter One: Issue at Hand

Key Takeaways

- Modern sow confinement operations are typically using stalls for dry sow housing.
- Pressure from animal welfare groups, niche marketers and governments have caused a number of states and countries to adopt group housing of dry sows as the standard.
- There is a lack of knowledge in many countries as to how best to implement loose housing of dry sows.

Gestation stalls have been the mainstay of dry sow housing in the United States since sows began moving indoors in the late 60's and 70's. Individual attention can be easily given, sows are protected from aggressive behavior of other sows, feeding to appropriate body conditioning score (BCS) is simple and there is less chance of injury to stockpersons.⁴ Pressure from animal welfare groups, retailers seeking marketing advantages, and ultimately government involvement has led to a number of US states passing resolutions regulating the housing of dry sows and businesses requesting or requiring changes in dry sow housing from their suppliers. In 2001 McDonald's requested US suppliers to begin to investigate alternate housing systems for dry sows, and in 2012 announced that it will require US suppliers to produce their plans for being stall-free as a condition of continuing business with the fast-food giant.⁵ In 2002 Florida passed legislation banning the use of gestation stalls, followed by Arizona in 2006, Oregon in 2007, Colorado and California in 2008, Maine and Michigan in 2009, and Ohio in 2010. Overseas stalls have been banned in the UK since 1999, and the rest of the EU will ban the use of stalls as of 2013.⁶ Major producers have responded, with Smithfield, the world's largest pig producer,^{7,8} announcing in 2007 that it would transition all of its sow farms to group housing by 2017.⁹ Hormel Foods has also agreed to phase out all gestation stalls before 2018.¹⁰

In spite of the overwhelming media attention and focus on moving dry sows to group housing, there has been little compiled documentation discussing the best practices needed to make such a transition work to the full benefit of the sows and also keep the costs low for consumers. This report will endeavor to provide some insight into the options available for loose sow housing, recommendations from producers who have already made the transition, and findings from scientific research concerning production results from various systems.

⁴ Barrie, E. "Management of Sows in Loose Housing Systems." OMAFRA Agdex 441/50 Jun 2011

⁵ McComb, L. "McDonald's Takes Action Toward Ending Gestation Stall Use; Humane Society of the United States Supports Effort." Feb 13th, 2012. Print.

⁶ Gonyou, H. "Systematic Literature Review and Needs Assessment of Housing Systems for Gestating Sows in Group Pens with Individual Feeding." 2009. NPB #08-276

⁷ Smithfield Foods. "Understanding Smithfield: who we are." www.rcalfusa.com/industry_info/2008_JBS_merger/080409-Exhibit18_HistoryofSmithfieldFoods.pdf. Accessed November 11, 2011.

⁸ Successful Farming. "Pork powerhouses 2007." 2007. Print.

⁹ Smithfield Foods. "Smithfield Foods makes landmark decision regarding animal management." 2007. Print.

¹⁰ Hormel Foods. "Hormel Foods Corporate Responsibility Report." 2009. Print.

Chapter Two: Group Housing

Key Takeaways

- Group housing can be a simple affair – but the production outcomes are the result of numerous complex interactions among variables.
- Group size, frequency of mixing groups, feeding system, housing styles, and space allotments are all key areas for consideration when planning loose housing systems.
- Other producers can be a good source of information and help.

The impact of group housing on the reproductive and ultimately financial performance of any operation is based on numerous factors and their complex interactions. A space allotment that one producer may consider too small for sows works quite nicely for another producer when combined with a high-fiber diet causing sows to interrupt their eating cycles to drink more frequently¹¹ – allowing timid sows more chances at the feeder. An initial disaster when switching to group housing may improve after two or three parities due to indirect selection for docile replacement gilts.¹² What one producer may swear by another may fail with – ventilation, lighting, diet, breed, average parity, cull rate, stockmanship, post-implantation stall time, feeding system, age and upkeep of penning, stalls and concrete, depth of bedding, slope of floor – all of these may interact to produce different results for different producers when moving to group housing of dry sows. Some collected research and anecdotal evidence from extant producers is presented below to assist in the thought process of designing and transitioning to group housing of dry sows.

Considerations for Group Housing

Group Size and Status (Dynamic v. Static):

One of the first considerations for making the transition to group housing is the number of sows to place into one pen section. This will depend heavily on the feeding plan and farrowing program.

- Large groups (more than 20 sows/group)
 - Advantages:
 - More cost efficient if using Electronic Sow Feeding (ESF, described later)
 - Easier to introduce new sows/gilts into the group¹³ as timid sows can blend into the crowd and escape dominate sows
 - Disadvantages:
 - More difficult to give individual attention to sows/gilts¹⁴
 - Unless farrowing in equally large batches, mixing and re-mixing of sows will be necessary, possibly increasing cull rate of sows from damage

¹¹ Salak-Johnson, J. “Impact of Group Size and Diet on Behavior and Physiology of Sows.” Pork Checkoff Project 07-105. 2011

¹² Miller, D. “Sows Flourish in Pen Gestation.” National Hog Farmer 15 Mar 2004

¹³ Gadd, J. Modern Pig Production Technology. Malta: Nottingham University Press, 2011.

¹⁴ Miller, D. *op. cit.*

- Small groups (less than 20 sows/group)
 - Advantages:
 - Easier to work with static groups and small-batch farrowing
 - Individual attention and observation of sows easier
 - Disadvantages:
 - Harder to introduce new sows/gilts into the group
 - Not cost effective if ESF is desired
- Static groups of sows are initially assembled and then no further sows/gilts are added to the group until such time as the size of the group has dwindled through recycles and attrition that the group size is no longer viable, at which point the group is dissolved and a new group formed.
 - Advantages:
 - Once a hierarchy is established, significantly less agonistic behavior is noted among static groups than dynamic groups¹⁵
 - If using a batch farrowing system, static batches work well with the all-in-all-out methodology for cleaning and disinfecting
 - Disadvantages:
 - Higher capital costs may be realized if pens are stocked to a certain density and not restocked following removal of recycles and cull sows. Extra pens are now required to maintain the overall number of sows needed in a static group system. Pens can be initially overstocked in anticipation of attrition but must be carefully monitored and managed during the overstocked phase
- Dynamic groups involve adding and removing sows from the group after initial formation. When the number of sows in a group changes there tends to be a period of aggression while the social order is re-established. This can range from one to four days, with the worst of the aggression usually occurring within the first four hours.^{16,17} (This holds true in static groups, as well.)
 - Advantages:
 - Allows maximum utilization of space by always maintaining stocking levels in pens
 - Disadvantages:
 - More frequent mixing creates more agonistic encounters as social orders are constantly being redefined¹⁸

¹⁵ Durrell, J., *et al.* "Sow Behaviour and Welfare in Voluntary Cubicle Pens (Small Static Groups) and Split-yard Systems (Large Dynamic Groups)." *Animal Science* 75 (2002): pgs 67-74

¹⁶ Kay, R. "Sow Aggression Under Spotlight." *Farmers Weekly* 1999

¹⁷ Burfoot, A. and R. Kay. "Aggression Between Sows Mixed in Small Stable Groups." ADAS Report 1995

¹⁸ Durrell. *op. cit.*

Feeding Strategy:

There are many ways to feed dry sows which need to be considered in light of the size of the building and pens, as well as the personal preferences of the stockman, and with an eye towards costs. Some of the more common methods of feeding are discussed below.

- Drop feeding – This can be as simple as hand-feeding sows over the fencerow on a concrete slab or as complex as automatic volumetric drops timed to release a certain portion of food multiple times throughout the course of a day. The discussion following will focus more towards automatic drop feeding than hand feeding, although there are notable pig producers who prefer or even insist on hand-feeding to maintain the person-pig interaction.¹⁹ A variant of drop feeding is trickle-feeding, wherein feed is slowly released at a controlled rate rather than dropped instantly onto the feeding pad. This method serves to accomplish much the same result as dropping feed multiple times throughout the day, namely, to reduce aggression by giving sows the impression that feed is not a limited resource to fight over, that it exists in many locations and arrives multiple times.
 - Advantages:
 - Simple system to design and implement – minimal electronics
 - Spatially and temporally separating feed drops within the pen reduces agonistic interactions resulting from a single point of feed.²⁰
 - Easy retrofit into an existing barn versus ESF.²¹
 - Disadvantages:
 - No individual feeding of sows based on Body Condition Score (BCS), although this can be overcome somewhat if sows are held in stalls for the first 28-35 days post breeding or groups are formed based on BCS feed requirements
- Electronic Sow Feeding (ESF) – This system utilizes special penning arrangements to direct animals into and out of a protected feed area where an individual ration is fed to each sow identified by an RFID tag in her ear. Small portions are fed until the sow ceases to eat or reaches her daily allotment, at which point gates are opened and the next sow enters. Typical ESF stations can serve between 60-80 sows, which would be grouped together into a single pen.
 - Advantages:
 - Sows are fed individually, allowing feeding to BCS throughout the gestation period
 - Sows are completely protected while eating, allowing timid sows to eat their full allotment unmolested
 - Software prints out a daily report of feed intakes or skipped feedings per sow
 - Disadvantages:
 - ESF can be a labor-intensive system, relying as it does on complex mechanical and electrical systems that need protection from the

¹⁹ Miller, D. “Sows Flourish in Pen Gestation.” National Hog Farmer 15 Mar 2004

²⁰ Kains, K.Z.F. “Making Group Sow Housing Work.” National Hog Farmer 15 Jun 2008

²¹ Barrie, E. “Management of Sows in Loose Housing Systems.” OMAFRA Agdex 441/50 Jun 2011

environment and regular maintenance, along with tracking down animals skipping feedings or without RFID transponders in a large pen, and regular updates to the individual sow daily allowances.²²

- ESF systems require substantial changes to pen design in retrofit scenarios, along with a higher cost than many drop feeding systems.²³

Housing:

Housing will be based in part upon the feeding system utilized – with ESF larger pens with specific fencing layouts are required to house the 60-80 sows/station. In general housing can be divided into either fully open or partial stall access. For the purposes of this paper only typical indoor housing systems will be described.

- Partial stall access – In some cases stalls are provided, either open-backed or free-access locking stalls (which close behind the sow upon entering and open again only when the sow backs out), so that the sows may choose whether to mingle in an open communal space or have the relative privacy of a stall for eating or lying. Typically if using free-access stalls one stall must be provided for every sow to allow all to eat at the same time. Free access stall pens are typically divided into either an ‘I’ configuration consisting of an open slatted alley of 3’ (.9m) to 10’ (3m) behind the stalls or a ‘T’ configuration with an alley behind the stalls leading down to a solid-floored open resting area which may be deep-bedded. See Figure 1 below. Alley widths in ‘I’ pens have been tested at 3’ (.9m), 7’ (2.1m) and 10’ (3m) widths to determine what effect, if any, the size of open space had on sow activity and comfort. One study published determined there to be minimal differences between widths on production and physiological responses.²⁴ It showed no difference in aggression among sows between widths, nor litter size nor other productivity measures. The sows in stalls with a 3’ (.9m) alley used the alley space less than those housed with wider alleys and had fewer interactions. The 3’ (.9m) width did negatively impact the sows’ ability to turn around, a measure of animal welfare.

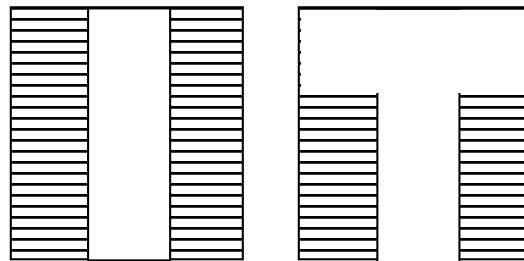


Figure 1: An “I” configuration (left) showing an open slatted alley behind two rows of free access stalls and a “T” configuration (right) showing an alley behind two rows of stalls with extra solid-floored resting space at the end of the alley.

- Advantages:
 - Sows have protection during eating and when desired to limit agonistic encounters
 - Can re-use a large portion of original investment in retrofit situations if re-using existing stalls less backs

²² Barrie, E. “Management of Sows in Loose Housing Systems.” OMAFRA Agdex 441/50 Jun 2011

²³ *Ibid.*

²⁴ Pajor, E. “The Effect of Alleyway Width on Sow Behavior and Welfare in a Free-Access Gestation Stall System.” Pork Checkoff Project 07-083. 2011

- Disadvantages:
 - Higher price than completely open design pens²⁵
 - Additional maintenance required anytime one adds additional mechanical components (i.e. crates) to a pen
- Fully open pen design – Here no full stalls are provided. Open pens can be designed with either separate sleeping/lying areas (typically solid floored, either concrete with half-wall dividers or deep-bedded with straw – see Figure 2 below) or fully slatted with no special lying areas called out. Drop feeding can be onto solid pads with no divisions or with short, ¼ stall solid dividers to prevent eye contact between feeding sows.

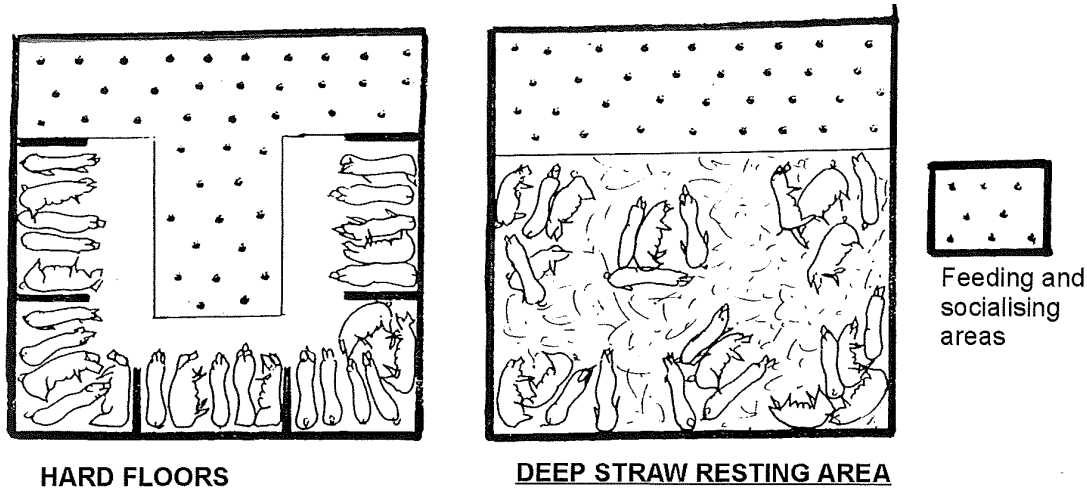


Figure 2: Examples of solid floor non-bedded sleeping/resting area (left) and solid floor deep-bedded sleeping/resting area (right.)²⁶ Feeding and socializing areas are typically slatted floor.

Space Considerations:

The amount of floor space to allocate per sow/gilt is a matter of no small debate and usually rises quickly to the front of any discussion regarding loose-housing sows as it has one of the easiest-to-quantify economic impacts on an operation. In practice, sow area has varied from 15ft² (1.39m²) to 38ft² (3.5m²) per sow. While there may be no consensus among producers today regarding the optimum floor space allocations, there are a number of references available, whether through published legislative guidelines, scientific examples, or producer best practices that will be referenced herein. Much will be based on the systems selected above for feeding, bedding, and housing the sows, as well as the breed temperament of producers' individual sow lines. Following are some tips, notes, and findings about floor space:

- A large (70k + sows) US-based producer has historically always housed sows in groups of five in an 8' x 10' fully slatted pen (16ft² per sow) and has always shown very good production numbers. They are big proponents of individual sow attention and hand-feed their pens.²⁷ They have been using this system since 1989.

²⁵ Western Hog Journal. "Individual Sow Feeding Stalls Offer Simple But Effective System." WHJ 14 Jul 2011

²⁶ Gadd. *op. cit.*

²⁷ Miller. *op. cit.*

- A prominent ESF manufacturer recommends a minimum of 24ft² (2.23m²) per sow, 60% of which should be solid floored laying area.²⁸
- The UK, which has been stall-free since the late 90's, recommends between 24.76ft² (2.3m²) and 31.22ft² (2.9m²) per sow in pens with or without free access stalls,²⁹ although RSPCA guidelines call for 37.6ft² (3.5m²) per sow.³⁰ This number (3.5m² per sow) has also been cited as a good stocking rate for a separate pen specifically used to mix groups for the first 24 hrs before placing the mixed group into the standard pen.³¹ The mixing pen allows more fleeing space and feed and water access to minimize aggression during the critical first 24 hours of a new groups' formation.
- The common wisdom of larger = better does come with the caveat that having too large of a lying area leads to dunging on the lying floor as opposed to in the dunging area of slatted flooring.³² A 2" (5cm) step-down from the lying area to the slatted dunging area is recommended to minimize soiling of the laying area, along with a minimum width of the slatted floor of 8' (2.4m). Slot width of slats should be no more than ¾" (2cm) with well rounded edges.

Additional Management Considerations:

Some further tips from producers and researchers covering a broad range of topics to assist in making loose housing of dry sows work:

- Adding hanging partition walls (hanging rubber mats or colliery belting) can reduce aggression by providing hiding places for sows being pursued.³³
- Mix sows towards the end of the day, immediately before lights-out – full, calm sows in a dark environment are less aggressive.^{34,35}
- Introduce **more than** three sows/gilts at a time into the main group, regardless of the size of the main group, to reduce singling out of any one new entrant.³⁶
- If introducing gilts to a group, make sure to pre-introduce the gilts to each other for at least 24 hours – gilts are extra-excitable and need time to familiarize with each other prior to joining a group.³⁷
- The use of sedatives (e.g. amperozide) seems to merely delay aggression, not prevent it.³⁸
- Some lines, or at least some batches within some lines, of breeding stock tend to be more flighty than others, and docility is a blessing in pen gestation.³⁹
- A producer in MI says removing the boss sow tends to be less effective at preventing aggression versus removing the timid sow undergoing abuse.⁴⁰

²⁸ Wyse, G. Personal Interview. 7 Jun 2011

²⁹ Gadd, J. *Modern Pig Production Technology*. Malta: Nottingham University Press, 2011.

³⁰ RSPCA. "RSPCA Welfare Standards for Pigs." Jan 2010

³¹ Gadd. *op. cit.*

³² Barrie, E. "Management of Sows in Loose Housing Systems." OMAFRA Agdex 441/50 Jun 2011

³³ *Ibid.*

³⁴ *Ibid.*

³⁵ Gadd. *op. cit.*

³⁶ *Ibid.*

³⁷ *Ibid.*

³⁸ *Ibid.*

³⁹ *Ibid.*

⁴⁰ Vansickle, J. "Gestation Pens Fare Favorably to Stalls." *National Hog Farmer* 15 Mar 2009

- Current legislation in the US allows sows to be kept in stalls for 28-35 days post-breeding. While there have been some studies showing no loss of reproductive performance from sows moved into pen gestation prior to this time⁴¹ most of the articles cited herein recommended against this practice until further research and documentation have occurred.
- Diet and floor space seem to be connected, with high-fiber diets combined with optimal floor space resulting in better reproductive performance.⁴² One study showed best results from a high-fiber floor-fed diet in sows housed at 18.3ft² (1.7m²) per sow.
- Careful design of ESF pens with respect to location of feeders, watering, and alley size is important as most aggressive behaviors in ESF pens are seen at the entrance to the ESF station.⁴³
- In deep-bedded pens, one prominent pig expert recommends against including divisions in the laying areas as the divisions tend to hinder the natural grouping of resting areas by the various sub-groups of sows in the pen.⁴⁴

⁴¹ Bierman, C and D. Kohler. "Timing of Post-insemination Movement of Sows Into Loose-sow Gestation Housing and its Subsequent Effects on Reproductive Efficiency." Babcock Genetics 2011

⁴² Salak-Johnson, J. "Impact of Group Size and Diet on Behavior and Physiology of Sows." Pork Checkoff Project 07-105. 2011

⁴³ Deen, J. "Effect of Timing of Grouping of Sows During Early Gestation on Welfare and Performance of Sows and Group Pens with Electronic Sow Feeders." National Pork Board Research 08-154. 2010

⁴⁴ Gadd. *op. cit.*

Conclusion

With increasing pressure to convert to loose housing of dry sows it is more important than ever to be well informed of the strategies and tactics available to assist any producer (who is planning to remain in the business of pig production) how to successfully transition from stalled housing to loose housing. The challenge for pork producers now is to rethink the management practices of the past so as to maintain a strong and productive industry well into the future. Each system or combination of systems will have inherent merits and drawbacks; it will be the task of the producer, combining knowledge from university research, allied industries, governmental extension services, and others in the field to find the best solutions with the strongest appeal to them and their customers that fits their specific farm model. Excellent stockmanship is mandatory for the success of loose sow housing, and no electronic, mechanical or automatic systems can replace good, caring attention to detail, careful consideration of the information available, and individual stockman work ethic.