

Everything Old Is New Again - Sow Housing

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The Danish pig industry is largely based on exports, i.e. more than 80% of the production are exported. The driving force has been to meet the demands of foreign markets, especially in terms of high product quality and competitive prices. Lately, other demands have emerged such as animal welfare, which have affected housing systems dramatically. The EU directive regarding animal welfare, which was adopted in 1991, did not impose any serious restraints on the Danish pig industry. However, during the 1990s political pressure and consumer demands led to new legislation requiring pregnant sows to be loose housed and to regulation regarding housing of weaners and finishers. This led the producer organisation, the National Committee for Pig Production, to change its research activities regarding housing in a more welfare-oriented direction. Its research organisation the Danish Applied Pig Research Scheme (DAPR), conducts comparative studies of equipment, housing and production systems. Contrary to most other applied research schemes, DAPR adopts a traditional research approach while using commercial farms as its research facilities. Trials are based on a comparative study of treatments within one herd. DAPR's applied research has led to development of new housing systems for pigs, which meet welfare, production and health requirements.

■ Introduction

Danish pig production has increased considerably since Denmark became a member of the European Community in 1972. In 2000, 23 million pigs were produced as compared with 11 million in 1970. Approximately 85% of the production is exported to more than 100 countries, which accounted for a value of 4 billion Euro in 2001.

A strong cooperative structure has been the basis for the production increase. The pig producers own the two abattoirs Danish Crown and Tican, which account for 95% of the pigs slaughtered. Furthermore, producer-owned cooperatives carry out processing and marketing of pig meat. The umbrella organizations, The Danish Bacon and Meat Council and the National

Committee for Pig Production (NCP), are responsible for common activities such as applied research, marketing, breeding, veterinary and public relations. Thus, Danish pig producers are acting as one company, which means that they control all parts of the pork production chain.

The NCP, which is a committee under the Danish Bacon and Meat Council, established The Danish Applied Pig Research Scheme (DAPR) in 1975 with the aim of developing and testing production systems for pigs including feedstuffs and technical equipment. DAPR has been heavily involved in developing and evaluating new housing systems, which have evolved as a consequence of new animal welfare legislation coming into force in 1993, 1999 and 2000, respectively. It is expected that producer sponsored research and development will continue since pig housing and management requirements will be tightened both nationally and internationally.

Recently the European Union required that member states adopt group-housing systems for gestation sows in new and converted buildings from 1 January 2003. In addition, certain markets require that pigs be produced according to animal welfare standards that are even tighter than that stipulated by current national legislation. Thus, Danish pig meat exported to the UK must meet the requirements set by the British welfare legislation. Similarly, organic pig meat must comply with specific rules set by the importing country. Nationally, abattoirs and retailers have provided their own standards for pig housing with respect to certain products.

■ Animal Welfare Legislation

The EU regulation on animal welfare outlines the minimum requirements that all member states must respect, while individual states may apply stricter rules nationally. The Danish animal welfare legislation provides a framework for national politicians allowing them to tighten regulation as needed. Until 1999 Danish animal welfare legislation was based on EU regulation (Council Directive, 1991). This Directive did not impose any restraints on Danish pig production compared to existing recommendations which were the foundation for pig production earlier. In the late 1990s, political pressure and consumer demands led to tightening of national legislation. Thus, a new act on housing of gestation sows came into force on 1 January 1999.

The Danish act on housing of gilts and sows requires that:

- Sows and gilts must be group housed from four weeks after service until seven days before expected farrowing.

- Minimum space requirement depends on group size:
 - < 4 sows 2.8 m² per sow
 - 5-10 sows 2.2 m² per sow
 - 11-20 sows 2.0 m² per sow
 - > 20 sows 1.8 m² per sow
- At least 1.3 m² of the pen space per sow and 0.95 m² of the pen space per gilt, respectively, must be solid floor and animals must have access to rooting materials.
- A cooling system, e.g., a sprinkler system, must be installed to allow animals to adjust their body temperature.

By January 1 1999 all new or remodelled gestation housing must comply with the law, while all gestation accommodation must meet the terms by 1 January 2013.

Recently, the EU commission agreed on tightening animal welfare legislation in all member states. Thus, a new directive will be effective on 1 January 2003 requiring gestation sows to be group housed. These rules are similar to the Danish legislation with respect to pen space allowance.

■ Sow Housing

The new animal welfare legislation has brought about significant changes in housing of pigs. Moreover, it has stimulated substantial innovation and development of new systems. The new legislation has been in force for a short time only. However, political and public pressure for welfare-friendly systems led NCPP to initiate studies of group-housing systems for pregnant sows more than ten years before the legislation came into force. Therefore, the Danish pig producers have been reasonably well prepared for the changes induced by the new legislation.

Simple Group Housing Systems

In the early 1990s Danish pig producers paid most attention to so-called simple group-housing systems. These systems employ static groups of sows throughout gestation. Sows are either floor fed using a dry meal/dry pellet diet or fed in a trough using a liquid diet. These systems are relatively cheap to install and are relatively low-tech, which means that technical break-downs are rare. Simple group-housing has been compared to confinement in three herds. Data regarding pen layout and management of group-housing systems as well as results are presented in **Table 1**.

Table 1. Production performance for group-housing systems with liquid feeding or floor feeding (dry feed) compared with sows in stalls in three herds (Fisker, 1994).

Herd	1		2		3		Overall average	
	Group	Stall	Group	Stall	Group	Stall	Group	Stall
Housing	Group	Stall	Group	Stall	Group	Stall	Group	Stall
Feeding	Liquid	Liquid	Liquid	Liquid	Dry, floor	Dry	-	-
Sows/group	12	-	11	-	12	-	-	-
Mixing	After service	-	After weaning	-	After weaning	-	-	-
Litters	402	442	279	279	293	242	923	1014
Liveborn/litter	10.7 ^a	11.2 ^b	11.6	11.4	11.4 ^a	11.9 ^b	11.2 ^a	11.5 ^b

^{a, b}Means differ ($p < .05$), (^{a, b})Means differ ($p < .06$)

Results presented in Table 1 indicate that the number of liveborn pigs was 0.3 lower for group-housed sows as compared to those kept in stalls. Difference in reproduction rate could be attributed to two herds. Furthermore, the study indicated that 15% of the sows had to be removed from group-housing due to poor body condition, leg problems or return to estrus.

DAPR does not recommend simple group-housing systems due to the fact that feed intake and body condition are difficult to control. Moreover, aggression is relatively high when sows are competing for feed, which leads to high culling rates. Instead an improved system such as trickle feeding might be used, which allow individuals in a group a similar amount of feed. However, this system is relatively expensive.

Electronic Sow Feeding Systems

One of the main arguments for maintaining sows in confinement is that it offers the potential of controlling individual feed intake. However, in the early 1980s electronic sow feeding systems (ESF) were introduced as an alternative to confinement of pregnant sows. Therefore, ESF was considered a major breakthrough in sow housing, because it allowed sows to be individually fed while residing in groups. Early developments took place in the UK and the Netherlands and the first systems were marketed in Denmark in 1986.

DAPR initiated trials with ESF as soon as the first systems were marketed. The first results regarding performance of animal and equipment were negative suggesting that further improvement in equipment and housing design was needed before ESF could be recommended in general. Therefore, ESF was never incorporated into the Danish production systems to the same degree as in other countries such as the UK, the Netherlands and Sweden.

The most important conclusions from the first study were as follows:

- Production performance was similar between ESF systems and confinement systems when using static groups and mixing 4 wks after mating.
- Keeping sows in dynamic groups mixed after service provoked risk of abortion, loss of embryos and a high frequency of rematings.
- Heat detection was easier in group-housed sows than in confined animals due to enhanced expression of sexual behaviour.
- ESF equipment, i.e. feeders and collars of poor quality - led to many breakdowns and frustrated sows. Technically, ESF needed to be improved.
- Pen layout and location of feeders was important for system performance.
- ESF and group-housing required high management skills.
- Incidence of MMA was higher in gilts, which had not been confined prior to parturition.

Thus, the first experiences with group-housing systems were relatively negative. However, DAPR has since then conducted several trials of newer ESF versions as well as other feeding methods (The National Committee for Pig Production, 1992). A major concern has been whether production performance is compromised with group-housing of sows. Therefore, the first studies included comparisons of a variety of group-housing systems with traditional confinement systems such as stall and tether systems (**Table 2**).

The results of this study indicated that:

- Productivity was lower with group-housing in one herd, when sows were mixed after service.
- A large number of sows had to be removed from group-housing systems with ESF in combination with partly slotted flooring due to fearfulness (sows, which were afraid of using the feeder), leg problems and abortions (pen design shown in Figure 1).
- The deep-litter system provided more options to sows for escaping aggressive encounters than a slotted system, however straw consumption was large - about 1000 kg per sow annually.

- A transition period of 1 to 1.5 years was needed for adjustment of herd and management to group-housing. During the transition period production performance might be reduced and culling rate might increase.

Table 2. Effect of gestation housing on sow production (data for gilts and first year of group-housing not included) (Nielsen, 1995).

	Herd 1			Herd 2		Herd 3	
	DG ¹	DG	Stall	DG	Stall	DG	SG ¹
Housing	DG ¹	DG	Stall	DG	Stall	DG	SG ¹
Feeding	ESF	ESF	Individual	ESF	Individual	ESF	Floor
Flooring	Partly slotted	Deep litter	Partly slotted	Partly slotted	Partly slotted	Partly slotted	Partly slotted
Time of mixing	AS ²	AS	-	AS	-	4wk AS	4 wk AS
Number of litters	313	348	354	455	265	364	365
Sows removed from group, %	17	13	-	29	-	24	12
Farrowing rate, %	83	84	87	86	94	94	95
Total born/litter	11.6 ^a	11.5 ^a	12.7 ^b	12.6	12.4	13.0	12.8
Liveborn/litter	10.7 ^a	10.7 ^a	11.3 ^b	11.9	11.7	11.8	12.0

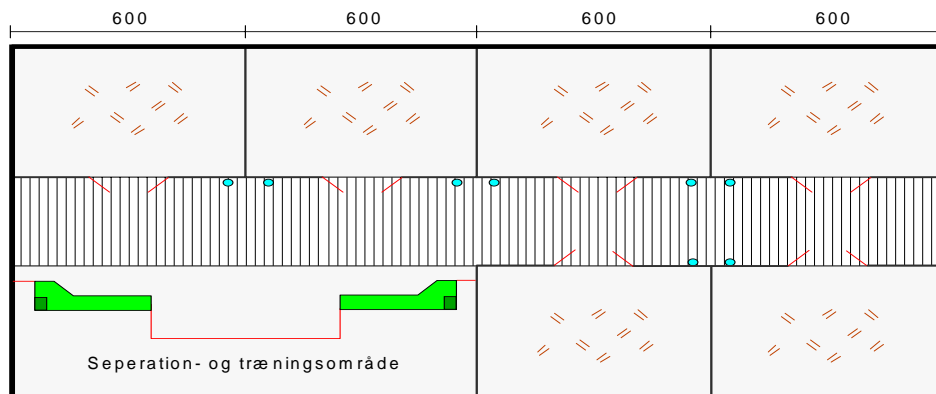
¹ DG = dynamic group, SG = static group; ² AS = after service; ^{a, b}: Means differ ($p < .05$).

Thus, pen designs with a large proportion of slatted flooring entailed that reproduction rate and sow longevity was at risk particularly when animals were introduced to group-housing after service.

In order to exploit the positive aspects of the straw-based system on sow longevity an alternative pen layout employing a separate lying, feeding and dunging area was developed and evaluated. This system has been more promising than any other in terms of functional performance (**Figure 1**). In addition, straw consumption might be reduced to 300-500 kg per sow annually as compared with deep litter systems. Later comparisons of production performance employing this system have shown that production performance was similar for sows mixed after

service compared to sows mixed 4 weeks after service (Nielsen, 1999). Moreover, the remating interval was shorter for sows returning to estrus when animals were grouped after service. Today, ESF systems are considered to be among the most promising systems for group-housed sows.

Figure 1. ESF pen design employing a lying area with straw and a separate dunging area with slats.



ESF is the only system that allows individual feeding while housing sows in groups. Although, most technical problems with ESF have been solved, failure may still occur. DAPR has developed a set of recommendations regarding ESF based on trials carried out over the last 15 years:

- Pen design should incorporate a separate lying area and dunging area.
- The lying area should provide sufficient space for sows to escape aggressive encounters.
- Straw must be provided in the lying area.
- Solid lying area: 1.1-1.3 m² per sow.
- The dunging area might be slatted and should be at least 3 m wide and separated from lying area.
- The system should incorporate a training pen for new animals.
- One feeder per 50-60 sows.
- Feeders should not be placed in corners - there should be free access to entrance from both sides.
- Choose a manufacturer of a well-known ESF brand, who is able to provide 24 hours service.
- Gilts should not be mixed with sows, since they are frequently intimidated.

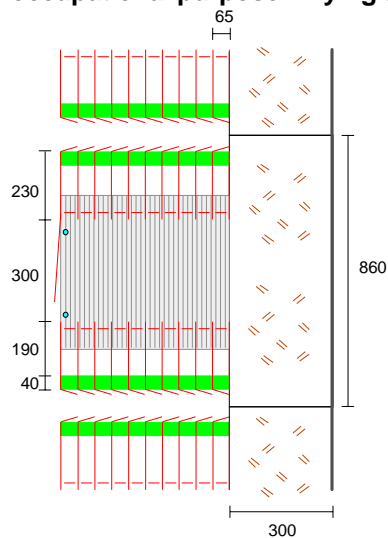
Free Access Stalls

Group-housing with free access stalls is a low tech system, which is becoming increasingly popular. This is probably due to the fact that this system resembles the conventional stall system, which provides control over individual feed intake. Thus, many farmers who are converting from conventional housing to group-housing feel more comfortable with a system that is similar to the one they had.

The first designs were called “cafeteria-systems” because four groups of sows were sharing a set of stalls. Thus, each group of sows was led out of their pen on shift. The advantage with this system is that investment costs are reduced, however, the draw-back is that manual labour is required for moving sows back and forth between stalls and pens each day. Newer group-housing systems with free access stalls are designed with a lying and dunging area behind the stalls. The lying area might have deep-litter or straw for occupational purposes only (**Figure 2**). DAPR has not made any comparative studies of free access stalls and conventional stalls due to the fact that it is expected that production performance is similar among systems.

Group-housing systems with free access stalls are more expensive than ESF-systems. This is due to the fact that space requirement is 30-50% higher. Moreover, one free access stall is required for each individual and the system is not flexible with respect to stocking rate. Systems designed for moderate quantities of straw need further development to maintain a hygienic occupational zone outside the stalls.

Figure 2. Group-housing system with free access stalls and straw for occupational purpose in lying area.



■ **Mating units**

111 Pig producers who are supplying pork for the British market are required to have their sows loose housed, but not necessarily in groups. As indicated earlier DAPR trials have shown that sows are sensitive to external strains when they are kept in groups right after weaning or mating. Loss of embryos might occur as a result of aggression. Moreover, individual control of feed intake is extremely important for ovulation to succeed. Excessive stress shortly after mating might also affect implantation of fetuses negatively. Therefore, sows are kept individually in pens or in static groups with free access stalls, which provide the safest environment.

■ **Conclusion**

In 2003 about half of the gestating sows in Danish will be loose/group-housed. Although it is possible to obtain a high efficiency in connection with the loose-housing system, there are still a number of unresolved issues, which need additional evaluation. Therefore, further development of systems, to improve efficiency and man-hours, is still appropriate.

■ **References**

The National Committee for Pig Production, Annual reports, 1991 to 2001, Denmark.