

**DLG Expert Knowledge Series 408**

# **Sow group formation**



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## Sow group formation

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Published by:

DLG e. V.  
Competence Center Agriculture  
Eschborner Landstr. 122, 60489 Frankfurt am Main, GERMANY

1st Edition, as off 9/2015 (based on German version, 1st Edition, as off 9/2015)

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## 1. Foreword

All group housing starts with the formation of a group.

To avoid negative effects on animal health and on the farm's results, group formation and subsequent group housing and feeding processes must be precisely planned and coordinated. This is primarily a management challenge.

When sows are placed together in a group they will fight to establish dominance, and this can cause problems. However, these fights are completely normal and cannot be avoided. Their purpose is to clarify the social relationships between the animals in a group and to build up a social hierarchy. Once this is done, the group remains stable for a long time and aggressive behaviour ceases.

Fights for dominance can also have a negative impact on fertility, however, resulting in higher numbers of repeat breeder sows, late-onset oestrus and fewer live-born piglets. In the worst case, all fetuses/embryos will die and the pig will abort.

This highlights the importance of managing the process properly and allowing fights for dominance to take place in a place and at a time that puts the sow and her pregnancy in the least danger.

When and where should a group be formed? How big should the group be, and how should it be made up? Is it better to work with static or dynamic groups? How should problem animals be handled?

Before a farmer invests in a group housing process, he should consider these issues carefully. Mistakes can only be avoided with good preparation.

Looking beyond the theoretical principles of social behaviour in pigs and animal welfare requirements, this edition of the Expert Knowledge Series provides recommendations as to the best way to group house sows on the farm, with practical examples to illustrate possible solutions.

*Dr Jörg Bauer*

## 2. Animal welfare requirements

The German rules for protection of kept animals (*Tierschutz-Nutztierhaltungsverordnung*, TierSchNutzTV) of 25 October 2001, as amended on 22 August 2006, defines the animal welfare requirements for pig farming in Germany. Under this order, the unobstructed floor area allocated to sows kept in groups must be 1.65 m<sup>2</sup> for gilts and 2.25 m<sup>2</sup> for older sows. For groups of less than six animals, the floor area should be increased by 10% and for groups of more than 40 the area can be reduced by 10%. There are very practical reasons for this requirement. Once sows in large groups have established their hierarchy they lie close together, leaving a relatively large space free and enabling social minimum distances to be observed. The pen floor must have a solid area of 0.95 m<sup>2</sup> for gilts and 1.30 m<sup>2</sup> for older sows, or the slatted floor area should not exceed 15% of the total.

The EU-wide requirement for group housing of pregnant sows introduced on 1 January 2013 brought about the most radical changes in pig farming for many years. It ultimately forced a struc-

tural change that led to many smaller pig farms giving up piglet production altogether. Under the TierSchNutzTV, gilts and older sows must be kept in groups during a period starting from five weeks after insemination to one week before the expected farrowing date. The sides of the pen in which the group is kept must exceed 2.8 m in length. For groups of fewer than six individuals, the sides of the pen must exceed 2.4 m in length. Sows and gilts raised on farms with fewer than 10 sows may be kept individually during this period provided that they can turn around easily in their crates.

With regard to the design of the floor, the openings in slatted floors for gilts and sows may not exceed 20 mm. Where a concrete slatted floor is used, the edges must be deburred and the slat width must be at least 80 mm.

Under the TierSchNutzTV, every pig must have permanent access to sufficient quantities of material to investigate and manipulate which does not compromise the health of the animals.

EU Directive 2008/120/EC furthermore requires sows and gilts kept in groups to be fed using a system which ensures that each individual can obtain sufficient food even when competitors for the food are present. This formulation allows all existing feeding systems to continue to be used for group-housed sows. Particularly aggressive animals, animals attacked by other pigs or sick or injured animals may be temporarily housed in individual crates provided that they can turn round easily in their crates. The conclusion to be drawn from this is therefore that group housing should be managed in such a way that as little selection needs to take place as possible. Crates should be kept vacant for selected individuals. Where it is necessary to house sows in individual crates to aid recovery, the veterinary surgeon can require this in line with the EU Directive.

However, unlike the EU requirement, under which pigs must be kept in light with an intensity of at least 40 lux for a minimum period of eight hours, the TierSchNutzTV additionally requires a light intensity of at least 80 lux in the animal area and access to natural daylight over at least 3 % of the house floor area.

### **3. Social behaviour in pigs during group formation**

Domesticated pigs and wild boar display very similar social behaviour patterns. Wild boar live in matrilineal groups: the pack (or “sounder”) consists of a dominant sow and her offspring or of a small group of closely related sows. The young males leave the group when they reach sexual maturity. Wild boar sounders consist of between three and 30 animals. When a pregnant sow reaches term she separates herself off from the group and only returns to it two to three weeks after the birth of her young.

Observations over several years by Stolba and Wood-Gush (1989) of domestic pigs in a large free-range enclosure showed that the social order in the group is similar to that of wild boar. Outsiders introduced into the enclosure were attacked and it took between one and two months for the others to allow them to lie in the group nest.

On pig farms group formation is not left up to the animals but organized by the farmer. When pigs are placed in groups, fights for dominance take place with the aim of establishing the social

relationships between the animals in the group. From a biological point of view it is important that this hierarchy is established quickly. Every fight costs the animals energy and puts them at risk of injury. A study by Bauer and Hoy (2002) showed that 78 % of all fights that break out on grouping end after 24 hours and 91 % after 48 hours. Although the social order in a group of sows is determined by fighting, it also serves the purpose of restricting aggressive behaviour once the hierarchy has been determined. A social hierarchy requires the animals to know each other individually and to be able to recognize each other quickly when they encounter each other again.

In the aforementioned study by Bauer and Hoy (2002) it was shown that the number of fights per sow on re-encounter rises as the interval between the first and second encounter increases (e.g. 28 days compared with 7). This echoes the findings of Olsson and Svendsen (1995) and Spooler et al. (1996), who established that individual group members can recognize one another over a period of between one and four weeks. Nonetheless, relationships in a sow group are more complex than is generally assumed. For example, up to 32 % of sows in a group never fight other group members when they meet for the first time, so it is not possible to identify their position in the hierarchy. Relationships between individual sow pairs remain undecided in a small percentage of cases (3.6 %), since each one of these animals wins as often as she loses (Hoy and Bauer 2004).

The more balanced the sow group is in terms of age and live weight, the more vicious the fighting can be. Older literature gives the optimum group size as between 8 and 20 sows, although it is not known how many members of the group sows can recognize individually. This number most likely differs from animal to animal, as a pig's ability to recognize or remember other pigs depends both on their individual abilities and on the length of time they have belonged to or been separated from the group.

When new animals join an existing group (e.g. when subgroups are integrated into an existing larger group – dynamic groups at demand feeding stations), renewed fights for dominance will occur, leading to stress, injuries and, in the worst case, loss of embryos or even repeat breeder syndrome (Arey and Edwards 1998). However, there is no clear indication of an ideal group size or floor area per animal in the literature, as results are often completely contradictory.

A distinction is drawn between frontal and lateral combat. In lateral combat, the opponents stand shoulder to shoulder and attempt to thwart their opponent and throw them on the ground. This shoulder contact also protects them against an attack involving bodily injury. In a frontal fight the sows bite their opponents on the head, the ears or the neck.

The individual distances between animals in small groups are shorter than in larger groups with the same amount of space available per animal. This has the disadvantage that there is less distance between subordinate and high-ranking animals than in large groups in which subordinate sows can keep as far away from high-ranking sows as possible and can “hide” in the group.

Sow fights can last for anything from less than one minute to half an hour. They either end when the subordinate sow retreats or when both sows are exhausted. Sometimes it is not clear which sow has prevailed as the two opponents part without a clear result (victory or defeat). Various ways of reducing the number and intensity of fights in sow groupings have been explored. However, the following results have not succeeded in significantly reducing injury in fights for dominance:

- Use of straw
- Administration of relaxants (e. g. Stresnil)
- Use of odour-concealing substances (e. g. camphor, soap or eucalyptus oil)
- Diversion feeding
- Group formation in the dark
- Grouping in the presence of a boar.

Sows are synchronous feeders, meaning that they endeavour to eat at the same time. Competition to access feed can trigger aggressive encounters. When forming groups it is important to distinguish between fights for dominance in the pen and agonistic interactions at the feeding point (feeding sows being pushed away or feeding points being defended when attacked).

#### **4. Effects of group housing on sow health and performance**

Keeping sows in groups raises concerns – and not without reason – regarding loss of performance due to a higher rate of repeat breeder sows and smaller litters of live born piglets, as well as a risk to health (e. g. injuries to claws or limbs) (Hoy et al. 2009a). It is also harder to identify abortions in the group pen. These problems are caused both by the direct contact between the animals and by the fights for dominance once the group is formed (Borberg 2008, Borberg and Hoy 2009, Hoy et al. 2009b). The inevitable fights between sows should take place in places, at times and in conditions that avoid injury to the sows or their embryos (Hoy 2006, 2011). In the first few days after fertilization the eggs move down the Fallopian tubes to the womb and are relatively well protected. During the second and third week of pregnancy, the embryos are still in the lumen of the uterus and only start to attach themselves to the uterus wall later on. This is a very vulnerable time. Fights for dominance in the first two to four weeks of pregnancy can result in the death of more than 20–30% of embryos and can even result in the loss of a pregnancy followed by repeat breeding (Schnurrbusch and Hühn 1994). With good management, however, this can and should be avoided. Many farm managers demonstrate that it is in principle possible to achieve very high performance with pregnant sows kept in groups.

The best time to form a group is immediately after the piglets have been weaned. The sows are not pregnant, so fights for dominance cannot harm the pregnancy. Another option is at the beginning of the fifth week of pregnancy – the time required throughout the EU. The embryos are already attached to the uterus wall by this point, and fights for dominance on group formation should not impact dramatically on eggs or sows. Starting group housing at a later stage would be even more beneficial in terms of this aspect, but this has been banned since 1 January 2013. Grouping sows immediately after insemination and after the abating of heat symptoms should only be considered if the sows had already been grouped beforehand (after weaning) and therefore already know each other. Otherwise the fights for dominance that would occur at this point could cause harm to the pregnancy. The least favourable time for grouping is in the second to third week of pregnancy.

Curtis et al. (2009) undertook a general comparison of group and individual housing of pregnant sows focusing on the aspects of behaviour, feeding, reproduction and health along with vari-

ous other factors, based on a comprehensive literature analysis. The authors quoted McGlone et al. (2004), who performed a meta-analysis of ten scientific studies and concluded that sows kept individually achieved higher or equivalent performance to sows kept in groups. However, Curtis et al. (2009) also pointed out that the results in the literature are not consistent and depend to a large degree on housing and management factors (e. g. Schmidt et al. 1985, Lynch et al. 2000, Lammers et al. 2004, McGlone et al. 2004, Estienne et al. 2006, Karlen et al. 2007, van Wettere et al. 2008, Spoolder et al. 2009, Bierman and Kohler 2009, Hoofs and Schulte 2010), although they underlined that the most critical period in terms of embryonic mortality and therefore fertility was the first month after insemination.

There is very little scientific analysis available on the influence of the start of group housing on fertility performance. Cassar et al. (2008) compared sows kept in groups that were 2, 7, 14, 21 or 28 days pregnant when their groups were formed with sows kept individually. The results clearly showed that the farrowing rate among sows put into group housing 2, 7 or 14 days after insemination was much lower (72.3 to 77.5 %) than among sows grouped in their 3rd or 4th week of pregnancy or among sows kept individually (82 to 83.2 %). In addition, the litter size of sows put into group housing when between 2 and 7 days pregnant fell by 0.2 to 0.6 piglets/litter (table 1). When the farrowing index was calculated (farrowing rate times litter size = total number or number of live born piglets per 100 sows served – Hoy 2008), significant differences were revealed between the variants tested. The lowest number of piglets born per 100 inseminated sows was produced by sows placed into group housing between the 2nd and 14th day of pregnancy (839 to 853 total births/100 sows served). There was no difference between sows kept individually and sows put into group housing from the 4th week of pregnancy onwards (or from the 21st day of pregnancy). These sows achieved around 100 total born piglets per 100 sows served, or 1 piglet per sow, more than the comparison sows placed into group housing at an early stage.



**Table 1:** Farrowing rate, average litter size (+ standard deviation) and farrowing index (own calculation) of sows kept individually (control) or in groups starting at different stages of pregnancy (Cassar et al. 2008)

No. of days after insemination when group housing started	Number of sows	Farrowing rate (%)	Litter size – total number of piglets born	Litter size – number of live born piglets	Farrowing index <sup>1</sup>
2	98	77.5	11.0 ± 0.4	10.2 ± 0.4	853
7	97	75.3	11.2 ± 0.4	10.3 ± 0.4	843
14	101	72.3	11.6 ± 0.4	10.7 ± 0.3	839
21	101	83.2	11.4 ± 0.4	10.4 ± 0.3	949
28	98	82.6	11.5 ± 0.3	10.6 ± 0.3	950
Control – individually housed	122	82.0	11.6 ± 0.3	10.6 ± 0.3	951

<sup>1</sup> Farrowing index = total number of piglets born per 100 sows served (farrowing rate times litter size of total born piglets) – own calculation and added into table

In the Netherlands (Sterksel), studies have been conducted on static and dynamic groups, with sows being introduced into the dynamic group at three different times:

time I: Introduction into group one week after insemination,  
time II: introduction into group two weeks after insemination,  
time III: introduction into group four weeks after insemination (table 2).

**Table 2:** Repeat breeding and pregnancy rates in sows in static groups or introduced into a dynamic group at different times (anonymous 2004)

	Total repeat breeder sows (%)	Regular repeat breeder sows (%)	Irregular repeat breeder sows (%)	Pregnant after 1st insemination (%)
Static group	9.3	4.2	5.1	87.7
Dynamic group, time I	9.6	7.3	2.3	89.8
Dynamic group, time II	11.4	3.6	7.8	86.5
Dynamic group, time III	8.4	3.5	4.9	90.7

The sows in the dynamic groups displayed more skin injuries and had more claw problems than animals in static groups. Sows in dynamic group III (introduced four weeks after insemination) showed the lowest repeat breeder rate and the highest pregnancy rate and achieved an average litter size of 11.8 live born piglets (anonymous 2004). The highest repeat breeder rate and lowest pregnancy rate were achieved by sows that were introduced into the group two weeks after insemination (litter size 11.76).

Levis (2006) reports on the impact of different grouping times in comparison with individual housing on the farrowing index (live born piglets per 100 sows served – table 3). The results show that group formation before the 7th day of pregnancy has a marked detrimental impact on fertility performance compared with individual housing and grouping at a later stage. Group formation after the 35th day of pregnancy achieves the same or even better fertility results than those of sows housed individually.

**Table 3:** Impact of group formation time in comparison with sows kept individually on the farrowing index (number of live born piglets per 100 sows served) – after Gonyou 2004 (cited in Levis 2006)

	Group formation < 7 d after insemination			Group formation > 35 d after insemination	
	Individual housing	Static group	Dynamic group	Static group	Dynamic group
Gilts	763	666	678	734	763
Sows after 1st litter	894	891	855	965	914
Sows after 2nd litter	973	906	958	929	1,020
Older sows	951	910	884	995	995

Levis (2007) also cites data from 71 farms in northern Italy with individual or group housing or various combinations of the two. The largest number of piglets weaned per sow per year was achieved with sows kept constantly in individual housing during insemination and pregnancy. The worst results were observed in sows kept in individual crates during insemination and grouped between the 14th and 28th day of pregnancy.

A report by the Scientific Veterinary Committee entitled “The welfare of intensively kept pigs” (anonymous 1997) refers to various studies on the impact of the start of group housing on reproduction parameters. For example, Brake and Bressers (1990) showed that starting group housing around 10 days after insemination led to a higher repeat breeder sow rate and a smaller litter size than starting after the 10th or 31st day of pregnancy.

There are no known scientific comparative studies on the health of sows kept in groups or individually, despite the fact that there seems to be a higher risk of inter-animal infection in group housing than in sows kept individually (Curtis et al. 2009, Hoy 2011). Sows kept in groups during early pregnancy have a higher incidence of lesions, more frequent repeat breeding and a higher cortisol concentration, whereas sows kept individually suffer more lameness in late pregnancy (Salak-Johnson and Curtis 2007).

## **5. Sow group formation**

### **5.1 Group formation in practice**

All group housing starts with the formation of groups. The differences lie in practice in the time when the group is formed, the type of group formed, the size of group and whether the farm works with dynamic or static groups.

#### **Time of group formation**

Besides being kept in groups continuously (family pens), sows are also kept in a social context (group) after being kept in confinement in the farrowing and insemination crates. A distinction is drawn between groups formed before and after weaning and those formed before and after insemination.

Group formation during the suckling phase is an exception as this procedure is very labour- and capital-intensive. In this procedure, several sows and their litters are housed together for about two weeks after farrowing. Wild boar also return to the group between one and three weeks after farrowing, so fights for dominance can take place before the sows become pregnant again. However, the stress of being moved can cause some sows to come into heat during lactation. These sows will cause problems after weaning as they will no longer fit in with the group cycle. Furthermore, group suckling has other negative aspects, including cross-suckling of individual piglets, greater separation of piglets, the amount of labour involved (more intensive inspection and servicing work, additional rehousing and cleaning) and the large amount of space required. From the point of view of breeding, the rearing performance of sows housed in groups with piglets is harder to assess if some piglets are suckling on different sows (multi-suckling).

In practice, group formation after weaning is the usual method. In this instance, a distinction is drawn between group formation immediately after weaning and group formation during pregnancy. The aim should be to allow fights for dominance to take place at a time and in a manner that poses the least risk to the sow and her foetuses. Group formation during the critical period in the second and third week of pregnancy should be avoided at all costs. The group should be mixed before or after this time (table 4).

As a rule, sows are transferred straight to individual insemination crates in the insemination area after weaning, where they usually remain until at least the 28th day of pregnancy. After the fourth week of pregnancy they are either introduced into an existing group (dynamic group) or form a new, separate group (static group). As the TierSchNutzV requires sows to be housed in groups from the fifth week after insemination (see above), later times for group formation cannot be considered.

**Table 4:** When should sows be grouped?

Suckling phase from 2nd week of piglet life	(+)
after weaning	++
1st week of pregnancy	+
2nd and 3rd week of pregnancy	–
after 4th week of pregnancy	+

+ = more favourable      – = less favourable

It has proven worthwhile to form later small groups (during pregnancy) of about 8–16 sows in a special pen (stimulation pen) or “arena” pen (see below) immediately after weaning. Any aggressive behaviour then takes place at a time when the sows are not pregnant or lactating. The group hierarchy will be established within 48 hours at most, after which the sows can be moved to individual crates for insemination. The hierarchy will remain static if the sows are subsequently re-grouped in the original configuration, either in the first week of pregnancy or, at the latest, from the fifth week onwards. On account of the higher risk of injury from mutual mounting or avoidance behaviour while in heat, sows should be kept individually during heat and insemination.

### Where to form the group

Groups are in practice usually formed in the dry sow area, although the conditions there are not always ideal. The amount of space available, the structure and the layout of dry sow pens are not specifically designed for this purpose. Subordinate pigs in particular have problems in a suboptimal group pen, which can lead to a drop in performance. Group formation for small groups should take place in an open pen designed specifically for this purpose (see “Stimulation pen” and “Arena pen” below).

### Dynamic or static groups

Whether a farmer chooses to work with dynamic or static groups depends mainly on the herd size and the feeding system in the dry sow area. If the sows in the dry sow area are fed from demand feeding stations, the farmer will usually opt for a dynamic group so as to utilize the feeding system to the full. If static groups are the preferred option in this situation, very large herds and/or weaning rhythms over several weeks will be required. For example, the herd size for a three-week rhythm with a demand feeding station is 420 sows (7 weekly groups times 60 sows). Both static and dynamic groups can also be achieved with a mash nozzle, self-catching feeding crates and, to a certain extent, with a liquid feeding system, although small static groups are preferred for technical reasons. The use of dynamic groups with these feeding systems makes sows difficult to sort as these systems do not have an automatic sorting gate. The mash nozzle can be fitted with a device to mark the sows a particular colour. Static groups are therefore the norm with dribble feeding systems, quick feeders and self-catching feeding crates.

In dynamic groups, sows approaching their due date are removed from the group and moved to the farrowing house at set intervals, with their places in the group being taken by sows in the early stages of pregnancy. The advantage of dynamic groups is that the feeding technology should

be well utilized, even in smaller herds. On the other hand, the group is disrupted every time a sow is introduced or removed, as dominance has to be re-established each time. If a herd of 420 sows (see above) is managed in a weekly rhythm, 21 sows approaching their due date must be removed from the dynamic group and 21 sows scanned and confirmed as pregnant must be introduced every week. It takes at least a week for the social hierarchy in the new group to stabilize, by which time the next change will be taking place.

In static groups, sows at the same stage of pregnancy are grouped in a pen and stay there until they farrow. This creates a static hierarchy throughout the pregnancy and also makes the group easier to manage since all the sows in the pen are at the same stage of pregnancy. Another option is to form body condition groups. Depending on the feeding technology, however, larger herds may be needed to make the best use of the equipment. In addition, spare places should be kept available for varying group sizes (caused by repeat breeder syndrome, losses etc.). The advantages and disadvantages of static and dynamic groups are summarized in table 5.

### **Group size**

The stress on the sows on introduction into existing or new groups depends primarily on the size of the group. The larger the group, the easier it is for new animals to assimilate: introduced sows find it easier to “disappear” into a larger group. Sows are able to recognize each other individually in groups of up to around 20 animals. In larger groups they can easily lose track of the hierarchy and can no longer decide whether a sow belongs to the group or not. The smaller the group, the more sensible it is not to allow the group to meet for the first time in the pregnancy pen as there is too little space for subordinate sows to retreat or avoid other sows. Effects on pregnancy and sow health (especially limbs) cannot be ruled out. With a group of less than 12 animals, it is always a good idea to form the group in a pen earmarked for this purpose, such as a stimulation or “arena” pen (see below).

**Table 5:** Advantages and disadvantages of static and dynamic groups

Advantages	Disadvantages
<b>Dynamic group</b>	
Feeding technology well utilized (even in smaller herds)	Anxiety in the group when a sow is introduced or removed
	Hierarchy has to be fought over every time
	Different stages of pregnancy
	Harder to select sows (not applicable with demand feeding station)
<b>Static group</b>	
Formation of body condition groups	Depending on the feeding technology, a larger herd may be needed to fully utilize the technology
Good overview	Pen structured less efficiently with small groups
Static hierarchy throughout pregnancy	Spare places needed for varying group sizes
Identical pregnancy status	

### Handling problem animals

Sows should never be introduced into a group individually but always in groups. Experience shows that sows introduced together stay together in the larger group later on. They will often seek out the feeding station together and rest close together. During the first few days after introduction, the “new” sows will nearly always lie with other “new” sows and the “old” sows will keep company with other “old” ones. It takes at least three weeks for sows to mix properly and become fully integrated. It is therefore advisable to match the width of the lying area to the size of the group (0.5 x 2 m per sow).

If introduced animals display highly aggressive behaviour, it is important to wait until the fighting phase has ceased before taking action. If there is no sign of the fighting abating even after several hours or days, the aggressive sows should be removed from the pen in order to protect the other animals. For this reason, it is advisable to keep spare places available in all forms of group housing (with regard to crate places in the dry sow area and depending on the housing process). Aggressive, sick or incompatible sows can be kept here, either until the end of the pregnancy (in accordance with the veterinarian’s instructions), or alternatively a new attempt can be made to integrate these sows into the group at one of the next moving dates.

In order to be able to replace aggressive sows and animals removed from the group for health reasons, it is important to have a sufficient supply of gilts available at all times. The most reliable way is to pre-order regularly, for example by way of annual purchase contracts. The restocking rate on a farm should be between 30 and 35 %. With an average herd performance of six litters, roughly every sixth sow will leave the group after weaning and will be replaced by a gilt.

### **Integrating gilts**

When integrating gilts, it is important to allow an adequate settling-in phase to begin with. During this time, which usually lasts for around six weeks, the sow will be introduced to the germ spectrum on the farm with the aim of fully immunizing her well before her first insemination. Gilts spend the first 14 days after delivery in an isolation house. This phase serves to protect the farm from any pathogens the animals may have brought with them. All contact with the existing herd must be avoided during this time. They should not be housed with slaughter sows that could bring the gilts into contact with farm-specific germs until after this period. It is important for the pig keeper to regularly spend time with the animals in the isolation house during the settling-in phase in order to build up a good relationship between man and animal.

The gilts are moved to the insemination area from week 6 onwards. They will be inseminated for the first time during their second heat, once they are at least 240 days old and weigh at least 130 kg. After insemination the animals are returned to a gilt group. It is considered good practice not to integrate gilts into an existing sow group until they have had their first litter, since the animals are much larger by then and can stand up to the older sows more easily. This phase is also an opportunity for the gilts to familiarize themselves thoroughly with the feeding process.

A gilt group using a demand feeding system will ideally have their own feeding station to learn from during the first week, and in smaller herds there should be at least one separate pen available for the gilts.

After the settling-in phase, the gilts can be integrated into the larger group. Where dribble feeding, self-catching feeding crates and quick feeder systems are used, sows are kept in body condition groups so that gilts can automatically form their own group or encounter other sows at the same stage of development. The sows in this group will remain there during the whole of their pregnancy.

## **5.2 Group formation in “arena” pen**

The “arena” pen (fig. 1) is a special free movement pen for housing new sow groups together. Its name comes from the fact that it offers an arena where fighting for dominance can take place. The sows are placed in the “arena” pen immediately after weaning and stay there for at least two days, after which time a stable hierarchy will have formed which the group will abide by during their pregnancy.

To ensure that the grouping proceeds as peacefully as possible and without serious injuries, every sow must have a space allocation of around 5–6 m<sup>2</sup>. This gives subordinate sows the opportunity to stay away from higher-ranking sows or to retreat after losing a fight. An arena pen should be optimally structured. It should be as rectangular as possible and have sides of at least 10–14 m in length so as to offer subordinate sows plenty of space within which to retreat. The width of the pen depends on the number of sows in the group.

Panels can be installed at a distance of at least 2 m from the pen wall to offer subordinate sows somewhere to hide from dominant animals.

The side panels, measuring at least 2.2 m in length by 1.2 m in height, should be simple board panels anchored into the ground with metal posts.

The floor design in the “arena” pen is of particular importance and should be such that the sows do not injure themselves when fighting. A dry, non-slip surface improves stability. For hy-



**Figure 1:** Example of an outdoor “arena” pen (© J. Bauer)

giene reasons (risk of endoparasites) there should be no grass, sand or bare earth surfaces in the pen. With solid floors, the concrete or screed should not be completely smooth but slightly rough to avoid slipping. Sawdust or straw can be strewn as litter. If a slatted floor is used, the concrete should be of high quality with the edges of the slats finished to a high standard. Any burrs should be removed mechanically. The openings should not exceed 17 mm in width.

Providing materials for rooting is not a particularly successful method of reducing fights for dominance, since the attractiveness of the materials (earth, sand, straw etc.) soon diminishes and fights for dominance continue anyway. In addition, these materials are regarded as a hygiene risk. However, suitable enrichment toys and manipulable materials should be provided in this area of the housing as well.

Because of the large amount of space needed, an indoor version of the “arena” pen would be very costly (for example, a group of 30 weaned sows would need around 180 m<sup>2</sup> of space). For this reason, more cost-effective accommodation is often used, such as a solid-surface outdoor area between two buildings or an old clamp, enclosed with stable fences around the top ends. Outdoor conditions also have a positive impact on heat stimulation. If sows are left outdoors for the entire two days, insulated lying areas must be provided. Of the 6 m<sup>2</sup> space allocation per sow, at least 1 m<sup>2</sup> should be roofed. It is not necessary to provide a larger area since the risk of manure build-up rises if the sows do not leave the lying area to defecate. Camouflage nets or old terrace awnings are suitable for use as sun protection. To avoid introducing salmonella, a bird net should be used to prevent migratory birds from entering and soiling the arena. Wallowing pools should not be provided for hygiene reasons (table 6).

The outdoor climate conditions can have a detrimental impact on disease prevention measures and on cleaning and disinfection of the pen. Effective disinfection is particularly difficult in frosty conditions. The German “Pig Keeping Hygienic Requirements Ordinance” prohibits the keeping of pigs outdoors in areas at risk of swine fever.

During these two days, pigs can be fed using simple dry feeding systems or, where the pen floor is solid, with ground feeding. During this time only, feed should be provided ad libitum so that the sows do not lose too much body substance. Where automatic feeding systems are used,

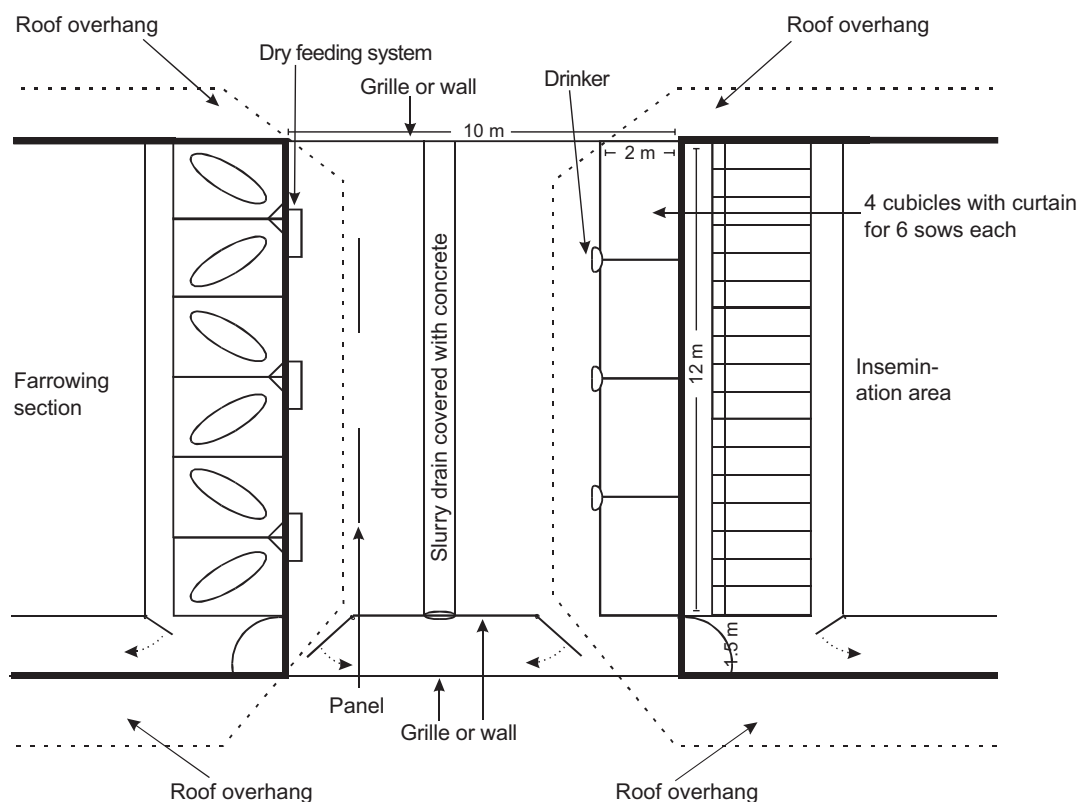


more than one feeding point should be provided per group in order to reduce aggression in the feeding area.

Feeding crates should not be used in “arena” pens since these can cause dead ends in which subordinate sows can be cornered. In addition, it should be ensured that there are no items of equipment protruding into the pen, as these could cause injury. Drinking nipples should be recessed into the wall so that they do not project. Drinking systems should furthermore be frost-proof.

**Table 6:** Advantages and disadvantages of the “arena” pen

Advantages	Disadvantages
Low-stress group formation	Disease prevention
Intensive movement, light, air – heat stimulation	Salmonella prevention
No places for turnover group needed	Large area of space needed for indoor pen



**Diagram 1:** “Arena” pen for 20 sows

### 5.3 Group formation in stimulation pen

An indoor method of group formation is the stimulation pen (fig. 2).



**Figure 2:** Example of a stimulation pen (© St. Hoy)

Providing space of approximately 3 m<sup>2</sup> per animal ensures that the inevitable fights for dominance take place as soon as possible after grouping. As the sows are placed in the stimulation pen immediately after weaning, they are neither lactating nor pregnant when the fights take place. An area of less than 3 m<sup>2</sup> per sow should be avoided, since subordinate sows in particular tend to suffer fertility problems and loss of performance in this situation (longer interval between weaning and insemination, higher incidence of repeat breeding).

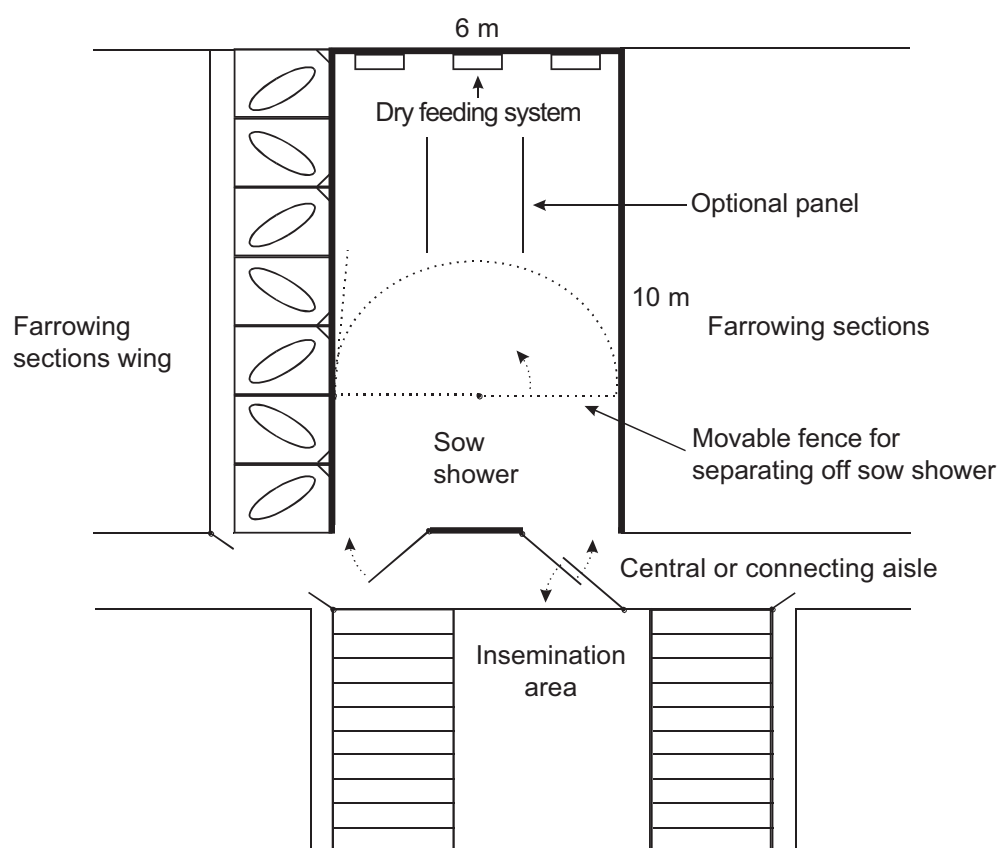
Because of the relatively small space required per sow, it is useful and cost-effective to set up stimulation pens inside the house. The stimulation pen should ideally be located close to the farrowing pen and the insemination area so that the sows can be moved in a group and labour costs are kept to a minimum. For optimum space utilization, the sow shower and the stimulation pen can be positioned after one another in the same room.

A combination of self-catching insemination crates (see 6.2) and a stimulation pen is a cost-effective solution. The access area behind the sows secured in self-catching insemination crates can be used as a stimulation pen for the weaned sows, obviating the need for space for the turnover group (see "Practical examples").

The floor in the stimulation pen should either be solid and covered with straw or slatted ( $\leq 17$  mm openings). The animals are fed via wall-mounted dry feeding systems. A round system placed in the centre of the pen should be avoided as this constricts escape routes. During their short stay in the stimulation pen sows are fed ad libitum and can see and make snout contact with the boar. This part of the house can be designed as either a warm or cold section. If possible, larger groups should be formed ( $> 8$  sows per group) so that the sows have proportionately more space available. Adding panels to the pen structure has no effect in comparatively small pens and is not recommended (table 7).

**Table 7:** Advantages and disadvantages of the stimulation pen

Advantages	Disadvantages
Relatively little space needed (approx. 3 m <sup>2</sup> per sow) – so suitable for indoor use	Additional turnover in sow group – can be avoided with good planning
No space needed for turnover group when combined with self-catching insemination crates	
Combination of stimulation pen and sow shower saves space	



**Diagram 2:** Stimulation pen for 20-sow group (combined with sow shower)

## 6. Practical examples

### 6.1 Dynamic group

#### 5 weeks in insemination area

Large group

Demand feeding station

Once a week, e.g. on Thursdays, approximately 18 sows are weaned. These sows are housed in the insemination area. With normal selection rates, 2–3 of the 18 weaned sows usually drop out of the production process.



**Figure 3:** Separate boar aisle in insemination crates  
(© St. Hoy)



**Figure 4:** Gilt at integrated learning station in dry sow area (© St. Hoy)

The insemination area is an area of the house in which sows are housed from weaning until they pass the pregnancy test on the 28th day after insemination. The sows are housed in special insemination crates which allow for good stimulation by the boar but also effective heat checks and insemination. The rear ends of the crates are fitted with insemination gates which allow very easy access to the sows. At the head end there is a boar aisle with the facility to secure the boar in front of 4–5 sows at a time (fig. 3).

There is an aisle of 1.8–2.2 m in width behind the sow crates.

To encourage heat onset, the sows are put in an “arena” pen outside the house, or alternatively the passageway behind the crates can be used as a stimulation pen in which the weaned sows perform their fights for dominance during the first two days after weaning. The sows are secured in the insemination crates before the first symptoms of heat appear and are then inseminated. The sows remain secured in the insemination crates until about the 28th day of pregnancy. The time between weaning and moving to the dry sow area is therefore approximately five weeks. Thereafter, sows with a confirmed pregnancy are moved to the dry sow area every Wednesday or Thursday, after five weeks in the insemination area.

The sow group is moved to the dry sow area as a closed group at the beginning of the fifth week of pregnancy. This avoids individual sows being introduced into the larger group. Gilts are not introduced into a group of older sows until they have produced their first litter. They learn how to use the demand feeding system in a gilt group at a separate station. Gilts are accommodated in a separate pen in the dry sow area where they can familiarize themselves with the demand feeding station (fig. 4).

The herd of older sows is managed as a large group, with a weekly cycle of early-stage pregnant sows from the insemination area being introduced into the dry sow area and sows approaching their due date being selected for transfer to the farrowing area. To support this work, demand feeding stations are equipped with marking and selection devices. The selection devices close at the front end of the stations. The selection pens are separated off with hinged fences to enable the size of the pens to be varied.

The large pen should offer between 2.05 and 2.25 m<sup>2</sup> space per sow. The house is structured with lying areas along the side walls which are subdivided into cubicles with closed walls. Spare pens are set aside for sick sows or sows that are unsuitable for introduction into groups.

## 6.2 Static group

### A Group formation after weaning

- Self-catching insemination crates/stimulation pen
- Self-catching insemination crates only closed during heat and insemination (toleration phase)
- Small group

Self-catching insemination crates (fig. 5) can be used to create a combined insemination area, dry sow area and stimulation pen with space for the turnover group.

The crates are equipped with a special rear wall designed as an insemination gate. In front of the sows' heads there is a boar aisle with the facility to secure the boar in front of 4–5 sows at a time. The separation fences in the pen can be rearranged to form group pens or stimulation pens as required. When the sows enter the self-catching insemination crates, they shut themselves in. All the crates can be reopened by operating a lever. It is also possible to secure individual sows while allowing the other animals in the group to move freely, or vice versa. Easy access to the sows should be provided, making sure the self-catching mechanism is not obstructed. However, the original intention of keeping sows in groups throughout the process is not always realized. Low-ranking sows are particularly prone to seeking out the self-catching feeding crates and staying there. Experience shows that up to 30% of animals remain in the crates.

During the first two days after weaning, the passageway behind the crates can be used as a stimulation pen (fig. 6).

Sows in the dry sow area remain locked in the self-catching insemination crates during this time. Weaned sows perform their fights for dominance there and remain there until the weaning area has been cleaned and disinfected and a group of sows nearing their due date have been introduced. This method avoids the need for space to be set aside in the house for a turnover group.

Drinking nipples (recessed into the wall to avoid injury) and dry feed dispensers (more than one per group) are provided at the top end of the passageways for an ad libitum supply of lactation feed. After sows nearing their due date have been moved from the dry sow area to the farrowing



**Figure 5:** Self-catching feeding crates in a combined insemination area and dry sow area  
(© W. Brede)



**Figure 6:** Self-catching feeding stalls with aisle used as a stimulation pen (© W. Brede)

house, the weaned group is assigned to the self-catching insemination crates on Friday. More than 90% of fights for dominance will have been completed by then, minimizing the risk of subordinate pigs retreating into the dead-ends in individual crates. If the first sows in the group are displaying heat symptoms, the back walls of the self-catching crates are closed (from approximately Sunday onwards). The sows are secured in the insemination crates from Monday to Thursday and are inseminated there. Once the last heat symptoms have abated, the rear walls of the insemination crates are opened and the sows can return to their old group configuration. After the brief separation period the sows will still know each other and accept the hierarchy established after weaning. Once the sows have been inseminated, body condition groups can be formed which can be fed in accordance with their individual requirements. Sows can be split into two groups, for example: group 1 consisting of sows producing their second or third litter and older sows that are less productive, and older sows in good condition being placed in the other group. Gilts should always form a separate group and should not be housed together with older sows.

The sows remain in the self-catching system until one week before farrowing, or are moved to group pens with a different feeding system after confirmation of pregnancy. Self-catching feeding crates can be narrower than insemination crates as they are not designed for long-term accommodation of sows.

Any sows remaining (where there are more than 24 older sows per group) or repeat breeder sows are kept in separate small group pens or in multi-week dynamic groups along with any remaining sows from other week groups.

## **B Group formation after individual housing in insemination area for five weeks**

- Stimulation pen
- Small group

Cycle	Suckling time	Groups	Group size	Productive sows	Farrowing groups	Insemination groups	Dry sow groups
3-weekly	4 weeks	7*	36	252	2	2	3

\* Turnover group in stimulation pen

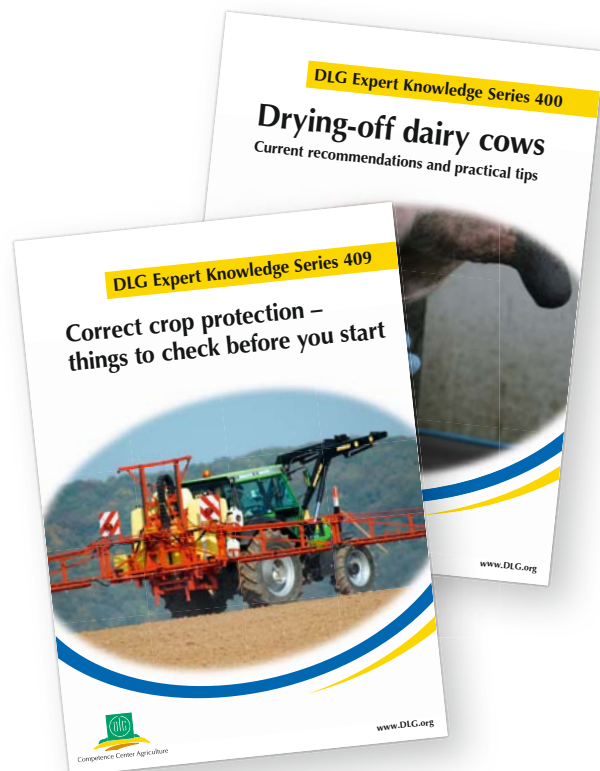
In a three-weekly weaning cycle, in our example approx. 36 sows are weaned and moved straight into individual insemination crates in the insemination area (4–5 sows leave the production process). After insemination and a pregnancy test the sows remain in the insemination crates in accordance with EU regulations up to their fifth week of pregnancy. The pregnant sows are then moved to the stimulation pen along with repeat breeder sows from the previous group. Repeat breeder sows can be added to this group as the group hierarchy has not yet been established and they can mix in easily with the next group due to their position in the cycle. The stimulation pen should ideally be located right next to the insemination area so as to avoid additional labour costs while moving the animals. If a dry sow area with at least 3 m<sup>2</sup>/sow is available, there is no need for a separate pen for settling in and the sows can be grouped directly in the dry sow area. The fights for dominance then take place at a time when the sows are pregnant but have already passed the

critical phase (nidation, day 13–21 of pregnancy). Performance depression is unlikely to occur even in low-ranking sows since fights for dominance take place in a structured pen with 3 m<sup>2</sup> per sow. After two days the hierarchy in the group has been established and the sows can be moved to the dry sow area, split into two or three body condition groups (e.g. 2 x 16 or 3 x 11 animals). The sows stay in the group until approx. one week before farrowing.

The bibliography is available from the authors on request.

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