Housing Sows in Groups

Transitioning to group housing for gestating sows: what you need to know!

ATELIER SUR LES TRUIES EN GROUPE

Training Manual

CDPQ Centre de développement du porc du Québec inc.

Les Éleveurs de porcs du Québec

Québec

©Centre de développement du porc du Québec inc.
Legal deposit 2015
Bibliothèque et Archives nationales du Québec
Library and Archives Canada
ISBN 978-2-924413-16-6

Production team

Senior Manager Sébastien Turcotte, agr., CDPQ

Project Manager Marie-Aude Ricard, ing., CDPQ

Contributors Yannick Ramonet, Chambres d'agriculture de Bretagne

Valérie Courboulay, IFIP – Institut du porc

Jennifer Brown, Prairie Swine Centre

Lisbeth Ulrich Hensen, Pig Research Centre

Editing Sébastien Turcotte, CDPQ

Marie-Aude Ricard, CDPQ

Marie-Claude Gariépy, CDPQ

Acknowledgements

This course has been produced with financial assistance from the *Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec* provided under the *Programme d'appui financier aux regroupements et aux associations de producers désignés*, from *Les Éleveurs de porcs du Québec* and from the *Centre de développement du porc du Québec inc*.

Québec

Les Éleveurs de porcs du Québec

CDPQ Centre de développement du porc du Québec inc.

Table of Contents

List of Tables

List of Figures

1. Introduction

The new **Code of Practice for the Care and Handling of Pigs**[a]**,** which was formally approved on March 6, 2014, requires that Canadian producers house their gestating sows in groups. This requirement came into effect on July 1, 2014 for all cases of major renovations or construction.[1] Effective July 1, 2024, bred sows must be group-housed in individual pens or left in stalls, provided they are able to turn around or exercise periodically. Appropriate forms of exercise will be detailed by July 1, 2019.[1]

In addition, the market has been attempting to impose its own rules. Olymel and Aliments Asta, two Quebec slaughterhouses, have announced that as of 2022, they intend to purchase pigs from sows bred in groups. Their announcements are in reaction to the Retail Council of Canada's decision to purchase only pork that originates from housing other than gestation stalls, effective in 2022. Both these Quebec abattoirs sell to businesses that belong to the Retail Council, including Wal-Mart Canada, Costco Canada, Metro, Loblaws, Safeway Canada, Federated Co-operatives, Sobeys and Atlantic Co-op. These retailers account for approximately 90% of the Canadian retail market.

It would be difficult to adapt existing buildings to handle grouped sows without major renovations. One project carried out in 2012 by the *Centre de développement du porc du Québec* [Quebec Centre for Swine Improvement] (CDPQ),[2] revealed that major investments ($820 to $1,155/productive sow) can be expected when existing nursery buildings are converted as part of a major renovation.

More recently, in 2014, the CDPQ[3] documented actual cases where buildings were converted to allow gestating sows to be handled in a group-housed setting. That study showed that most of the producers who made the transition took the opportunity to restructure their businesses. The most frequently encountered types of restructuring were as follows:

- Farrow-to-finish sites converted to farrowing houses only: with this type of transformation, a finishing site becomes a group managed gestation unit, the nursery becomes a farrowing area and the gestation stall unit then becomes the breeding area;
- Farrowing-nursery sites converted to farrowing houses only: the nursery then becomes a pen gestation unit and farrowing area. This allows for approximately 25% to 35% more productive sows per site;
- Finishing sites converted to farrowing houses only: the finishing area then becomes a group managed gestation area and a new building housing the breeding area and farrowing rooms is then built;
- Farrowing houses that increase inventories of productive sows by 140%: this type of restructuring eliminates the need to renovate the existing building and allows a new one to be built, housing a group-managed gestation area and new farrowing rooms. With this type of transition, the building's entire gestation stall section then becomes the breeding area for the new herd;

[a] For purposes of brevity, the title *Code of Practice for the Care and Handling of Pigs* will be referred to as "the Code." The complete reference can be found under 1. NFACC, 2014 at the end of this document.

- Gestation sections with stalls converted to house gestating sows in groups: two scenarios were observed, involving either retaining the same number of productive sows or increasing the inventory. In some situations, it then becomes possible to group-house the same number of sows as there was when they were kept in stalls. Here are the concerned situations: use of a feeding system where there is no competition for feed and/or on a farm with a sufficient number of stalls to allow proper movement of the animals (with respect to the Code and the Canadian animal welfare standards (ACA).

A number of other observations emerged from this study. The change from the use of gestation stalls to housing sows in groups is often accompanied by various other changes, such as:

- A change in husbandry practices. This is seen mainly in the case of smaller herds. In order to be able to properly house sows in groups, producers normally move from weekly batches to every two or every four weeks. This gives them batches with increased numbers of sows, making it easier to form homogeneous groups or achieve a sufficient number of sows to optimize the use of certain machinery;
- Increasingly, the health of their herds is becoming producers' number one priority. As a result, sites that make changes to handle gestating sows in groups are usually well located geographically, and most of the time in areas with a lower porcine density;
- Changes in suppliers of feed and genetics;
- Farm equipment is updated to remain at the leading edge of the technology, thereby improving the performance and profitability of the business.

Costs from the eight farms that were part of the study are shown in Table 1. It is important to note that the costs shown below are the actual costs for the eight farms visited. Costs may vary, however, because each farm and each conversion project is unique and costs will vary based on the feeding system used and the types of changes made to the buildings (renovations or new construction). In cases that involved renovations, the labour costs are not included because they varied greatly from one farm to another, depending on whether the work was done by farm staff or by outside specialists.

Table 1 **Conversion costs to house sows in groups using the preferred feeding system (includes only those costs related to housing sows in groups)**

	Floor Feeding	Shoulder Stalls	ESF	Free-access ESF
	$/space - gestation in groups (labour not included)			
Farm #1 (renovation)	$58	$266	$532	$147
Farm #2 (renovation)	$30	$134		$286
Farm #2 (new construction)			$1,815*	

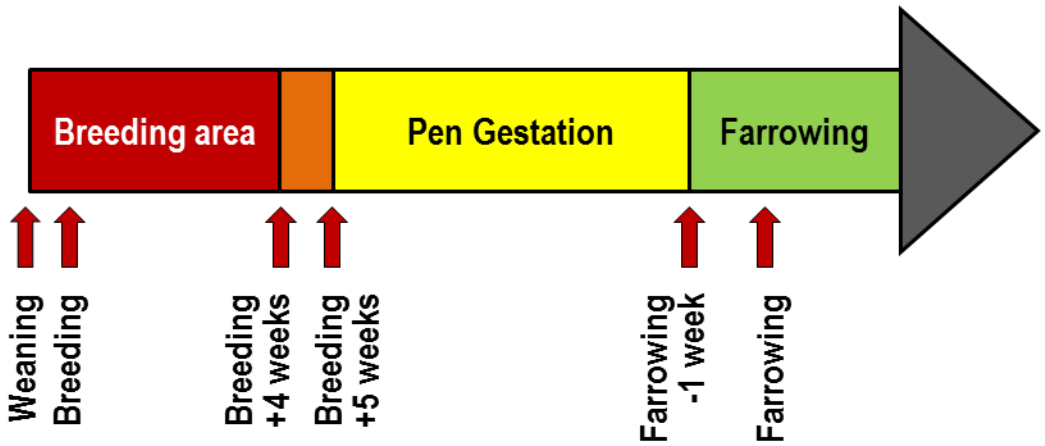
***** Costs based on 1,400 additional producing sows added to the herd, plus labour costs
Source: CDPQ, 2014.[3]

2. Animal welfare standards

2.1 Canadian standards: "Code of Practice for the Care and Handling of Pigs"

2.1.1 Pen gestation

The new Code requires that in "... *all holdings newly built or rebuilt or brought into use for the first time after July 1, 2014, mated gilts and sows must be housed in groups. Individual stalls may be used for up to 28 days after the date of last breeding and an additional period of up to 7 days is permitted to manage grouping. Time in stalls can only be extended to protect the welfare of individual sows on the advice of a competent stockperson.*" Subsequently, gestating sows must be housed in groups until approximately one week prior to farrowing. The location of sows in the farrowing house, based on requirements in the Code, is shown in Figure 1.



Source: Adapted from Code of Practice[1]

Figure 1 **Timeline showing the location of sows in farrowing area**

The Code also states that:

As of July 1, 2024, mated gilts and sows must be housed:

- in groups;* or
- in individual pens; or
- in stalls, if they are provided with the opportunity to turn around or exercise periodically, or other means that allow greater freedom of movement. Suitable options will be clarified by the participating stakeholders by July 1, 2019, as informed by scientific evidence.

* If sows are group-housed, individual stalls may be used for up to 28 days after the date of last breeding, and an additional period of up to 7 days is permitted to manage grouping.

During the period that the gestating sows are group-housed, the Code recommends minimum floor-space allowances based on the type of group and the type of barn floor (Table 2).

Table 2 Minimum floor-space allowances recommended by the Code[1] for grouped sows

Group description	Partially Slatted Floor	Solid Bedded Floor
Gilts	15-18 ft^2 (1.4-1.7 m^2)	16-20 ft^2 (1.5-1.9 m^2)
Sows	19-24 ft^2 (1.8-2.2 m^2)	21-26 ft^2 (2-2.4 m^2)
Gilts and sows	18-23 ft^2 (1.7-2.1 m^2)	20-25 ft^2 (1.9-2.3 m^2)

It is strongly recommended that more floor space be allowed per animal in order to prevent aggressiveness among the sows in the group. This is particularly important in systems where there is competition for feed (floor feeding and shoulder stalls). Where there are free-access stalls, if they are on slatted floors, sows will spend most of their time lying down in the free-access stalls and are sheltered when feeding. The surface of the run or loafing area behind the stall can be reduced. ESF systems can require less space, and animals that are fed individually with these systems are protected while feeding. Also, large groups are often involved and, in this type of group, the amount of floor space needed per animal is reduced.

2.1.2 Breeding areas

The Code further requires that, as of July 1, 2014:

All new installations and replacements of existing individual stalls must be sized appropriately to allow sows to:

- stand up at rest in a stall without simultaneously touching both sides of the stall
- lie down without their udders protruding into adjacent stalls
- stand up without touching the top bars
- stand in a stall without simultaneously touching both ends of the stall.

Based on recommendations in the Code regarding the width of the stalls, which varies according to the weight of the sow, and using the normal distribution of parities in a herd where renewal is 45% to yield average sow genetics, the number of stalls for each width is shown in Table 3.

Table 3 Code requirements for minimum stall width in the breeding area based on sow weight and approximate proportion of the herd in each weight category

Minimum Stall Widths in Breeding Area			
Stall Width	**Sow Weight at Breeding**	**Proportion of Herd**	
		%	**Parity**
24 in. (0.61 m)	< 210 kg (< 463 lb.)	52	Gilt + P1+P2+P3
26 in. (0.66 m)	210-260 kg (463-573 lb.)	25	P4 + P5
28 in. (0.71 m)	> 260 kg (> 573 lb.)	23	P6 or over

Source: Adapted from Code[1]

2.1.3 Boars

"As of July 1, 2024, boars must be housed

- in individual pens; or
- in stalls, if they are provided with the opportunity to turn around or exercise periodically, or other means that allows greater freedom of movement."

This above requirement does not cause a problem for farmers, since boars are already housed in sufficiently large pens on most farms. Table 4 shows the minimum dimensions required for housing boars.

Table 4 Minimum space required for housing boars

Pens		
Floor type	**Minimum Dimensions of Pen**	
Fully or partially slatted	1.8 m x 3.1 m (5.6 m^2)	6 ft x 10 ft (60 ft^2)
Bedded	2.4 m x 3.1 m (7.4 m^2)	8 ft x 10 ft (80 ft^2)
Stalls		
Boar weight	**Minimum Dimensions of Stall**	
135 kg (300 lb.)	0.70 m x 2.13 m	28 ft x 7 ft
180 kg (400 lb.)	0.82 m x 2.29 m	32 in. x 7 ft, 6 in
≥ 225 kg (≥ 500 lb.)	0.91 m x 2.44 m	36 in. x 8 ft

Source: NFACC, 2014[1]

2.1.4 Farrowing

Standard farrowing stalls measuring 5 ft x 7 ft (1.52 m x 2.13 m) are adequate. However, the Code recommends that when undertaking renovations, plans should be made for adjustable-width farrowing stalls to allow for increased space for the sow after 5 to 10 days.

Further, whenever possible, as in the case of major renovations or new construction, allowance should be made for larger farrowing stalls (6 ft x 8 ft) (1.83 m x 2.44 m) in order to be able to adjust for current and future sow prolificity. Even if the stalls are larger, a different farrowing arrangement will make it possible to bring virtually the same number of stalls into the same floor area, but in order to achieve this it will be necessary to give up the passageway in front of the sows.

2.2 European standards for the group housing of gestating sows

In Europe, ACA standards have been mandatory since January 1, 2013. European standards are more strict and demanding than those in effect in Canada. However, they are recognized internationally and are often viewed as the standards to meet.

The European regulations (Directive 2008/120/CE) are enshrined in the law of each European state. Interpretations on certain points may differ, depending on the country involved. Some governments may zero in on certain parts based on a reading of the regulations or minor additions may be added to the directive, all of which may mean that the technical provisions do not end up identical in each European country.

Canada and Quebec export approximately 70% of what is produced here, and our slaughterhouses export to over 100 countries throughout the world. Because the European standards seem to be recognized world-wide, it is important to present them in order that producers are able to make enlightened choices, when considering renovations, in moving from a system of gestation stalls to housing sows in groups.

European regulations require that sows be group-housed from four weeks after breeding up until one week prior to farrowing. European regulations also require the following:

- Minimum total usable floor space for sows is determined according to the size of the group and the ages of the animals (Table 5);
- Minimum pen size must be 2.8 m (9 ft 2 in.), except where the group has fewer than six animals, in which case minimum size must be 2.4 m (7 ft 11 in.);
- Concrete slat specifications: a maximum of 15% open space may be allowed for the evacuation of droppings. In addition, the maximum width of the openings allowed is 20 mm (¾ in.) and the width of the solid portion must be a minimum of 80 mm (3 in.);
- Sows must have permanent access to manipulable matter and water;
- Sows must be given high-volume or high-fibre feed, as well as feed that has a high energy content;
- Any sows in a group that appear aggressive, have been attacked or are sick or injured must be housed temporarily in individual pens large enough for them to be able to easily turn around, except where a veterinarian advises otherwise.

Table 5 European minimum floor-space standards per sow, based on group size and ages of the animals[4]

Size of group	Gilts	Sows
Fewer than 6	1.81 m^2 (19.5 ft^2)	2.48 m^2 (26.7 ft^2)
6-39	1.64 m^2 (17.7 ft^2)	2.25 m^2 (24.2 ft^2)
40 or more	1.48 m^2 (15.9 ft^2)	2.03 m^2 (21.9 ft^2)

2.3 Grouped sows: percentage of Quebec herd

The CDPQ recently estimated the number of farms that currently house their gestating sows in groups (Table 6). Their study did not yield official statistics, but does give an idea of the number of sows that are being group-housed.

Data from electronic sow feeders (ESFs) and free-access stalls are much more accurate, because the producers would have had to purchase specialized equipment to house their sows when using these systems. That is not necessarily the case with shoulder stalls or floor feeding, because producers would have been able to make changes without having to purchase more equipment; this is due to the fact that these systems lend themselves well to the re-use of existing equipment in the stall-gestation area.

Table 6 Estimated number of farms in Québec that group-house gestating sows

	In Production 2010		In Production September 2013		In Production July 2014		Under Renovation or Construction		Short-term Estimate (max. 2 yrs.)	
Feeding System	No. of farms	No. of sows	No. farms	No. of sows	No. of farms	No. of sows	No. of farms	No. of sows	No. of farms	No. of sows
Floor*	18	9,500	20	10,700	23	12,750	1	800	n/a	n/a
Shoulder stall	4	4,900	6	6,450	9	8,300	2	2,100	5	2,400
ESFs	1	600	3	5,400	6	9,450	0	0	2**	2,400
Free-access stalls	0	0	0	0	0	0	5	8,800	13**	15,460
Self-locking free-access stalls	0	0	0	0	0	0			1	1,200
Cumulative total	23	15,000	29	22,550	38	30,500	46	41,400	67	62,860
% of sows housed in groups	4.54%		7.15%		9.53%		12.93%		19.63%	
Grouped sows/ total no. of sows	15,000	330,200	22,550	315,200	30,500	320,200	41,400	320,200	62,860	320,200

* Data for floor feeding are less accurate because this system does not necessarily require the purchase of specialized equipment.

** Some producers who are running short-term projects are still undecided between the ESF system and the free-access stall system.

Note: These figures are based on a 2010 in-house survey by the CDPQ and have been updated to the best of our ability, based on contacts with equipment suppliers, and are not official.

3. Breeding techniques and group-handling practices for gestating sows

3.1 Floor type

The choice of floor type will depend on a number of factors: the needs of the herd, the method being used to manage droppings, straw availability and labour availability. Further, target ACA standards (European standards, biological, certified human, etc.) will also play a factor in the type of floor chosen. In Canada there are currently no standards for the type of floor or concrete slats that must be used in group-housing gestating sows.

3.1.1 Straw

Bedding provides material that the sows are able to manipulate and chew on and thereby express their need to root.[5] Also, bedding generally promotes good standing ability among the sows (Figure 2).[5] However, it must be of good quality and readily available at a reasonable cost, which is not always possible because it is becoming more and more difficult to find on the market at an affordable price.

Figure 2 Grouped sows on bedded floor with a raked area and ESF feeding

There are two possible ways to manage bedding, i.e. raking (removal of droppings two to seven times per week) or leaving them to accumulate (removed once a month or after a batch has finished gestating). To work properly, straw-based systems require a greater amount of floor space per animal than on a slatted floor. According to European standards, that amount of space needs to be 3 m^2/sow (32.3 ft^2/sow) on a raked bed and 3.5 m^2/sow (37.7 ft^2/sow) on a bed where droppings are allowed to accumulate. Failure to meet these floor-space requirements will affect the amount of straw needed per sow, because the straw becomes soiled more quickly. On average, 1.7 kg (3.75 lb.) of straw/sow/day are required when using the raked-bedding system and 2.4 kg (5.30 lb.) of straw/sow/day are required when droppings are left to accumulate.

However straw bedding requires an increased workload because handling it (distributing, scraping and managing manure) requires a great deal of time and it cannot always be completely mechanized.[5] It also requires larger buildings, not only for the sows, but also for the storage of straw and manure.[5]

3.1.2 Full or partially slatted floors

Floors in the pen-gestation sections can be completely slatted or of solid concrete surfaces, in strategic areas. It is important to remember that sows prefer to lie down on solid concrete surfaces and these surfaces need to be located in areas where it is desirable for them to lie down.

Slatted floors

Concrete slats make it easier to manage the removal of droppings and require very little clean-up time (Figure 3). They also mean drier surfaces, thereby avoiding injury due to slipping. On the other hand, the risk of injury (e.g., dew claws) resulting from fighting is greater.

Figure 3 Sows on a fully slatted floor

New concrete slats from the Quebec firm of Latte Drummond meet the criteria set out in the European standard:

- maximum slit opening of 20 mm (¾ in.);
- minimum width of solid portion of slat 80 mm (3 in.);
- total surface area of slat openings must not be greater than 15%.

However, it must be remembered that even though there are no current Canadian standards governing concrete slats used in pen-gestation applications, it is recommended that this type of product be installed in the case of major renovations or new construction. This would, ensure compliance over the longer term, as it is unknown what will happen in the future and it is better to plan ahead now, rather than be obligated to make costly changes later on.

There are other very important points to be aware of when it comes to using concrete slats in order to avoid problems relating to standing/lameness among group-housed gestating sows:

- The edges of the gaps between slats must not be too sharp because if they are, there is increased risk of injury to the feet.
- The slats need to be installed properly in order to avoid height differences between the slats and also to prevent movement when they are being walked on.
- Before sows are brought in for the first time, the concrete floor and slats MUST BE WASHED WITH ACID in order to avoid problems related to lameness. Concrete is a very basic product, and if not neutralized with acid it softens the hooves, which leads to lameness. It is recommended that the concrete be neutralized at least 10 days before sows are brought in.[6] Consult your veterinarian to determine which product to use, the concentration and the method of application.

Slats tend to wear with use, and the gaps widen; this increases the risk of injury to the dew claws because they go deeper into the gap. It is also important to ensure, as in the case of new floors, that the slats comply with prescribed standards and are laid correctly in order to avoid height variations.

Solid concrete floors

Solid floor surfaces should be installed only in lying areas (Figure 4), because sows prefer to sleep or lie on solid surfaces.

Figure 4 Solid concrete floor in sleeping/lying area

Various locations where solid floors can be found are described in Table 7.

Table 7 Recommended areas for locating solid floors

Feeding system	Areas where solid floors can be used
Floor feeding	Feeding/lying areas
Shoulder stalls	Only under the troughs—avoids wastage of feed
Free-access stalls	In the front part of the free-access stall / common sleeping/lying areas
ESFs	Sleeping/lying areas
Free access ESFs	Sleeping/lying areas

With solid floors, controlling ambient conditions is essential in order to avoid harmful drafts in the sleeping areas and having the sows relieve themselves there, resulting in a lack of cleanliness.

3.2 Watering

In a group context, one success factor is the control of watering.[6] To safeguard the health of the sows and to avoid damp floors, the volume of water provided must be around 14 litres/day in winter and 16 litres/day in summer.[6]

3.3 Motor activity and inability to walk

The type of housing affects the animal's motor activity. In fact, the greater the available floor surface, the more a sow will move around and cover longer distances. In order of importance, sows are more active in the following standard types of housing:

1. ESF, dynamic group;
2. ESF, static group;
3. Free-access stall;
4. Shoulder stall.

Between the two extremes, sows housed in a dynamic ESF setting are twice as likely to be standing and running about, covering a distance 7.2 times greater than those housed in shoulder stalls.[7] More specifically, over a six-hour observation period per day sows stand 55.7% of the time under an ESF system, compared with 26.5% of the time under a system using shoulder stalls. As for distance, sows housed under the ESF system cover an average of 362 m (1,188 ft) (varying from 173 to 716 m, or 568 to 2,349 ft), whereas those housed in shoulder stalls travel an average distance of 50 m (164 ft) (varying from 7 to 77 m, or 23 to 253 ft).[8]

In addition to the size of the barn, the feeding sequence also affects locomotor behaviour. When feed is distributed at fixed times, as with floor-feeding, shoulder-stall and free-access stall systems, sow activity is closely linked to feed distribution. For sows housed using the ESF system (static or dynamic) the start of the feeding sequence triggers group activity, but not for all sows at the same time.[8] In short, in systems where activities are concentrated around mealtimes, sows are less active than those housed under the ESF system, where mealtimes are spread out over the course of the day and the sows are forced to travel greater distances (larger-sized barn) to find their feed, compared with floor feeding, shoulder stalls or free-access stalls.[7]

Sow motor activities are therefore dependent in large measure on the type of housing, and it is important to take this into account, primarily in order to better understand problems with walking.[8] Locomotor problems in group-housed sows appear linked to the type of housing.[7] In fact, it may be said that the more active a sow is and the more a sow moves about, the less time it will spend resting and the more likely it will be to develop a limp or other walking-related problems. Therefore, the ESF system (static or dynamic) presents greater risk than shoulder stalls or free-access stalls. The hypothesis given is that sows housed in an ESF setting are forced to stand in order to obtain feed or water, but they are less able to isolate themselves if they present a problem walking that could resolve itself with rest, compared with systems using shoulder stalls or free-access stalls. It is therefore crucial that sows experiencing problems under the ESF system be quickly identified and promptly isolated; this applies equally to the other types of housing.[7]

There are other factors that can affect a sow's ability to walk. For example, sows housed on a slatted floor have greater risk of injury, compared with those housed on a bedded floor (using straw, for example).[7] However, it appears that courtyard size has a greater effect on locomotor problems than does floor type.[7]

According to a 2010 study carried out on grouped sows by IFIP [French Pork and Pig Institute],[9] the rate for sows culled due to problems related to standing is more than 5% where the floor is completely slatted, compared with a straw floor (12.5% versus 7.5%). Another study done by IFIP in 2009[9] shows a cull rate for standing-related problems of 8% on slatted floors and 4% on straw.

In addition, feed requirements are closely tied to a sow's activity because the more active they are the higher their energy needs will be. In fact the maintenance energy requirement for a standing sow is double than what is required when the sow is lying down. Therefore, it is essential to take into account sow activity when estimating their nutritional needs; in short, they need to be adapted, based on the housing system being used.[7]

Les Chambres d'Agriculture de Bretagne[10] did a study assessing the activity levels of group-housed gestating sows based on the various housing systems used. Table 8 provides a summary of the findings from that study.

Table 8 Activities of gestating sows based on type of group housing

Housing System	Activities
Shoulder stalls	• Sows inactive and lying down; • Minimal exploration of surroundings; • Oral activities (drinking, eating, manipulation of objects, materials, etc.) less available than in other housing systems.
Free-access stall	• "Intermediary" system • Sows stand for longer periods, compared with shoulder stalls; • More exploration of surroundings than in stalls.
Static ESF	• Sows standing and active; • High number of activity sequences; • High degree of movement.
Dynamic ESF	• Sows more highly active than in any of the other systems; • Major presence of oral activities; • Major exploration of surroundings because there is more movement.

Source: Chambres d'Agriculture de Bretagne[10]

Locomotor problems in sows are undoubtedly tied to the type of housing but in a lot of cases there are numerous factors at play, such as genetics, breeding, type of floor, nutrition and handling of the gilts.

Group handling can increase the incidence of the inability to walk, primarily because the sow has to co-exist with its pen-mates and is required to travel longer distances.[11] The risk of lameness is higher with ESF systems and increases where the floor is slatted, soiled or damp; the free-access stall involves the least amount of risk.[12] In this sense, the free-access stall is the safest system when it comes to standing-related problems, followed by open stalls, static ESFs and then dynamic ESFs.[13] Since the ESF represents the greatest risk, it is important to have enough lying space in order to avoid a situation where the sows lie down in areas that have damp floors. [14]

The floor is obviously a key factor in maintaining foot health. Culling due to problems with standing are doubled when sows are housed on a slatted floor, compared with a straw-bedded floor.[11] A slatted concrete floor is the first risk factor in problems associated with walking, and this risk is ten times higher than for a straw floor (87.8% versus 8.8%).[13] When sows are group-housed, the floor condition is critically important. Soiled, damp and slippery floors are to be especially avoided.[14] A dry floor will resolve 80% of problems associated with lameness.[15]

The selection and preparation of the gilts is another vitally important element because single- and 2-parity sows are at greater risk of becoming lame, compared with those of higher parities.[11] In fact, because the rate of lameness is high in young sows, they are culled for problems standing. Sows of higher parities are those that have previously overcome standing problems when they were young. Their feed and their handling while in quarantine and then during their first gestation need to be taken seriously.[14] In fact, it is recommended that gestating gilts be separated from multi-parity sows and specific groups be formed in order to reduce the incidence of locomotor problems. As a result, it is then easier to adapt their feeding program to their particular needs.[13] As stated, feeding needs to be taken into account in preventing locomotor problems. It is suggested that weight gain be controlled during quarantine and during the latter stages of gestation in order to avoid excessive weight gain. Quantities need to be controlled and a balanced diet offered.[16]

Given these risk factors, the recommendations designed to reduce the incidence of problems related to walking in group-housed sows are as follows:

- Carefully observe the animals every day;
- Limit aggression and causes of slipping (by placing sows in homogeneous groups, reducing the number of feedings per day in systems where there is competition for food – such as floor feeding, shoulder stalls and free-access stalls - and keeping groups static whenever possible);
- Meet the feed requirements of the sows (balanced feeding, specifically with regard to vitamins and minerals, and monitor weight gain during late stages of gestation);
- Maintain proper floor conditions (clean/dry, cleaning/disinfection and appropriate resting surface);
- Maintain good ambient conditions (heating, ventilation);
- Selection and preparation of gilts.[12,15]

3.4 Managing the herd: static groups and dynamic groups

There are two possible types of managing groups of gestating sows: static groups and dynamic groups. The choice of which type to use will depend first on the size of the production batch, which depends in turn on the size of the herd and how it is managed (e.g. one weekly batch or one every fourth week). It is also possible to find both types in a single herd. The choice of batch type is important because in addition to having an impact on how the herd is managed, it will affect the choice of housing (ESF, free-access stall, etc.).

3.4.1 Static groups

A static group is made up of all or part of a single batch of sows, depending on whether or not there is a high number. In this type of group, all sows are at the same stage of gestation and the group remains together throughout the gestation period.

Operating in this way makes it possible to use the all-in/all-out method for each batch of sows. This makes it easier to manage the herd because if the sows need to be manipulated, the entire group can be done at once. Manipulation refers for example to the 2nd gestation test, vaccines or transfers to farrowing. Also, it is easier to compare the body condition of the sows in the group because they are all at the same gestation stage.

In addition, there is less aggression with static groups because the sows are only mixed once.

3.4.2 Dynamic groups

Dynamic groups are made up of several batches of sows housed together in the same pen throughout the gestation period. This results in sows at different stages of advancement in the gestation process in the same pen. At regular intervals, depending on the batch, sows are removed from the group and taken to farrowing, while others are brought in to the group after they have been in the breeding area. Each time an animal is brought in or out, there is infighting within the group.

This practice has the primary advantage of allowing better utilisation of the floor space by creating the possibility of forming large groups of 40 or more animals because they require 10% less floor space, based on European standards. This is an attractive benefit for small farrow-to-finish producers who want sufficiently large groups of gestating sows in order to optimize the ratio of sows per ESF. In fact, small herds do not normally allow for the optimum number of sows per ESF, so this practice makes it possible to optimize the number of sows per feeding station. Also, the larger the group, the less infighting there will be.

However, this practice is essentially encountered when using the ESF system. Individualized feed management makes it possible to mix sows at various stages, with varying feed requirements. In this case, the ESF allows the sows to be sorted when they are being transferred to farrowing or during individual vaccination sessions, for example. Even though it is not recommended, the use of dynamic groups is sometimes seen with producers using the self-locking free-access stall feeding system, where very few sows use the common area. However dynamic handling should not be used with systems where there is competition for the food (floor feeding or shoulder stalls).

3.5 Timing of group formation

There are primarily three points at which sows can be grouped: after weaning, after mating or 28 days post-breeding. Care should be taken to avoid grouping sows during the embryo implantation period, which is 7 to 28 days post-artificial insemination (post AI), as grouping them at that stage reduces the herd's reproductive performance. This is to avoid stress-related miscarriages that result during the grouping period, a time when embryo implantation is not optimal. According to the Code,[1] groups can be formed 35 days after breeding, which allows for better implantation and reduces the risk of miscarriage.

3.5.1 Grouping after weaning

Group housing during the breeding period can be problematic because sows tend to straddle one another when in heat. The problem is made worse when numerous sows are in heat at the same time and when older and heavier sows straddle younger sows, which can lead to foot injuries.

The Code makes no mention of the requirement to group-house sows during the breeding period. However a number of recommendations are provided below on the overall design for a breeding area when sows are being housed in groups[17]:

- When sows have more than 4 m^2 (43 ft^2) of space each, it is easier for them to avoid one another.
- Individual stalls can also be constructed, preferably the self-locking types; these allow farm staff to provide individual care to the animals. They also make it possible for the sows to get away from their pen-mates for a time.
- Long straw is the preferred type of bedding because it seems better at preventing slipping than cut straw or small amounts of bedding.
- Promote contact with the boar when sows are in heat. One side of the boar's pen adjacent to the area where the sows are should be completely open to allow more than one sow at a time to come into contact with the boar. This will prevent the sows from jostling one another. The floor here needs to have anti-skid properties so that the animals are able to easily mount one another.

It is also very important that farm staff pay special attention to this part of the building. Supervision is essential because this allows for intervention if it becomes necessary to separate some of the animals for their own protection or for that of their pen-mates. For this to work well, it is critical that the sows have healthy limbs.[17]

Forming groups of sows at weaning can only be done with static groups. This practice is not widely used, except by producers who raise pigs that specifically require it. It means breeding sows that roam freely, which is not very easy. Producers who group their sows at breeding mostly use free-access stalls for housing, and are thus able to separate sows at the time of insemination.

3.5.2 Formation of groups after breeding

The restraining period for sows lasts about a week, so sows are grouped two to three days after insemination. Grouping is done prior to embryonic implantation. This limits the number of spaces needed in the "breeding" area but increases the number of spaces required in the area where the sows are group-housed. When using this procedure, it is important to have a boar in close proximity to the sow's pen in order to monitor its coming back into heat. It is also advisable to have pens that are used solely for forming groups, where the sows can remain for approximately one month. This allows for larger pens dedicated to the formation of groups. These pens can be arranged so that aggression and injuries are reduced as the groups are being formed. It is also here that the diagnoses of gestation can be made; only those sows that are confirmed as being pregnant will be moved to other pens that are able to handle approximately 10% fewer sows. This procedure optimizes the amount of space needed to group-house the sows, but involves one additional move for them.

Also, in order to avoid reproductive problems, forming groups after mating should only be done if the herd is being managed in static groups. A short "bred" block and a dynamic ESF group, where animals are taken into or out of the group every week should be avoided because there will inevitable be a mixing of sows during the critical embryonic implantation period of between 7 and 28 days, post-breeding.

3.5.3 Formation of groups after 28 days post-insemination

This is the most widely used practice because it offers the highest level of control over the sows and their returns into heat. Heat detection and inseminations are done in the stall, which makes the task easier. Also, during this time, it is possible to control sow feeding in order to adjust their body condition before they are placed in the group. This technique allows for the initial diagnosis of gestation using an ultrasonograph while the sow is in the stall. It also allows for the use of existing stalls during renovations, thereby limiting the number of spaces required for the group.

3.5.4 Reproductive performance based on when group is formed

According to IFIP data[9] derived from over 300 herds where sows were grouped (Table 9), those sows that were grouped right after weaning yielded good results, but the rate of farrowing-house loss and the rate of fertilization from first breeding varied considerably from one batch to another.

Where groups were formed between a few days and 21 days post-insemination showed poorer farrowing-house results. In fact, the farrowing-house loss rates and the weaning-to-service interval (WSI) are slightly higher and the first-service fertility rate is also lower. It appears that producers should avoid placing sows in groups at that time because that is when embryonic implantation occurs.

Sows should be grouped not less than 21 days after breeding. Reproductive performance numbers can also be good if groups are formed immediately after weaning, but there is a risk of increased variation in zootechnical performance.

Table 9 Reproductive performance in sows based on when they were grouped as seen in a study done in France by the IFIP

Time of Grouping vs. AI	No. of Batches	No. of Sows Present	Live Births / Litter	Loss Rate / Live Births	WSI	First-breeding Fertilization Rate
Groups – at weaning	48	182	13.3	13.9 ± 4.3	8.1 ± 2.6	90.4 ± 6.8
Self-locking max. 2 days to AI	29	178	13.1	15.4 ± 3.6	8.5 ± 2.4	86.0 ± 7.8
2 - 7 days post-AI	36	212	13.0	14.2 ± 4.0	9.2 ± 3.0	84.6 ± 5.6
15 - 21 days post-AI	11	182	13.3	15.3 ± 3.6	7.8 ± 1.6	87.3 ± 7.2
22 - 28 days post-AI	97	270	13.3	138 ±3.8	8.0 ± 2.3	89.7 ± 5.0
28 days post-AI	119	283	13.3	126 ± 3.3	8.0 ± 3.1	90.4 ± 4.9

Source: Adapted from Courboulay and Massabie[9]

3.6 Fighting is unavoidable

3.6.1 General rules for reducing aggression among group-housed sows

In order to limit interaction among the sows, the building should be planned to take into account essential factors such as sow size and behaviour and husbandry practices tailored to the herd.[18]

A number of general recommendations will help minimize aggression among sows and its consequences on sow health, stress and performance:

- Appropriate group batching. When the batch is divided into several groups, make sure that the animals in each group are homogeneous in size, ensuring that multi-parity sows are not grouped with young sows;
- Static group management;
- Ensure, based on pen arrangement, that sows are able to escape from those that are aggressive;
- Use non-competitive feeding systems;
- Ensure that there is an adequate number of watering points available for the sows;
- Make enrichment objects available for the sows, as these help relieve boredom.

3.6.2 Tips for reducing aggression that accompanies the formation of groups

When groups are being formed, fights are inevitable. They serve to establish a hierarchy within the group. These are of short duration, lasting normally from two hours to a full day.

However, for sows that have always been housed in stalls, aggression is more intense and lasts longer when they are first placed in groups. This can be explained by the fact that sows that have only been in stalls have not learned how to interact with their peers. For this reason, it is important that a human be present in the hour after the sows have been mixed in order to ensure that no one sow is attacked more than any other by its pen-mates.[6]

Unfortunately, there are no magic solutions, but there are a number of tricks that can be used to dial down the intensity and number of fights that occur when the groups are being newly formed:

- Immediately upon weaning, it is recommended that all sows from the same batch be grouped side-by-side in the breeding area. That way, some of the sows will already be familiar with one another before the groups are formed.
- Whenever possible, it is preferable that a group include the same sows from one gestation group to another. As a result, some of the sows will already be familiar with others, and fights will be avoided.
- With ESF systems, it is recommended that one additional meal be given in the breeding area before the sows are sent to groups. That way, the sows will be calmer and will lie down instead of fighting. This will also lead to less aggression in the feeding station waiting areas. The frequency of fights among grouped sows at the ESF will decline quickly over the first three hours after they have been placed in groups. [18]

- In the case of systems using shoulder stalls or free-access stalls, it is recommended that the sows be fed as soon as they arrive in the pen, in order to distract them. With free-access stalls, sows will take refuge in them to eat, and this will protect them against any aggression. With floor feeding and shoulder stalls, sows will be calmer after they have eaten, and will look for a place to lie down instead of engaging in fights.
- Shutting off the lights in the room encourages the sows to rest, thereby reducing the frequency of fights.
- The use of antiparasitics masks the sows' keen sense of smell, which will cause a reduction in the amount of aggression when they are in groups. When liquid antiparisitics are prescribed for sows, the recommendation is to apply the treatment immediately prior to bringing them together. Calming pheromones can also be used.[19]
- Use good pen design[20]:
  - block off sows that are aggressive (free-access stalls);
  - make straw available for the sows;
  - provide a safe zone (out of sight);
  - allow for minimal protection of sows when feeding.
- Do not overload pens and follow space recommendations for each type of system.[20]
- Never bring a lone sow into an already-established group.[20]

It is a given that fights are inevitable, so it is important to minimize the consequences for the sows by:

- Making sure that floors are dry. This avoids slipping, which can result in serious foot injuries.
- Using gilt-specific management practices. Whenever possible, group the gilts together, and not with single- or multi-parity sows. Gilts are smaller, and if they become involved in a fight with a large sow this can result in more severe injuries.
- Creating reasonable groups. With floor feeding, shoulder stalls and free-access stalls, it is critical that the groups be homogeneous (as to size and body condition) in order to help make it easier to monitor body condition and also the competitive capabilities of each sow in the group.

It is important to note that with dynamic groups, fights occur primarily among sows that were newly introduced into the group, not between the newly arrived and those that were already in the group, except on certain occasions.

3.7 Stress + fear = bad!

It is recommended that, in the first month of gestation, any type of stress-producing actions such as attacks from pen-mates, brutal actions or less-than-optimal conditions be avoided because these can result in a higher rate of sows coming back into heat. Weeks 2 to 4 of the gestation period seem to involve the greatest vulnerability.[21]

In fact, stress occurring at sensitive stages can affect the reproductive performance of sows through direct effects on the hormonal system (rise in cortisol, reduced LH) as well as indirect effects (decreased appetite, injuries, decreased immunity, etc.).[22]

Group-housed sows are potentially exposed to various types of stress: social stress, nutritional stress, thermal stress, etc. They have resistance capabilities, particularly in the case of acute, short-duration stress (e.g. fights, painful injections, etc.) but chronic stress lasting more than four days and social stress are the most difficult types to deal with. This resistance capability can be weakened in situations of poor nutritional health or poor sanitation conditions.[22]

3.8 Hospital pens

Sick or injured pigs often benefit from being segregated in an area where they can recuperate without having to compete with healthy pen mates for food, water and comfortable lying areas.

The Code requires that:

"*Every pig production facility must have the ability to segregate sick or injured pigs in a separate area where the necessary treatment can be administered."*

A pig should be moved to a hospital pen if it[23]:

- shows symptoms of illness;
- is limping or remains lying down/sitting for prolonged periods;
- is not eating or drinking;
- is seriously injured (e.g. from vulva biting);
- is constantly being subjected to aggression on the part of its pen mates;
- is systematically attacking other sows in the group.

The Code[1] recommends that producers:

- *"design facilities for sick and injured pigs in such a manner so as to improve pigs' chances of recovery. For example, facilities for sick and injured pigs should allow sick animals to spend large amounts of time resting in a warm place*
- *provide an enhanced comfort zone that is conducive to recovery (e.g. bedding, rubber mats, supplemental heat, additional space, easy access to fresh feed and water, etc.)*
- *locate the facilities for sick and injured pigs in a warm area where there are no drafts, preferably in areas where pigs can be observed more frequently*
- *provide sufficient lighting to ensure thorough inspection of the animals*
- *provide non-slip flooring in facilities for sick and injured pigs."*

In Denmark, the recommendations are similar to those in Canada, but they also specify a number of other items, including[23]:

- Ensure that a minimum of 2/3 of the space is covered with bedding or rubber mats to provide comfortable surroundings for the pigs;
- Ensure a minimum of 3.5 m^2/animal (37.7 ft^2) where a pen houses a sow or a gilt;
- Ensure a minimum of 2.8 m^2/animal (30.1 ft^2) where a pen houses 2-3 sows or gilts.

In the days after animals have been grouped, it is important to identify those sows that are injured or are losing weight and segregate them accordingly. For these animals, allow 2 to 5% of extra room as a hospital.[6]

3.9 Human-animal relationships

It is important for the welfare and productivity of pigs that they have positive human contact. This makes them easier to move if they have been previously handled and moved, so it is critical to ensure that those in charge of handling the animals have a proper understanding of behavioural principles such that handling the animals creates the least possible amount of stress. Farm staff who is in contact with the animals should take the appropriate training on the various aspects of animal welfare, such as handling methods and euthanasia. They should also recognize that their attitudes and their behaviour impact the welfare of the animals.[1]

The relationships that the producer has with his or her sows change when the animals are being raised in groups.[19] In the case of free-access stalls, or trough or floor feeding, this relationship remains limited because the herd can be supervised from the service corridors, at feeding time, without necessarily entering the pens.[19] When the ESF system is used, however, this relationship becomes a success factor because interaction is necessary for the system to function properly. The producer is forced to enter the group every day to monitor the herd and identify problem sows, and perhaps show and provide support to the gilts as they learn to get comfortable with how the system operates.[19]

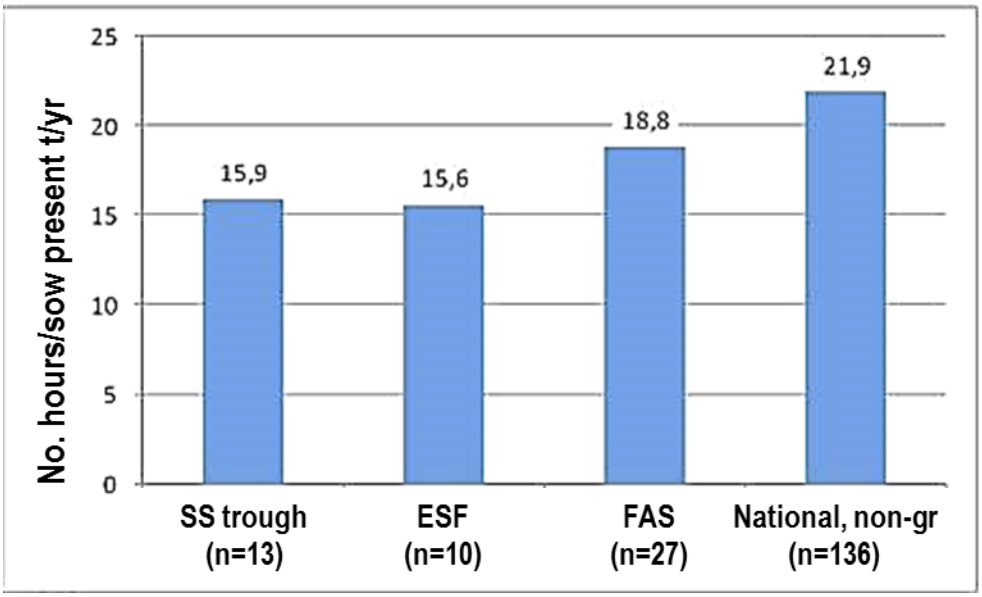
The actual transition to a group-management system normally takes places smoothly, but adequate preparations need to be made in advance; the producer can become discouraged if the transition has not been well planned out (especially in the case of ESFs). There is a learning curve for the animals, and also for the producer.[24]

3.10 Managing moves

Grouped sows are normally quite calm and move about more easily than stall-housed sows.[6] To facilitate moves, it is important that the layout be properly organized. Because the pig is a curious animal, solid walls should be used on each side of the passageway to avoid distractions.[20] However, some grouped-sow layouts require walls with openings in them to prevent the sows inside the pen from lying down there. It is also necessary to pay particular attention to changes in lighting, the type of floor (reflections in the water), drafts and slope of the floor in order to avoid blockages and slow the movement of the animals. Also, moves will be easier with smaller-sized groups.[20]

3.11 Changes in work practices

Grouping sows involves changes in how the animals are handled and, accordingly, in how work is scheduled (Figure 5). When sows are grouped (except in the case of free-access stalls), the producer no longer has individual access to each gestating sow. Individual access to a locked-in sow is limited to the weaning period up until the time they are placed in a group and during farrowing. With all these changes regarding what work needs to be done and how it is organized, it is easy to see that group management can be a headache for the producer. Apart from the fact that placing sows in groups represents a regulatory and financial constraint, most producers when interviewed as part of a study had positive views on the use of grouping. Theyfelt that the practice of group management shortened the time they needed to spend dealing with gestating sows and simplified their work, or at least made it more pleasant.[25]



Source: Courboulay and Massabie[9]

Figure 5 Number of hours of work per sow present per year according to type of housing system for farrow-to-finish producers (France)

The transition to group housing appears to reduce the amount of work time spent on the part of the producer; there is a difference of about 3 fewer hours/sow/year when swine are group-managed, given an equivalent-sized herd.[26]

However, producers said that they changed the way they manage their sows when they were placed in groups. They now have greater contact with their animals, but that changed the way they monitor and supervise them. Observing them requires more time for some, whereas other producers stated that group management makes observing the animals easier. [25] However, on a daily basis, the arrangement is seen by the producers as something that simplifies their work. This gain in efficiency is tied in part to the simplification of certain tasks, such as raking. Operations where the sows are housed in free-access stalls saw the least amount of change in work procedures because the sows can be temporarily locked in.

A number of practices still remain to be adapted to the group-handling system, but on the whole, the new management system seems satisfactory for the producers interviewed. With the ESF system, as with small groups, supervision and monitoring of the herd remains a constant challenge.

4. Performance based on housing system used

There are various systems for housing and feeding gestating sows in groups. According to IFIP,[9] in France, it appears that the performance of group-housed sows can be equivalent to sows housed in stalls (Table 10). However, this data was taken from herds averaging between 220 and 250 sows. It would be interesting to analyze sow performance under each of the different systems with larger herds, like those in Quebec and in Canada.

Table 10 Technical results from French producers based on management type (individual stalls compared with groups)

	All Types (mainly individual stalls)		Grouped Sows	
	Average	Standard Deviation	Average	Standard Deviation
Number of sows present	219.7	192.9	248.4	197.4
Weaned piglets/sow prod./yr	28.3	2.3	28.7	2.2
Live piglets born/litter	13.2	0.8	13.3	0.7
Farrow-to-weaning mortality	13.8	3.9	13.7	3.9
WSI	8.3	3.1	8.3	2.6
First-breeding fertilization rate	89.1	6.4	89.1	5.8
Annual cull rate	41.1	11.7	41.5	10.8

Source: Adapted from Courboulay and Massabie[9]

No one system appears better than another (Table 11). There are pros and cons for each one, and it is up to the producer to decide which system works best for him or her, based on personal values, tastes, available labour force and finances. However the level of oversight and qualifications of the producer in charge of each system vary from one to another.

In short, it is primarily the producer who makes the difference, and some systems are more easily managed than others, depending on conditions existing on each farm (size of herd, level of qualification of staff, etc.).

Table 11 Average technical results (France) for the principal types of housing sows in groups

	Shoulder Stalls		ESF		Free-access Stalls	
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
Number of herds	151		64		135	
Number of sows present	308.3	239.0	276.0	193.2	186.3	155.9
Weaned piglets/sow/yr.	28,9	2.0	28.9	1.8	28.4	2.4
Live piglets born/litter	13.3	0.7	13.4	0.6	13.2	0.8
Weaned piglets/litter	11.5	0.6	11.6	0.6	11.4	0.8
Farrow-to-weaning mortality rate (%)	13.5	3.5	13.4	3.8	13.2	3.9

Source: Adapted from Courboulay and Massabie[9]

There is a large number of systems available for housing sows in groups, making the producer's decision more difficult. Because the transition to group housing represents a crucial decision, it is important to be aware of the various aspects of each type of system.

Below is a description of each of the systems used in Quebec—floor feeding, shoulder stalls, free-access stalls, ESFs and feeding stations with self-locking free-access stalls.

5. Floor feeding

5.1 Operating principle of floor feeding

This is a very simple system where the animals feed directly off the floor (Figure 6). This requires a large floor section of solid concrete, where the feed is spread. At mealtimes, the feed is distributed directly onto the floor for all sows in the pen at the same time. It is recommended that the feed be distributed over the largest floor area possible, in order to reduce the risk of fighting as the animals feed. The solid portion of the floor will be used as a lying area during times of the day that the sows are not being fed. Under this system, it is impossible to monitor whether each animal in the group is eating. The only factor that can be controlled by the producer is the total quantity of feed that is distributed by pen.

Figure 6 Floor-feeding system

5.2 Managing the herd

The following consists of general recommendations for group-managing a herd of sows using the floor-feeding method.

5.2.1 Formation of groups

With floor feeding, it is critical that the sows be formed into homogeneous groups. In order to ensure that the younger and smaller animals take in enough feed, they should be put in groups that are as uniform as possible. When sows of the same parity and of similar weight are placed together in the same group, their feed requirements are then more uniform within the group and each animal's competitive capabilities are more equal.

Normally, sows are grouped according to body condition, parity and size. Whenever possible, a minimum of 3 groups per batch is advised: for example, one group of gilts, one group of lean sows and one group of sows with good body condition. The optimum group size with this system is between 10 and 25. In a group of fewer than 10 sows, the social hierarchy is very strong, and dominated sows are often bullied. Conversely, the larger the group, the weaker the hierarchy, but it becomes difficult to form homogeneous groups of more than 25 unless the herd includes very large batches of sows (large herds or four-week batches).

5.2.2 Feeding

With this feeding system, when conditions allow, it is very important to take advantage of times when the sows are in individual stalls in the breeding area to increase the amount of feed to sows that are underweight. This provides an opportunity for bringing the weights of animals of the same parity up to the same level, making it easier to place them in groups. Since individual feeding is not possible under this system, feeding needs to be managed on a pen-by-pen basis to make sure that the groups are as homogeneous as possible. The quantity of feed per sow needs to be higher in pens where the sows are thinner than in the other pens.

With this feeding system, feed intake is not uniform throughout the group. This means that the dominant sows take in more feed and gain more weight than the dominated sows, accounting for the variable nature of body conditions that begins to appear within the group.

In practice, producers tend to overfeed their sows under this system, and so in order to avoid having too many thin sows in their gestating group, producers often feed this group based on the sow with the poorest body condition to ensure that it does not become too thin. This means that each animal is given approximately 0.225 kg (0.5 lbs.) of excess feed per day, compared with those that are fed individually (Dr. Parsons, personal contact).

Also, the more evenly that feed is distributed on the floor, the less frequently bullying is seen. To achieve this, the feed should not be placed out in a single pile. It is better to have a number of locations where it is distributed within a single pen (Figure 7).

Figure 7 Distribution of feed through multiple dispensers over two separate feeding areas

It is also strongly advised that someone be present when the sows are feeding. This will enable prompt identification of problem animals, even before their condition begins to deteriorate. Under this system, the sows all feed at the same time and if there are any sows that fall behind the others and do not get to the feeding area, this may be a sign that something is wrong. The animal may be too sick, injured or perhaps too overly dominated to allow it to remain within the group. In any event, quick action is needed in order to prevent the sow's condition from deteriorating. The problem animal should then be removed from the group and placed in a pen or stall so that it can be given appropriate care.

5.2.3 Number of meals per day

Mealtimes are highly stressful for floor-fed sows, especially for those in the group that are being dominated. These animals fear these times because they do not know if they are going to be bullied by the dominant sow or whether or not they will be able to eat as much as they want. Also, each mealtime sees its share of bullying because the sows are all competing for the same food. This is why it is recommended that just one meal be given per day. This requires distributing a large volume of feed at the same time, which lengthens mealtime duration and allows the dominated sows time to eat a certain quantity of feed. If the distribution system cannot handle the entire feed volume needed for all animals in the group, the recommendation is to then provide two subsequent feedings, spacing them out as little as possible (taking the minimum time needed to refill the dispensers).

One other method, which is recommended by the Ontario Ministry of Food and Rural Affairs (OMAFRA), is to provide 3 to 6 meals or more per day to sows.[27] Under this procedure, once the sows learn how it operates, mealtime bullying is reduced because they know that there will be another meal soon. It has also been observed that the dominant sows often feed at the first meal of the day, while those on the lower social levels feed at later mealtimes. In addition, the sows seem less hungry, because intervals between feedings are shorter.

5.2.4 Type of feed

Because it is impossible to monitor the amount of feed consumed by each animal in the group and because gestating sows are limited in order to prevent them from becoming overly fat at farrowing, a condition that leads to future reproductive problems, it is recommended that a state of satiation be created in the sows. To achieve this, the use of feed with a higher fibre content than conventional feed in the form of meal (non-cubed, (Figure 8)) allows the sow to take in a large volume of feed in order to satisfy its needs.

Figure 8 Meal spread on the floor

Normally, when sows consume large quantities of feed, they reach satiation and they no longer feel hungry. This leads to less aggression within the pen and also allows dominated sows to eat, because once the dominant sows have had their fill, they will leave the other sows in the pen alone to feed as they wish.

5.2.5 Feed distribution

Feed can be distributed in two ways—manually or with the use of an automatic dispenser.

5.2.6 Manual feeding

Feeding manually requires a greater amount of labour time but a lower initial investment. The person responsible for feeding the animals does not need to enter the pen in order to distribute the feed; this is done from the passageway or any other installation giving access to the pen without having to actually be in it. Feed must be spread out over the broadest possible area and special care must be taken to avoid it ending up in the corners of the pen. Ear protection is required, because the sows create a highly intensive sound level.

But this system applies especially in the case of small batches or to a particular section of a building (gilt development section, for example). To cut down on stress and the time needed to feed the sows, automatic feeding is recommended.

5.2.7 Automatic feeding

Distributing feed through the use of an automatic feeder makes this practice faster and more flexible than manual feeding. This simple, well-known system allows the producer to follow a feeding regime of his or her own choosing. Several meals can be provided each day, and this would be practically impossible if feeding manually. One very important criterion involved with this type of distribution is the requirement for a series of feed drops or distribution chutes.This is necessary in order to ensure that the feed is scattered over the widest possible are of the solid floor. (Figure 9).

Source: Ontario Pork[27]

Figure 9 Distribution system providing coverage of a large floor surface area

It is also important to accurately calculate the number of distributors required in each pen to distribute feed according to the chosen feeding regime, that is, a single meal per day or six or more meals per day.

5.3 Watering

The watering area should be located in a slatted area of the floor (Figure 10), because the sows normally relieve themselves close to the watering points. This also helps to keep an area within the pen where the floor is solid, dry and clean.

The recommended ratio is 10 sows per bowl and 5 per nipple drinker. It is also highly recommended that there be a watering point in each pen, but because sows all feed at the same time, it has been observed that there is a certain level of competition for water immediately after the meal with this ratio. Flows of 3 litres/minute and 1.5 litres/minute are also recommended for bowls and nipple drinkers, respectively.[28]

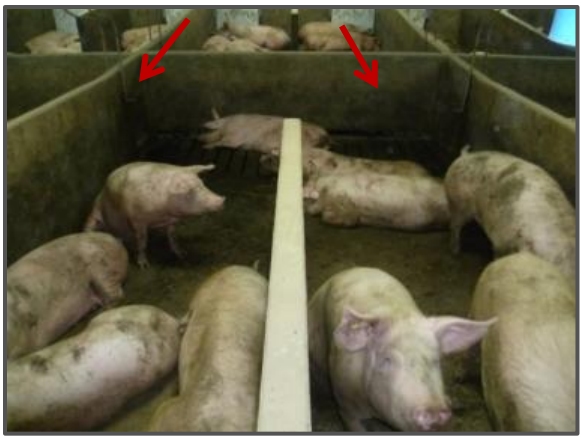


Figure 10 Two watering points located over a section of slatted floor

We do not have a specific recommendation regarding the choice of water bowls for group-housed gestating sows. However, you should ensure that the bowl selected is designed for sows, large enough for their entire snout to fit into, and that it holds a sufficient volume of water (Figure 11).

Figure 11 Sample bowl meeting described criteria

The height of the bowl will also be critical. It needs to be approximately 12 inches (30 cm) but refer to the manufacturer's recommendations for the type of bowl. A bowl that is placed too high will make watering difficult for many of the smaller sows.

5.4 Pen layout

The minimum recommended surface area per sow when the animals are being fed from the floor is 22 ft^2 (2.04 m^2). With this system, the way the pen is laid out is very important in ensuring that it operates smoothly.

For floors, it is recommended that approximately 2/3 of the floor area be solid (Figure 12), because this is where the feed will be spread and where the sows will later lie down. This should be between 12 and 15 ft^2 (1.11 to 1.40 m^2) per animal.

Figure 12 Layout showing 2/3 of the surface area in solid flooring

However, if this amount of space proves to be too large, there is the possibility that the sows will defecate on the solid portion of the floor. Floor-fed sows will generally keep themselves clean if ambient conditions (ventilation, heating and air flow) are adequately controlled. It is recommended that floors be given a 5% slope towards the slats to allow for quick removal of any possible urine. Any puddles of liquids, if left in place, will encourage defecation on the solid portion of the floor, which should be avoided. In addition, a small 2-inch (5-cm) step leading down to the slatted portion will help retain the manure on the slats.

To reduce bullying, partitions can be installed to create a number of feeding areas. However, this is not possible if the sow groups are too small (fewer than 10 sows).

Below are some examples of layouts created for use with floor feeding:

- In U-shaped pens (Figure 13), there are two feeding areas separated by a solid partition in the middle of the pen. This allows the dominated sow to feed away from the dominant one, thereby reducing the amount of bullying that takes place at mealtimes. Also, this configuration allows sows to escape and therefore avoid infighting, but it is very important that the space between the end of the partition and the back of the pen be a minimum of 8 feet (2.44 m) to allow for good traffic flow within the pen.

Figure 13 U-shaped layout

- One other possible type of arrangement is an H-shaped pen (Figure 14). Here, the sows can roam and feed in four different areas. Bullying becomes less and less in these pens because the sows have various options for escaping and numerous locations where they can feed. It is important to have a minimum distance of 8 feet (2.44 m) between the partitions, as above, but ideally 10 feet or more (3.05 m) would allow the sows to circulate easily from one area of the pen to another.

(Source: Adapted from Ontario Pork[27])

Figure 14 H-shaped pen layout

- Finally, pens with several partitions located at different spots within the pen (Figure 15 and Figure 16) that allow the animals to feed in various locations also work very well. Once again, care must be taken to ensure that the space between the dividers is at least 8 feet (2.44 m) in order to allow the sows to easily circulate within the pen.

(Photo: Jennifer Brown)

Figure 15 Pen with partitions placed at various locations

Figure 16 Another example of a pen with partitions placed at various locations

5.4.1 Hospital pens

Hospital pens need to be available in order to house sows having difficulties integrating into the group. Under this feeding system, up to 15% of sows can be removed from the group and transferred to hospital pens because of poor body condition, injury or bullying.

5.4.2 Pass-through gates

Pass-through gates allow the stockperson to enter and exit pens without having to move barriers (Figure 17). This makes the job easier because in order to properly manage grouped sows at the ESF, the producer has no other option but to be able to circulate about. This is an indispensable work tool because it has been observed that sows are much calmer when a stockperson circulates regularly among them.

Figure 17 Examples of pass-through gates

5.5 System cost

This feeding system does not require any special equipment and often numerous items of existing equipment can be re-used in making the transition, meaning that this a very inexpensive system.

As part of the project carried out by the CDPQ in 2014,[3] two farms that had previously transitioned to the group-management system and chose to floor-feed their sows were visited. Table 12 shows data from these two farms.

Table 12 Data from two farms that had previously transitioned to group management of their sows – floor feeding

	Farm No. 1	Farm No. 2
Before	Farrow-to-finish	Farrow-to-finish
After	Farrow-to-finish	Farrow only
No. of sows	+ 25%	+ 150%
Change in practices	"Every-3-week" batches to "every-4-week" batches	"Every-3-week" batches to "every-4-week" batches
Changes to buildings	Finishing converted to group gestation	Finishing converted to group gestation
$/space (grouped)*	**58**	**30**

*Excluding labour

The costs for making the conversion from finishing to housing sows in groups were very low, that is $30 and $58 per space for group gestation. However, it should be noted that the transition costs account only for the conversion of the housing and do not include the labour costs for carrying out the work.

5.6 Ease of converting buildings to a floor-feeding system

There are two types of buildings that can easily be converted to the floor-feeding of gestating sows in groups: these are finishing barns, where 2/3 of the floors are solid (Figure 18), and gestation barns where stalls are present (Figure 19).

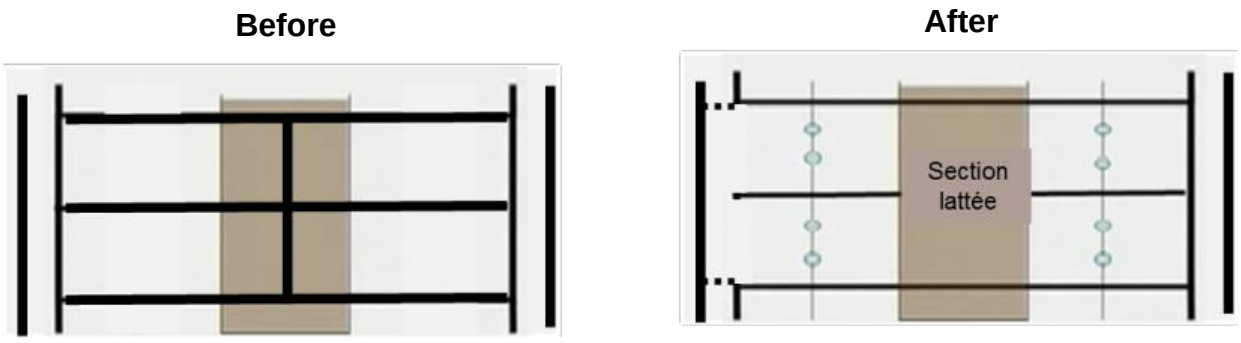


Figure 18 Conversion of a finishing operation with outside passageways to a floor feeding system for group-housed sows

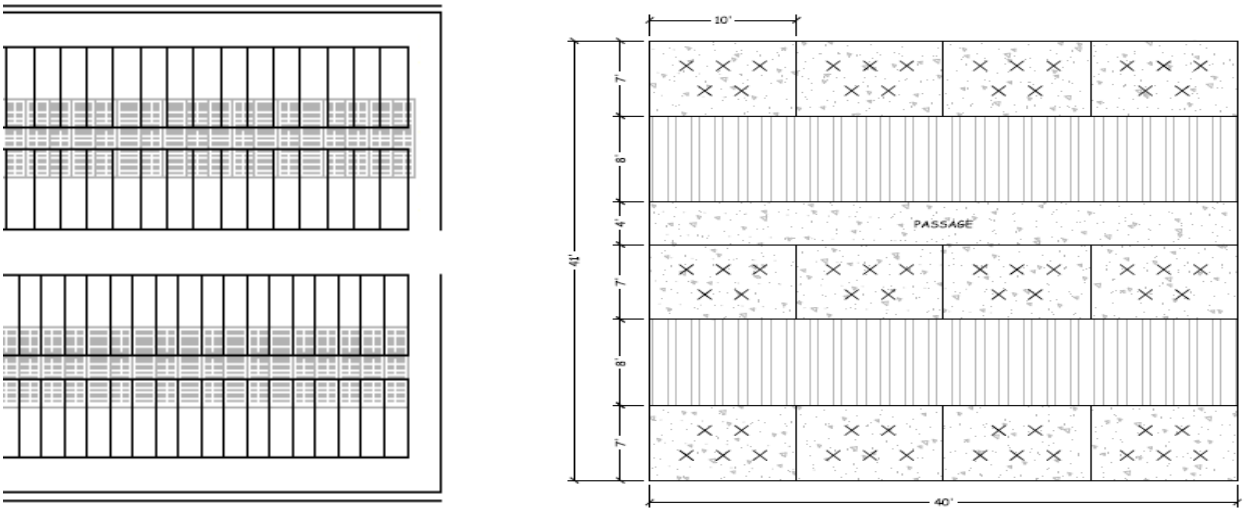


Figure 19 Converted gestation stall sections (or barns) with floor feeding

6. Shoulder stall system

6.1 Operating principle

This is a very simple, robust and inexpensive system, under which the sows are all fed simultaneously from a trough or directly off the floor. Here, sows are separated by panels referred to as shoulder stalls (Figure 20), which protect them against aggression in the shoulder area and therefore reduces thefts of feed during mealtimes. The stalls also prevent an animal from blocking access to more than one trough, but theft is not completely prevented. This system is designed to allow all the sows to access the trough at the same time (one shoulder stall per sow) at feeding times, thereby encouraging identical rates of feed consumption for each animal by limiting theft and the associated fights.[19] The sows do not necessarily always feed from the same shoulder stall, so it is important to offer equal quantities of feed to the entire group.[29]

With shoulder stalls, a feeding system fills the dispensers; these are the same as those used in gestation stall units and feed is distributed into a trough or onto the floor for all sows in the pen at the same time. With shoulder stalls, as with floor feeding, it is impossible to individually control the feeding of each animal. The only factor that can be controlled is the total quantity of feed distributed in the pen.

Figure 20 Feeding time at shoulder stalls

6.2 Shoulder-stall system

The following includes the overall recommendations for raising gestating sows in groups, using the shoulder-stall feeding system.

6.2.1 Formation of groups

When using this system, it is critical to form homogeneous groups of sows. To accomplish this, it is necessary to sort the batch according to body condition, parity and size. Whenever possible, create a minimum of 3 groups per batch of sows, i.e. one group of gilts, one group of thin sows, and one group of sows with good body condition. Marie Estelle Caille[30] recommends forming three groups of sows from batches of 18 and four or five from batches of 25 or more.

One other important criterion is to ensure that the number of sows correlates to the number of spaces at the shoulder stalls. Failure to follow this rule will result in increased stress in the sows, and this translates into less time spent at the trough and more time spent changing places at feeding time. These two factors will increase the likelihood of lower weights among the sows that are being dominated.

6.2.2 Feeding and watering

With shoulder stalls, producers need to take advantage of the regulatory period that the sows are in stalls in the breeding area to bring their body condition back up to where it should be. Since it is not possible to feed each animal individually under this system, the producer needs instead to manage feeding in each pen by ensuring that the groups are as homogeneous as possible. The quantity of feed distributed to each sow needs to be larger in those pens that house the thinner sows.

6.2.3 Shoulder-stall feeding

It is possible to provide two meals per day, but changing to a single meal would be better if there is aggression during mealtimes. This way, the sows remain calmer and change places less frequently. Also, feeding with meal, rather than cubes, slows down ingestion speed, which has the effect of allowing dominated sows more time to eat. This strategy limits poor weight numbers for these sows.

Classical dispensers or slow-flow dispensers can be used in conjunction with this type of feeding. With the first type, there is one dispenser for each space and the entire amount of feed falls into the trough at the same time (Figure 21a).

a) Classical dispensers

b) Slow-flow dispensers[30]

Figure 21 Dry shoulder-stall feeding: use of classical dispensers and slow-flow distribution system

The slow-flow distribution system (Figure 21b) consists of two lines: the first line fills the dispensers and the second one regulates feed distribution at the selected speed. The manufacturer's recommended speed is approximately 120 g per minute, which is less than the sow's ingestion speed. The theory behind this concept is that this slow, continuous rate of distribution encourages the sows to remain in place but unfortunately, in practice, this is not what actually happens and the sows change places even more often than with classical dispensers. Slow-flow dispensers are therefore not recommended.

6.2.4 Watering

Sows need access to fresh water at all times. With dry feeding, water can be distributed in a dividerless trough or through drinkers inside the pen, based on a ratio of 10 sows/drinker.[28] The length of mealtimes is reduced by 30 to 50% when sows are given water in the trough prior to the meal. This reduces differences in body condition among the sows in the group because there is little variation among sows in the ingestion speed of damp feed, whereas with dry feed it could vary from single to twice as much, depending on the individual animal.

6.3 Layout of shoulder-stall pens

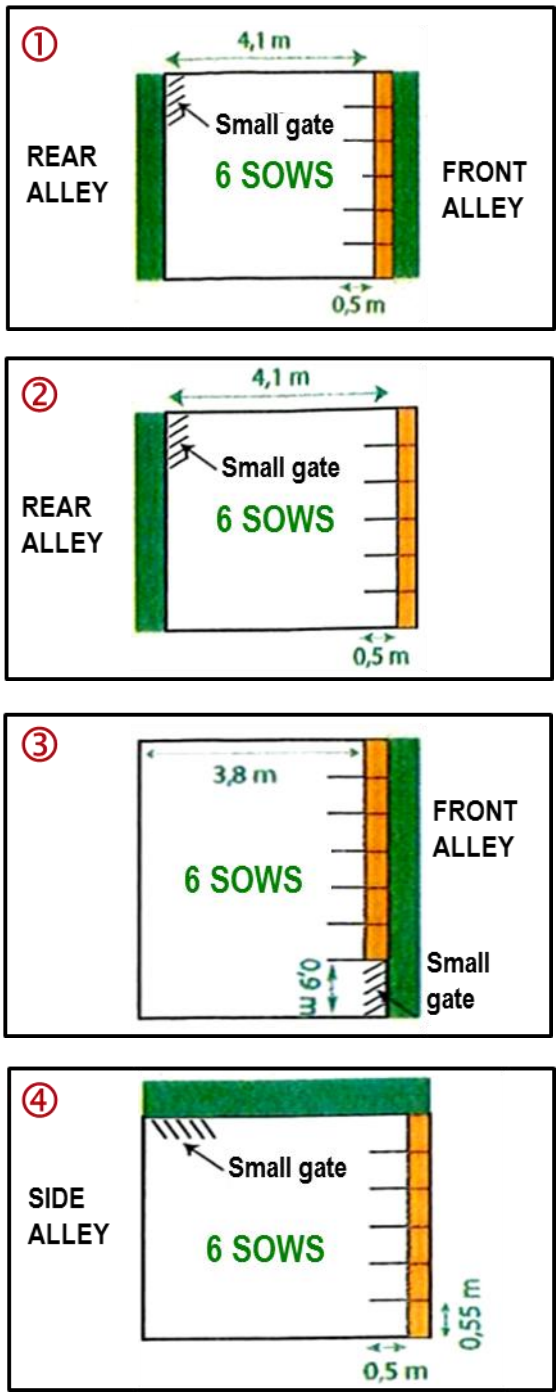
Shoulder stalls are often used for groups of 6 to 25 sows. The minimum recommended area per sow is approximately 20 ft^2 (1.86 m^2). With shoulder stalls, the surface area inside the stall dividers (2-3 ft^2) (0.19-0.28 m^2) is not considered usable by the sows, so the actual floor area of the building needed for each sow is 22-23 ft^2 (2.04-2.14 m^2).

6.3.1 Pens of varying sizes

When sows are grouped before gestation has been confirmed, it is important to have pens of various sizes available. This maximizes the use of the building's floor space, thereby avoiding pens with two or three fewer sows than planned.

6.3.2 Types of layouts

Shoulder stalls can be configured in various ways within a pen (Figure 22). Each layout has its pros and cons. To optimize the use of the building, it is preferable that the passageways be in the middle and that they serve the pens on either side. Also, partitions between the pens need to be solid, up to 0.8 m (2 ft 7 in.), to make it more conducive for the animals to rest. As with other systems used for feeding grouped sows, pass-through gates are critical in fostering good herd management.



① Front and rear alleys
This arrangement makes it easier to monitor the sows but requires a larger total surface area. The front alley should be about 0.4 m (16 in.) wide to serve as a passageway for the producer and to allow adjustment of the dispensers. The 1.2 m (4 ft.) minimum width of the rear alley is needed for moving the animals into and out of the pen.

② Rear alley only
The alley should be at least 1.2 m (4 ft.) wide. The producer does not have easy access to the dispensers to adjust the quantities being distributed during gestation.

③ Front alley only
The alley should be at least 1.2 m (4 ft.) wide. Supervising the sows during mealtimes can only be done at the front. Also, it is more difficult to assess body condition or detect abortions. Finally, with this configuration, removing animals is not easy.

④ Side alley
This configuration makes it easy to bring sows out but supervising mealtimes has to be done from the side.

Source: Chambres d'agriculture de Bretagne *et al.*[5]

Figure 22 Layouts frequently seen in France where shoulder-stall feeding is used

6.3.3 Troughs

It is recommended that troughs be used when feeding sows in order to make it possible to moisten the feed and thereby shorten the length of mealtimes. Troughs should also be raised off the floor (bottom of trough 15-20 cm (6-8 in.) from floor) to prevent soiling (Figure 23). The number of spaces at the trough should equal the number of sows in the pen.[19]

6.3.4 Shoulder stall dimensions

Shoulder stalls should be spaced 0.55 m (22 in.) apart at the trough. In order to reduce place changing at mealtimes, the depth should be at least 0.3 to 0.5 m (12 to 20 in.) deep (Figure 23) and the height should not be more than one metre (39 in.) high. This is due to the increased risk of vulva biting and that the dominant sows will chase the submissive ones back. The stalls should be well anchored because they see a lot of traffic at mealtimes.

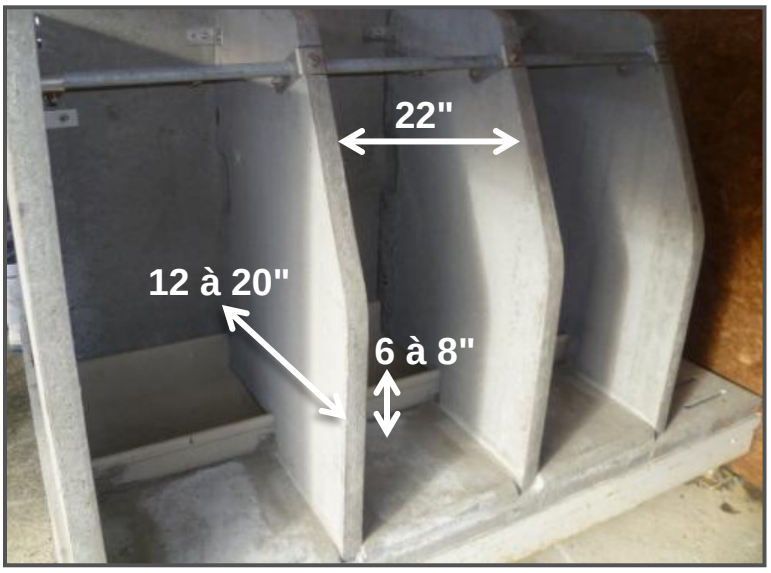


Figure 23 Planning criteria for pens using the shoulder stall system

6.3.5 Solid shoulder stalls vs. open ones

Solid shoulder stalls are preferable (Figure 24) because they help keep the sows at the trough during feeding times. Also, because the sows cannot see one another at the trough, a submissive sow is not aware of a dominant sow's presence, and therefore remains at the trough until it is physically chased away.

Figure 24 Solid shoulder stalls and open metal stalls

6.3.6 Hospital pens

Even if all these management and layout points are followed, 5 to 10% of the sows will have to be removed from their groups and placed in hospital pens on account of poor body condition, injury or attacks. These pens should be as close as possible to the gestation pens.

6.3.7 Pass-through gates

Pass-through gates allow the stockperson to enter and exit the pens without having to open and close any of the gates (Figure 25). This makes the work easier because in order to be able to properly manage grouped sows using ESFs, it is essential that the producer be able to circulate about among the herd. This is an essential work tool, because it has been observed that sows are much calmer when the stockperson circulates regularly among them.

Figure 25 Various types of pass-through gates

6.4 Costs

Shoulder stalls represent the least expensive system, after floor feeding. This system requires little in the way of equipment (automatic attendant, trough and shoulder stalls) all of which are simple and sturdy.

Under the project carried out by the CDPQ in 2014[3], two farms that had previously transitioned to group management and elected to feed their sows from shoulder stalls were visited (Table 13).

Table 13 Data from two farms that transitioned to the group management of sows using the shoulder stall system

	Farm 1	Farm 2
Before	Farrow-to-feeder	Farrow-to-wean
After	Farrow-to-wean	Farrow-to-wean
No. of sows	+ 33%	+ 30%
Changes in husbandry practices	None	None
Changes to building	Nursery converted into group gestation and farrowing room	Gestation stall units converted into group management with small addition
$/group space*	266	184

*Labour costs not included

7. Free-access stall system

7.1 Operating principle

This is the system that most closely resembles existing gestation stalls (Figure 26). Each sow is assigned a free-access stall where it can enter or leave whenever it wants by activating a door. There is a courtyard at the rear of the free-access stalls where the sows can roam about freely. The sows are fed from the trough through dispensers that drop an identical amount of feed at the same time into each stall. The free-access stalls have a two-fold purpose: they serve as a feeding area and as a resting area. They provide real protection for the sows at mealtimes, thereby assuring the producer that all sows in the group take in the same quantity of feed. Some types of free-access stalls make it possible to lock sows into the stalls to isolate thin sows in order to be able to manually supplement the amount of feed they receive at feeding times. It is also possible to lock in all the sows at mealtimes, allowing the producer to more easily attend to them (for ultrasounds, vaccinations, de-worming, etc.).

Figure 26 Sows housed in free-access stalls

7.2 Two types of free-access stalls

7.2.1 Self-locking free-access stalls

This type of free-access stall allows the sow to lock the small gate at the back after it enters the stall (Figure 27b). To do this, the sow needs to push on a half-gate that activates the closure of the small gate at the back or lift a bar that performs the same action. Once a sow is in a free-access stall, none of the other sows can follow it. The animal is fully protected from the other sows.

a)

b)

Figure 27 a) Non-self-locking free-access stall b) Self-locking free-access stall

To exit the free-access stall, the sow only has to back up to unlock the small gate and open it. The producer is able to lock the free-access stalls individually, a section or the entire pen.

7.2.2 Non-self-locking free-access stalls

Sows are able to enter or leave these stalls whenever they want, but they are not protected at the rear and can be subject to attack from other sows in the group when in the stall (Figure 27a). However, it is also possible to lock the free-access stalls individually, completely or partially, in order to perform certain husbandry procedures.

7.3 Husbandry practices

7.3.1 Forming groups

With this system, it is advisable to form at least two homogenous groups of sows from each batch. This requires sorting the sows in the batch according to body condition, parity and size, but failure to follow this practice has fewer consequences with self-locking free-access stalls than with shoulder stalls. This is because, with shoulder stall systems, approximately 75% of the sows prefer to remain in the free-access stalls during the resting phase, without moving into the courtyard at the back.[31]

One other essential criterion is ensuring that there is an equal number of sows as there are free-access stalls. Also, it is better to handle the gilts separately from the sows.

This system lends itself well to all types of husbandry practices, regardless of the point at which the animals are grouped. It is the best system to use when sows are grouped right after weaning until they enter the farrowing area. It offers the possibility of mixing sows right from the time of weaning, locking them in for artificial insemination and returning them to their groups afterwards. However, where free-access stalls are used for breeding purposes, the producer should ensure that the free-access stalls provide good access to the rear of the sow (Figure 28).

Figure 28 Some manufacturers sell self-locking free-access stalls with a small gate at the back for performing artificial inseminations.

7.3.2 Feeding and watering

Sows are fed from the trough by distributors that release an equal amount of feed to each space at the same time. Since the sows are automatically locked in once they enter the self-locking free-access stalls to feed, this type of stall ensures that each animal in the pen consumes an identical-sized ration. Also, as stated above, the ration amount can be increased manually for thinner sows, but in order to be able to do this, the room must be configured to allow for a small alley in front of the sows to give farm staff access to the trough. This therefore requires a larger building floor surface.

In the case of non-self-locking free-access stalls, the sows are not locked in at mealtimes, except if a stockperson needs to attend to them. Dominant sows are therefore able chase other sows away from the free-access stalls by biting their vulva and then stealing a portion of their ration. Managing the herd using non-self-locking free-access stalls is very similar to using shoulder stalls because the sows are no longer protected at mealtimes and feed theft can occur. At this level of investment, it is recommended that free-access stalls be of the self-locking type.

Sows need permanent access to fresh water. When the animals are being given dry feed, water can be distributed through the trough or through drinkers in the pen (with a ratio of 10 to 15 sows/drinker).

7.4 Pen layout

7.4.1 Types of layouts

Free-access stalls can be configured in two different ways within a pen: a single bank with a courtyard at the back or two banks with a courtyard in the middle (Figure 29).

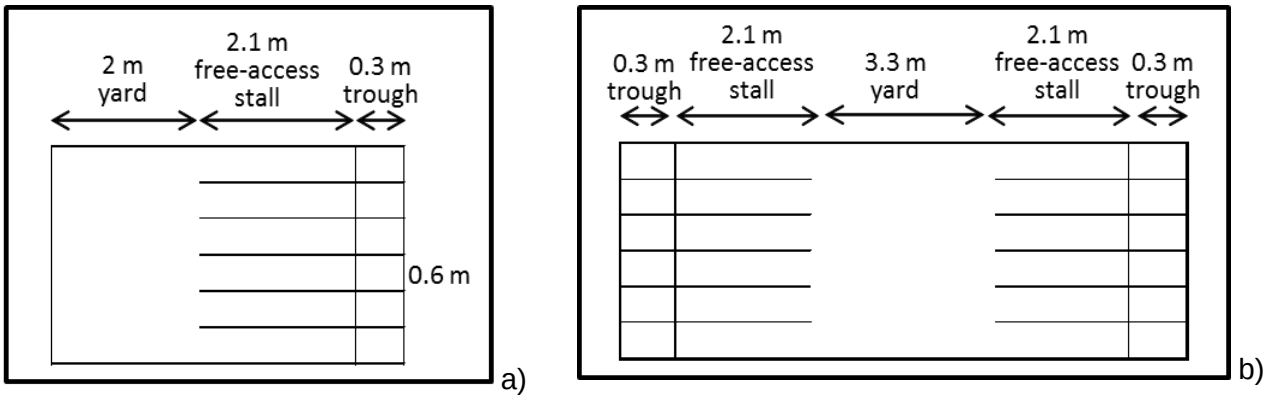


Figure 29 a) Layout for free-access stalls with a single row, and b) with two rows

7.4.2 Free-access stalls arranged in a single row

This type of layout (Figure 29 a) requires a greater amount of floor space per sow, since France requires a minimum of 2 m (6 ft 7 in.) behind free-access stalls and the wall or divider. With this type of configuration, the minimum floor space required per sow is 2.64 m^2 (28.4 ft^2) including the trough. The *Chambres d'agriculture de Bretagne* and the IFIP recommend a distance of 2.2 to 2.5 m (7 ft 3 in. to 8 ft 3 in.) beyond the free-access stalls to provide more room for the animals and make it easier for them to move about.

For purposes of sound feeding management, it is preferable to provide small alleys in front of the sows to allow for the thinner sows to be hand fed. Subsequently, with an alley 0.4 m (16 in.) wide that serves two banks of free-access stalls, the minimum actual inside floor space required per sow is 2.76 m^2 (29.7 ft^2). This generous amount of floor space for each sow translates into higher housing costs.

7.4.3 Free-access stalls in two rows

To optimize the use of space, the best option would be to arrange the free-access stalls in two banks, with a courtyard shared by both banks (Figure 29b and Figure 30).

(Photo: Jennifer Brown)

Figure 30 Self-locking free-access stalls configured in two banks

According to the Prairie Swine Centre (PSCI) [32], for an I-shaped layout, the central space needs to be 3 m (10 ft) wide, whereas in Europe the minimum suggested width of the courtyard is between 3.3 m (10 ft 10 in.) and 3.5 m (11 ft 5 in.) in order to achieve the standard of 2.25 m^2 (24.2 ft^2). Overall, the required floor surface per sow is 2.43 m^2 (26.15 ft^2) where there is a 0.6 m (2 ft) wide passage for two banks of free-access stalls. However, the French recommendations advise that the courtyard be a minimum of 3.5 m (11 ft 6 in.) wide, which calls for even more space per sow. In the U.S., some farms have courtyards that are 8 ft (2.44 m) wide, but in these cases, there is a resting area located at the ends of the banks of free-access stalls, which encourages the sows to come out of their stalls.

Sows do not really find the central courtyard attractive because they do not have a natural section where they can lie down. In fact, there are no solid floors or solid partitions that would allow them to lie down comfortably. When there are no areas of solid floor, just 15 to 25% of the sows regularly use this common area and it is primarily the dominant sows that take advantage of this area. Therefore, to make the central courtyard more attractive to the sows, the addition of a resting area with low walls would be necessary.

There are two possible types of layouts that include lying areas (Figure 31). In Denmark, these lying areas are mandatory and the recommendation is to allow 0.6 m^2 (6.5 ft^2) per sow in the lying areas and to reduce the width of the rear courtyard to 3 m (9 ft 10 in.).

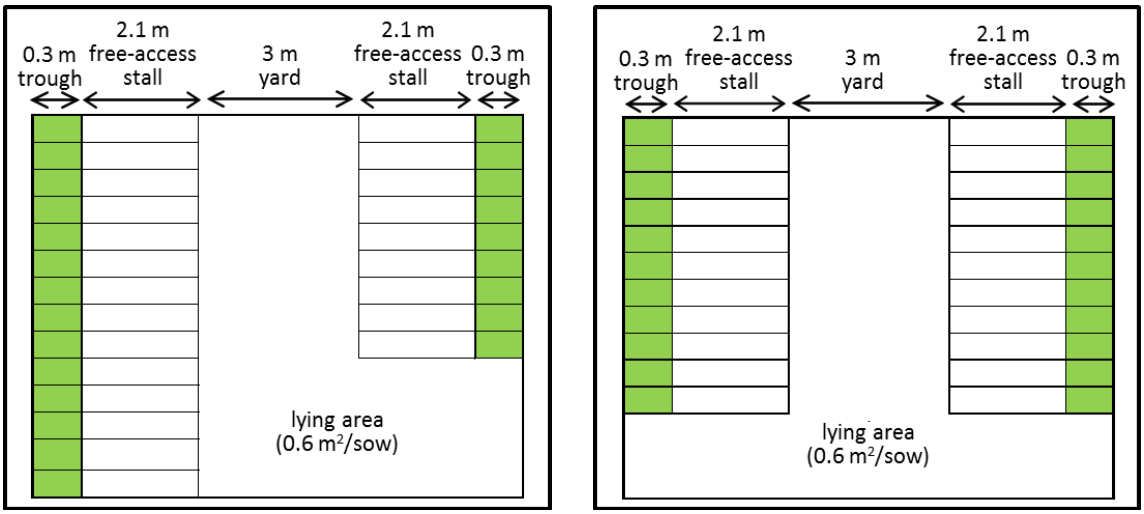


Figure 31 L- and T-shaped layouts

7.4.4 Use of available floor space

In examining the use of the un-bedded free-access stall system, the PSCI[32] discovered that the use of the lying area varied greatly among the sows. The average time spent outside free-access stalls was approximately 4 hours. Some of the sows may not have left the free-access stalls at all during the day, while others were out for over 20 hours. Those that were the least likely to leave their stalls were the smallest ones and the youngest ones, whereas the larger, older (dominant) sows spent most of their time in the lying area. There are three possible theories to explain this:

- The smallest sows may feel intimidated by the large, dominating sows.
- The largest sows may find the stalls uncomfortable.
- The smallest sows may have difficulty opening the back gate of the stall, given their size, or possibly their lack of training.

The PSCI[32] found that there were two possible methods for encouraging sows to use the lying area and thereby raise their exercise levels:

- Provide resources outside the free-access stalls to entice the sows out at least once per day:
  - supply water in the lying area but not in the stalls (this assumes, however, that all the sows are actually able to easily leave their stalls at any time);
  - provide sources of fibre, such as chopped straw or hay racks.
- Improve comfort in the lying area:
  - sows prefer to rest up against solid walls; solid floors are also preferred over slatted floors;
  - add rubber mats.

7.4.5 L-shaped courtyard

L-shaped common area: this configuration requires more floor space per sow, since some of the free-access stalls at the end of the row have been removed to create a resting area (Figure).

Figure 32 L-shaped courtyard

7.4.6 T-shaped courtyard

Here the common area is in the shape of a “T” (Figure 33). This is the configuration that requires the most floor space per sow. The free-access stalls at the ends of both banks have been removed to create a large common area at least 3 m (10 feet) wide[32] where the sows can lie down. However, this type of configuration sees the greatest usage of the communal area and the lying area.

It may be tempting to reduce the space between the two rows of free-access stalls but this area needs to be large enough to prevent aggressiveness; two sows from the same row need to be able to exit their stalls at the same time.[32]

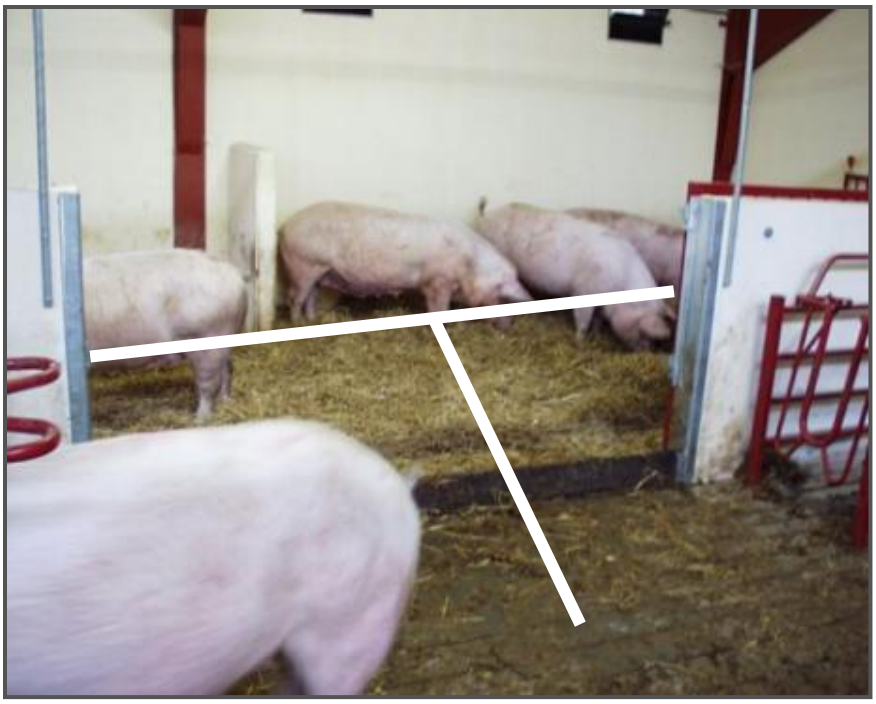


Figure 33 T-shaped courtyard

7.4.7 A system that requires even more space

The one configuration that calls for the least amount of floor space per sow (two banks but no lying area) still requires 2.25 m^2/sow (24.2 ft^2/sow). In addition, in order to encourage the use of the common space, it is recommended that lying areas be added, plus an alley in front of the banks of stalls to facilitate feeding. Following these recommendations will considerably increase the total amount of building floor space needed for each sow, and this can add up to more than 30 ft^2 (2.79 m^2) per sow.

To reduce space required and cut down on costs, there is one other configuration that can be considered; this is known as a cafeteria.[32] With this configuration, all the animals in a group feed at the same time, and once a group has finished feeding, it is moved out and another group is brought in to feed at the same free-access stalls. For example, rather than provide a feeding space for each sow in a herd of 100, a series of 20 free-access stalls could be used to feed 5 groups of 20 at a time over the course of the day. This would reduce installation costs, but on the other hand, the associated labour costs would rise. This is a very restrictive system, requiring human involvement at each mealtime.

7.4.8 Hospital pens

Even if all of the steps outlined above are followed, approximately 5% of the sows, where non-locking free-access stalls are used, will have to be removed from their group and placed in hospital pens due to injury or attacks. These pens should be as near as possible to the gestation pens but the Code does not require that problem sows be housed in pens. Therefore problem animals could simply be left in their free-access stalls, which can be locked for as long as necessary to provide them with the appropriate care.

7.4.9 Pass-through gates

Pass-through gates allow the stockperson to enter and exit the pens without having to open and close any of the gates (Figure 34). This makes the work easier because in order to be able to properly manage grouped sows using ESFs, it is essential that the producer circulate about among the herd. This is an essential work tool, because it has been observed that sows are much calmer when the stockperson circulates regularly among them.

Figure 34 Various types of pass-through gates

7.5 Costs

This type of system is very expensive because of the high cost of the self-locking free-access stalls (between $250 and $400 each); it also requires one free-access stall for each confirmed gestating sow. In addition, a large surface area is required, one much larger than that required for other group-housing systems. This adds considerably to the total purchasing or conversion cost of the farrowing house.

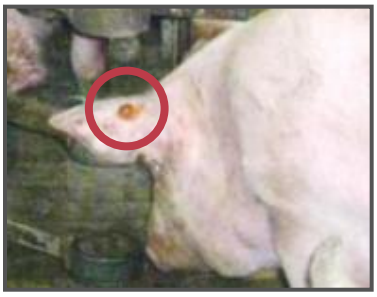
For these reasons, there will be very few Quebec farms equipped with this system. At the present time, only the farms using this system are in compliance with some of the highest of the ACA animal welfare standards (Figure), which require that the sows be free to roam as soon as they are weaned. This is why we do not have any Quebec-specific data on construction or renovation costs for this type of system.

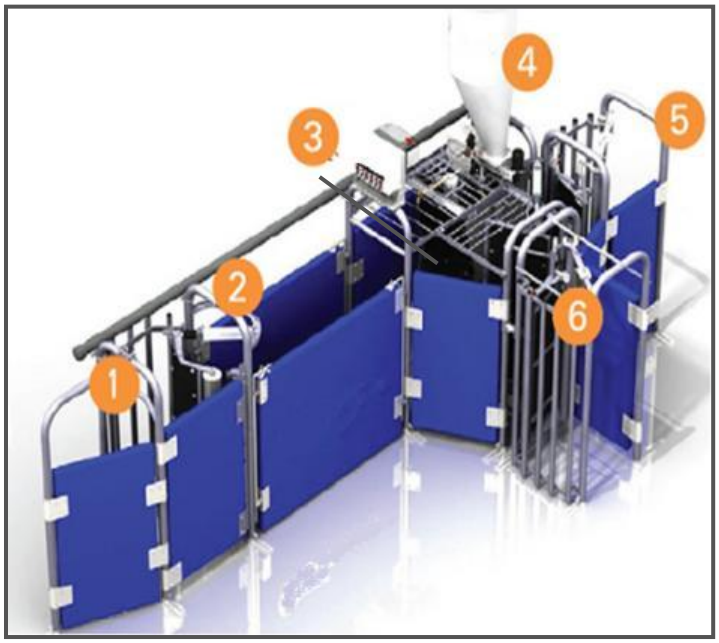
Figure 35 Quebec farm, in compliance with very strict ACA standards, using self-locking free-access stalls with straw

8. Electronic Sow Feeder (ESF) system

8.1 ESF operating principle

With the ESF system (Figure 36), each sow is identified by an electronic chip attached to one of its ears which is recognized by the system's computer. In order to be able to feed, the sows must go to a feeding station and enter it to receive feed. A motion detector closes the gate as soon as the sow enters the ESF.





Legend:

1. Entrance gate
2. Motion sensor
3. Chip reader
4. Feed hopper
5. Exit selection
6. Exit gate

Figure 36 ESF operating principle

Once inside the ESF, the sow is identified by the system. If it has not eaten all of its daily ration, the feed becomes accessible and is distributed. For a sow to access the feed, there are two possibilities: 1- the use of a hopper (that becomes accessible or not (Figure 37)) or 2- the use of a retractable bowl (Figure 38).

Figure 37 Photos of ESF hopper closed and hopper open

Figure 38 Bowl not accessible by the sow and retractable bowl made accessible, allowing the sow to eat

Feed is portioned out in drops of approximately 100 grams every 30 seconds. To prevent wastage of feed and to ensure that the dispensed feed that is is indeed consumed by the sow, the system constantly checks the animal's ear tag before dispensing more feed. In most ESF models currently available on the market, water is dispensed along with the feed to encourage the sow to eat. It can eat all of its ration in a single visit to the ESF, or it can leave the station at any point and come back later to eat the rest of the ration. Once the entire ration has been consumed by the sow in the feeder, the hopper shuts off and the entrance gate opens to allow another sow in to feed. If a sow eats all of its ration and is still in the feeder, the animal will be urged out by the next one waiting to feed, regardless of the social rank of the sow in the ESF. The sow is vulnerable because it is unable to turn around inside the feeder to defend itself.

When the ESF system identifies a sow that has already consumed its daily ration, the feed hopper remains shut and the entrance gate opens immediately. That sow is then urged out. On some ESF models a sow that has already consumed its ration is simply not able to enter the feeding station because the operation of the entrance gates is based on the sow's identity.

The manufacturers recommend a ratio of 50 to 80 sows per ESF station, but this ratio is higher than what has been presented in a number of research papers. Denmark's Pig Research Centre[33] has established different ratios, depending on the situation (Table 14).

Table 14 Ratio of sows per ESF according to group type

Type of group	Number of sows or gilts/ESF
Gilt training group	30
Group of gilts	40 - 50
Group of sows with just one ESF in the pen	55
Group of sows with more than one ESF in the pen	65

It should be noted that a gilt will not consume its ration as quickly as a multiparity sow and that it is learning how the system operates. Whenever possible, it is better for the gilts to be separated from the sows to avoid hierarchy problems.

The main drawbacks to the ESF system are the possibility of breakdowns, blockages or loss of the electronic ear tag. Also, the sows cannot be observed while they are eating (they don't eat at the same time) and the stockperson needs to be able to make adjustments (use the computer, analyze the data, etc.).[34] Also, it may be necessary to plan for additional or more highly qualified labour (programing the ESF, identifying sows, helping train the sows, etc.)[22]

There are various ESF systems available in Quebec. Models available at the time of writing are shown in Figure 2.

ACEMO ELISKOOL distributed by *Les Industries et Équipements Laliberté Ltée* (IEL)

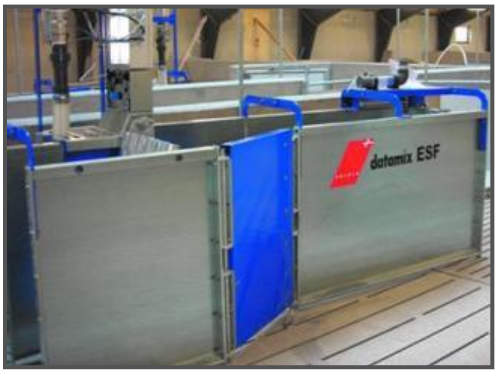
Big Dutchman Inc. © Call-in distributed by Distribution Jean Blanchard inc.

SowChoice System™ distributed by Canarm® AgSystems™

Nedap® Velos distributed by Conception Ro-Main inc.

Osborne Industries inc. TEAM® distributed by Ekipek

Schauer® Compident distributed by *Équipements G.D.L. Ltée* and *Distribution Godro inc*.



SKIOLD datamix distributed by Distribution ECHBERG

Figure 29 Various ESF systems available in Quebec

8.2 Feeding and watering

This system allows individual feeding for each sow, as determined by body condition and by physiological stage. In addition, some manufacturers offer the option of dispensing more than one feed item to the sow. This precision-feeding technique for gestating sows, in addition to better meeting the actual needs of each of the sows, also has the potential (in theory) to reduce the feeding cost by about $12/sow/year.[35] The CDPQ is preparing a research project to test, under commercial conditions, the true benefits (from a performance, body condition and economic standpoint) of precision feeding of gestating sows. Also, on certain ESF models it is even possible to dispense mineral supplements, medications and even Regumate® when the producer wants to do so. The producer can also consult herd data on a remote basis.

When a sow is in the ESF, the animal is completely safe from bullying and can therefore eat its feed ration worry free. On average, a sow takes 15 to 20 minutes a day to eat, with most consuming their ration in a single turn.[36]

8.2.1 Parameters to be defined for ESF systems

Producers have to define the following basic parameters to make the required adjustments and thus ensure that their feeding stations run smoothly: feed intake curves, number of meals per day, when the ESFs are open, feed drop size, interval between drops and amounts of water associated with the feed drops.

Feed intake curves

It is crucial to have at least three feed intake curves: one for thin sows, another for those in good body condition and a third for fatter sows. It is also recommended to have a curve for gilts.

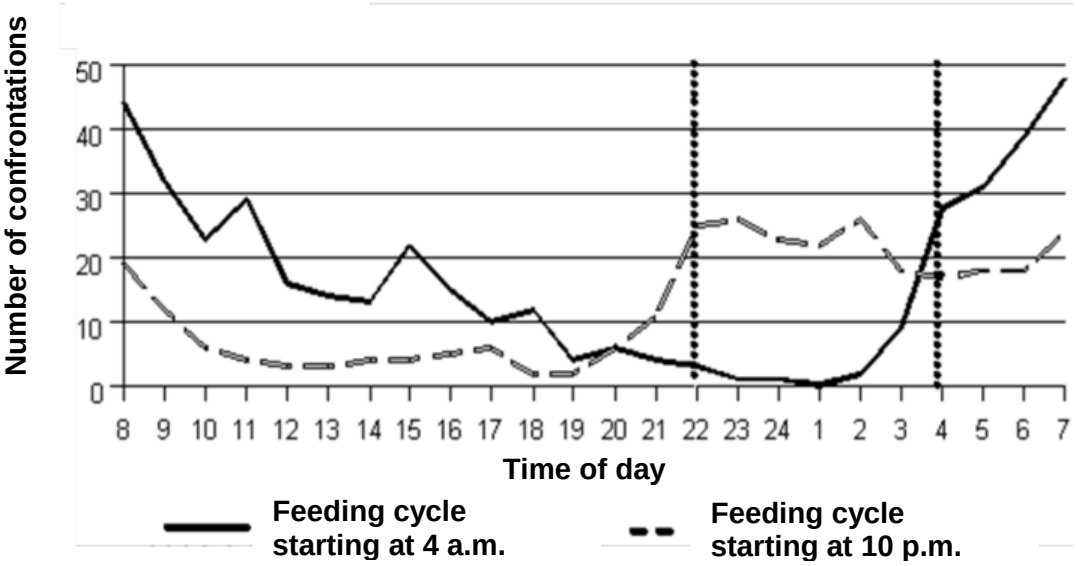
Some systems offer the possibility of creating an unlimited number of feed intake curves, which can prove useful for more extensive and precise management of sow body condition (e.g. thin gilt, fat gilt, cull sow, thin second parity, etc.). In addition, a feature in all the systems is to modulate the feed quantity per sow. A very thin sow could receive 120% of the ration indicated on the curve for thin sows. It's important to remember that more than one feed can be given to gestating sows (up to six, but typically one or two different types), so the number of curves can also be multiplied by the number of feeds.

Number of meals per day

In order to lower the level of stress inside the pen and the jostling among the sows waiting to enter the ESF, it is advised to reduce the number of sow visits to the feeding system. Producers are therefore advised to allow the sow to consume its entire ration in a single visit. Each sow has the choice to eat its ration in a single meal or in several meals. According to Hans Gerd Ulrich[37], over three quarters of sows eat their entire ration in a single visit to the feeding station.

ESF access hours

To reduce the jostling among sows waiting to eat, opening the feeding stations in the evening (start of a new day) is strongly recommended, as this is a period when the sows are typically less active. That way, less dominant sows can go eat while most of the other sows are sleeping. Furthermore, opening the ESF in the evening allows producers, when they arrive in the morning, to identify which sows have not consumed their ration. Figure shows the changes in the number of confrontations per hour according to whether the feeding cycle starts at 4 a.m. or 10 p.m. When it starts at 10 p.m., there is no point in the day where the number of confrontations exceeds 30 per hour, which is not the case when the ESFs are opened at 4 a.m. (over 30 confrontations an hour are observed between 5 and 9 a.m.). If the feeding takes place overnight, it is important to leave on some artificial lighting (it can even be low-intensity) so that the animals can see the entire room. Producers generally install lighting atop the ESF so that the sows won't be afraid to enter too dark a corridor.



Source: Adapted from Lisbeth Ulrich Hansen[33]

Figure 40 Number of confrontations by time of day for a feeding cycle starting at 4 a.m. and 10 p.m.

Size of feed drops

Feed portions weighing about 100 grams are recommended when feeding sows. Small portions allow the sow to consume a more precise quantity of feed. This is because if it leaves the ESF before eating its last dispensed feed portion, only 100 grams will not have been eaten. This feed is not wasted because the next sow will consume this quantity.

Most ESF models have a volumetric measurement feature. Therefore, the systems have to be calibrated regularly based on changes in the feed formula, since volumetric density varies by ingredients used.

Drop interval

A 30-second or so drop interval is recommended. The feed should be dispensed at a slightly faster pace than the time it takes the sow to consume the feed, but not by much. Intervals that are too short will cause the feed to accumulate in the bottom of the hopper. If the sow leaves the station for one reason or another, this feed will be considered to have been eaten by the sow, but in reality it is the following sow that will have eaten it. Conversely, intervals that are too long will cause the sow to wait for the feed to be dispensed and it might leave the ESF out of frustration.

In addition, this interval between drops should be more spaced out for gilts because their food intake is slower than that of sows.

Amount of water associated with feed drops and the feed intake curve

The amount of water dispensed by the ESF system can be used to facilitate feed intake and at the same time increases the sow's intake speed. Each feed drop must be accompanied by a water drop to obtain the desired feed consistency. It is important for the water pressure in the dispensing system to be consistent, because water volume is determined by how long the ESP-controlled electric valve is left open. Variations in pressure will also modify the amount of water dispensed per drop.

It should be noted that the water dispensed by the ESF system serves only to moisten the feed. It is crucial to have drinkers near the ESF exit to meet the sows' hydration needs. The drinkers should be placed at least 3 m (10 ft) from the ESF exit and also placed in the feeding or traffic area so that they do not disturb the sows' sleep. There needs to be one drinker per 25 to 30 sows if water is dispensed in the ESF, and at least two water points per pen. If the ESF system does not dispense water, the ratio of sows to bowls should then be 10 to 1. In addition, the recommended water flow is 3 litres per minute.[28]

One of the observations made during production is that sows drink very little water when fed in the ESF. Some sows do not bother to go over to the drinkers. Cases of under-consumption of water were observed (8-9 litres/day). Measures taken in experimental stations showed that the amount of water dispensed daily to the animals was smaller in operations with ESFs than in free-access stalls (8.2 and 12.6 litres/sow, respectively). Sows fed with the ESF system on a slatted floor were also significantly more likely to have nitrites show up in their urine.[38] Use of a water meter in buildings equipped with ESF systems should allow producers to track their herd's water consumption. If consumption is low at the drinkers, they should increase the amount of water dispensed with the ESF feed to ensure that the sow is consuming at least the minimum amount of water necessary to ward off urinary disorders.

8.2.2 Parameters to be defined for each of the sows

Once the basic parameters have been entered in the ESF computer system and everything is working correctly, the producer will no longer need to be concerned about the above parameters, unless problems come up.

However, the producer will have to enter the data for each of the sows with each gestation cycle. When a new sow enters the herd, it will have to be fitted with an electronic chip in its ear, and a personalized profile must be created for it containing its work number, location in the farm, date of entry in the herd, date of its last event and its feed intake curve by body condition. The system can also be programmed to mark the sow with the desired colour or to sort the sows for the events to occur during gestation (2nd gestation test, vaccines, vermifuge, transfer to farrowing, etc.).

For sows already in the herd, a producer will only have to choose the feed intake curve according to body condition, determine the location and enter any upcoming events.

Since ESFs operate with the help of a computer system, producers can enter this information just once, then apply it to all the sows from the same group. It is then only necessary to choose the feed intake curve for each of the sows.

8.3 Herd management with ESF

Working with sows in groups fed with the ESFs is very different than working with individual gestation stalls. With the ESFs, the sows eat one after the other and not all at once like in the other systems. Consequently, producers cannot use this time to watch over their sows. To do so, they have no choice but to walk about the pen, in the midst of the sows. Producers are urged to have the sows lifted at least once a day and to take the opportunity to check for lameness, body condition, vulva bites, etc., as these are indicators of a malfunction in the ESF rear doors or of a poorly laid out pen.

The consumption list is an essential tool in managing the sow herd.[36] To ensure that all the sows have consumed their daily ration, each day the producer must get a list of the sows that did not consume their entire ration from the ESF computer system. These sows must then be identified on the farm and a rapid intervention must be carried out, if applicable (checking their general condition: sickness, leg pain, loss of ear tag, sluggishness, etc.). If no problems are detected, producers generally wait until the sow underconsumes two days straight before guiding it to the stations.[36] Producers must check the number of trips sows make in the ESF per day. A sudden spike or drop in the number indicates that something has happened (lack of feed in an ESF (empty meal), entry door, electronic chip reader or detector of defects, water problem, a number of ill sows (PRRS, influenza, etc.), mix of sows, etc.).

Some ESFs can make it easier to manage sows in groups. Here are some ESF features offered by certain manufacturers, which either come standard or as options:

- Distribution of vitamins, minerals, supplements, medication;
- Distribution of Regumate® to synchronize sow or gilt heat;
- Marking the animals with different colours for a variety of reasons (vaccines, 2nd ultrasound test, move to farrowing, etc.);
- Sorting out the animals for the same reasons as stated above;
- Detection of heat and returns with the help of an antenna placed in the boar pen adjoining the sow pen. This system is used to register the number of visits and the amount of time each sow spends in nose-to-nose contact with the boar. A sow in heat will be very interested in the boar and will thus spend more time near him and near the antenna;
- Portable electronic chip readers to identify a sow in a pen;
- Hand-held terminals can be used to modify, right in the pen, certain parameters for tracking sows individually (change in feed intake curve).

8.3.1 ESF system and the learning period for gilts

The sows need time to adapt to their new environment. They need to be given the time to access the ESF.[6] It is also essential to include a learning period for the gilts. Over 99% of gilts are capable of learning how ESF works, but a learning period is necessary for success. On average, they need between three and seven days to understand how the system works and the earlier they learn, the easier it will be. So it is recommended to carry out the learning period in quarantine if the number of sows is sufficient, or in acclimatization. The benefit of acclimatization is that biosecurity-related constraints are not present; the producer can go see how the gilt training is going several times a day and, for example, move the gates around and then go about his daily chores for the rest of the day. When the training is done in quarantine, the producer cannot return to the main herd. In that case, the training strategy would have to be different.

A number of methods can be used for sow learning. Some manufacturers recommend the use of dummy ESF stations and a pen setup that has the food on one side and the water on the other (Figure 41).

Figure 41 Gilt training with a dummy ESF station

This requires the gilts to pass through a narrow corridor with gates resembling the ESF ones. This method is less expensive, but the gilts will still have to go through a second learning period to be fed in a real ESF.

The other alternative is to use a real ESF specially designed for this function.

The way the learning pen is set up is very important. The ESF must be situated in the centre of the pen, which must contain several movable gates so that the pen configuration can be changed as needed (Figure 42).

Figure 432 Gilt training with an ESF

The recommended method consists of reducing the floor space for gilts with the help of gates. First, the pen must be divided in two using the gates, such that all the gilts are on the ESF entrance side. The lack of space and their natural curiosity will get them to enter the ESF. That way, it is easy to see which gilts have gone through the feeding station because they will have got there from the other side of the pen. After a while, once about half the gilts have gone through, the producer must once again reduce their space to get them to go through and, at the same time, increase the space for those that have already gone through.

Once only a few gilts remain on the ESF entry side, they must be manually led into the ESF. Producers must ensure that the sows and gilts do not have a bad experience during this learning phase, because they might refuse to enter the ESF.[37] That is why the workers assigned to train the sows must be very good at handling them, in addition to being very patient.[37] All it takes is to repeat these few steps until all the gilts have understood how the ESF works. This usually takes from three days to a week for most gilts.

To facilitate the learning process, it is very important to refrain from distributing feed outside the ESF. Furthermore, it is recommended that the ration be reduced the day before as well as the day the gilts arrive at the ESF so that they are hungry and on the lookout for food. One last extremely important point: during the learning period, the feed ration should be split into several meals to reduce the time spent in the ESF and to be able to carry out the same floor space reduction strategy several times per day. This will speed up the gilts' ESF learning process.

At the beginning of the training period, the ESF access gate can be kept open and the feeding stations should be sufficiently lit to encourage the sows to explore.[39]

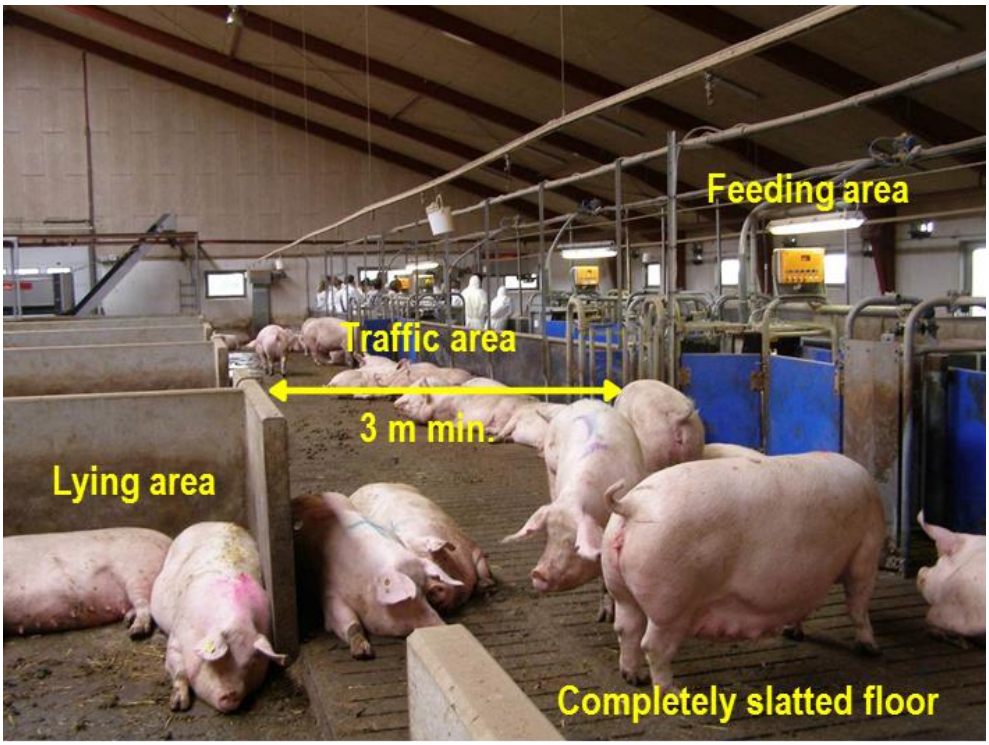
8.3.2 ESF grouping

It is preferable to group the sows after more than 28 days following breeding. This strategy allows the producer to take advantage of this period when the sows are in stalls to get them into good body condition and also proceed to the first gestation test. This avoids grouping non-gestating sows.

Regarding the best time for producers to proceed to grouping, producers may have a number of considerations, such as work conditions, the desire to keep some of the equipment that is already in place, desired outcomes regarding sow reproduction (whether they are grouped or not following insemination) and respecting the specifications that ban the restraint of sows during the first 28 days of gestation.[36]

8.4 Pen setup for ESF

The way the pen is set up for ESF is very important if the system is to run smoothly. The pen must have three separate living spaces, namely a lying area, a passageway and dunging area and a feeding area (Figure 43). If these areas are not kept separate the sows will become confused, which could result in dirtier pens, dirtier sows and more aggression among them.



(Photo: Lisbeth Ulrich Hansen, Pig Research Centre)

Figure 43 Pen setup for ESF

8.4.1 Lying area

The lying area floor can be made of solid concrete, fully slatted or strawed. The cost of straw in Quebec is high. Its use requires more handling, which translates into more labour. Also, this choice is likely to be unpopular here.

Figure 44 Lying area on solid concrete

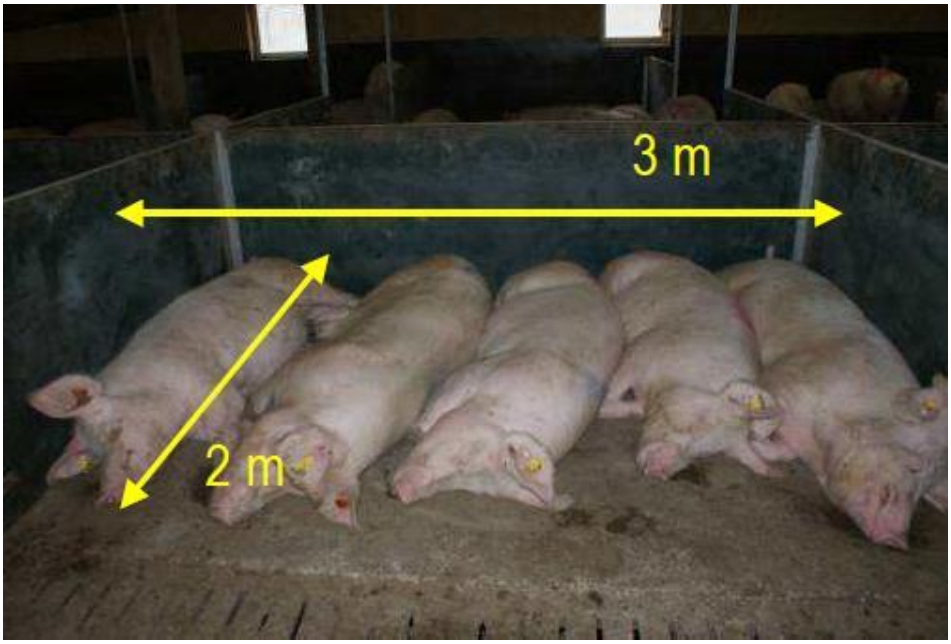
When they have the choice, sows prefer a solid, concrete floor to sleep on. The main advantage of a solid floor (Figure 44) is that sows won't feel a current of air coming from the culverts, as can be the case with a slatted floor. On the other hand, solid floors have a tendency to get dirtier when the ambient conditions (temperature and air current management) are not good and the sows relieve themselves there. Also, the lying area must not be situated in a passageway area. Feces- and urine-soiled floors are more slippery and increase the risk of injury or locomotion problems. In that case the floors must be scrubbed regularly and the ventilation must be adjusted to resolve this problem.

Completely slatted floors (Figure 45) ensure that the pens and sows are kept cleaner. But it is important the slats be properly installed.

Figure 45 Completely slatted lying area

The lying area must be divided into small resting places to increase the wall surfaces, because sows prefer to lie along these. Furthermore, when there are large groups the sows form subgroups that cohabit throughout gestation.

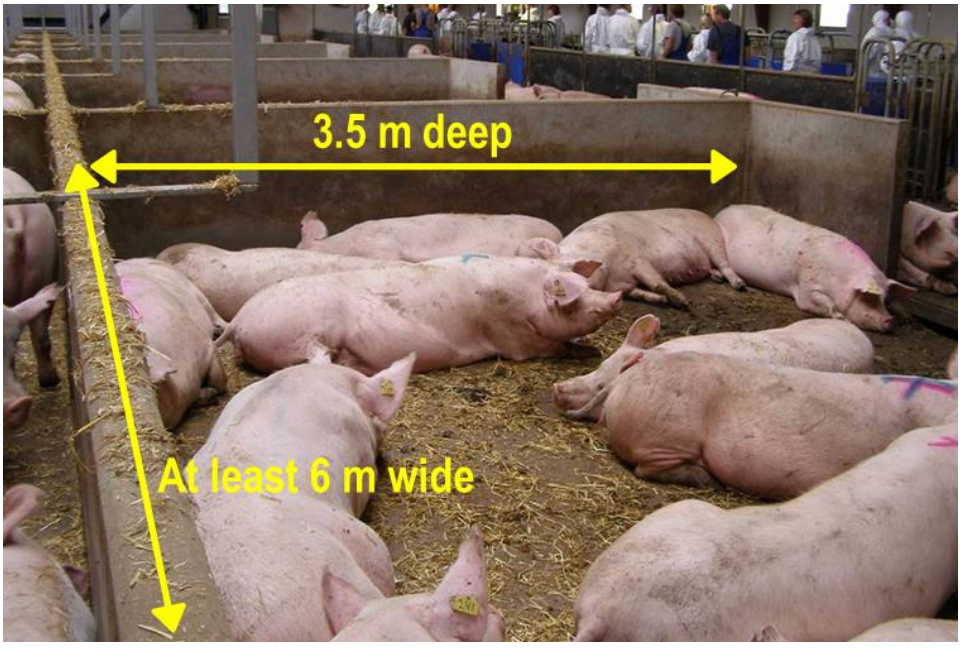
According to the *Chambres d'agriculture de Bretagne*, the ideal resting place size is 2 m deep by 3 m wide (about 7 ft x 10 ft) (Figure 46). A resting place of this size allows five sows to rest side by side. Also, producers must avoid positioning the passageways along the walls, because the sows will rest alongside these and disrupt traffic flow. The passageways between resting places should measure at least 2.5 m (8 ft).



(Photo: Yannick Ramonet, *Chambres d'agriculture de Bretagne*)

Figure 46 Resting place dimensions recommended by the *Chambres d'agriculture de Bretagne*

The Denmark Pig Research Centre recommends larger resting places to avoid turning passageways into floor space that the sows don't use. Their recommendation is 3.5 m (11 ft 6 in) deep by 6 m (20 ft) wide with an entrance measuring at least 3 m (10 ft) (Figure 47).



(Photo: Lisbeth Ulrich Hansen, Pig Research Centre)

Figure 47 Ideal resting place dimensions

8.4.2 Passageway/dunging area

The passageway and dunging area connects the lying areas and the ESFs. Its floor must be completely slatted (Figure 48).

Figure 48 Passageway measuring 10 ft (3 m) wide with 2 water bowls

This passageway must be at least 3 m wide (about 10 ft) to ensure good flow in the pen. In France, they prefer to have 4 m (about 13 ft) between the lying areas and the feeding stations, especially when the passageway doubles as a waiting area for sows wanting to eat.

Watering points need to be installed in the passageways and waiting areas (Figure 9). There must be one drinker per 25 to 30 sows. Watering points should be situated near the ESF exit (about 3 m (10 ft)) or on the curbs separating the lying area and passageway to ensure that the sows don't lie along these curbs. They must also be well distributed in the passageway so that the sows won't have to cross the entire pen to drink.

Figure 49 Passageway and waiting area for sows feeding at the ESF

8.4.3 Feeding area

This is the area where the feeding stations are. When laying out the pens, producers must always keep in mind the need for the sows to move fluidly within the pen. It is recommended to maintain a space free of any obstacles within a 3 m radius (about 10 ft) in front of the entrance and the ESF exit so that the sows won't lie there. It is also recommended that openwork dividers be located in these areas (Figure). Also, there should be a distance of at least 2 m (6 ft 6 in) between the station entrances, and all the gates must be one-way so that the sows won't head in the wrong direction into the ESF. Clamps that prevent lying down can also be installed on the floor (Figure 51).

Figure 50 Openwork divider in front of ESF in feeding area

Figure 51 Clamp preventing lying down installed on floor in front of ESF exit gate

When there is more than one ESF in the pen, various layouts are possible. The stations can be grouped together at an angle. Under this configuration, the ESFs are placed side by side and the exits open onto a common corridor as shown in Figures 52 and 53 or on the other side of the pen.

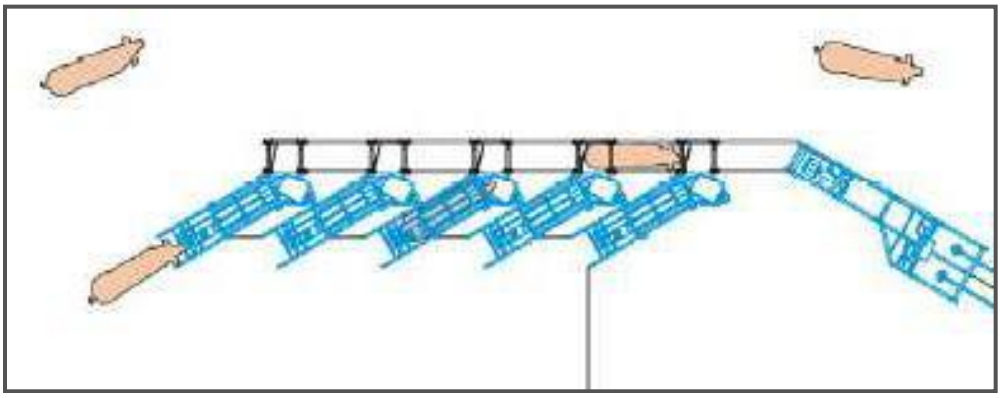


Figure 52 Angled ESF configuration

Figure 53 Sows enter the ESF on one side of the pen and exit the other side

This configuration limits the incidence of sows passing through for non-feeding purposes, since the exit is far from the station entrance. But it does require the sow to travel a long way to eat and then return to the lying area. The common corridor is usually fitted with a sorting station used to isolate certain sows. This type of setup is often seen in a dynamic management scenario.

The other option for configuring the stations is called isolated stations (Figure). Each station has an entrance gate and exit gate. Some manufacturers offer ESFs that come with a sorting system for each of the stations.

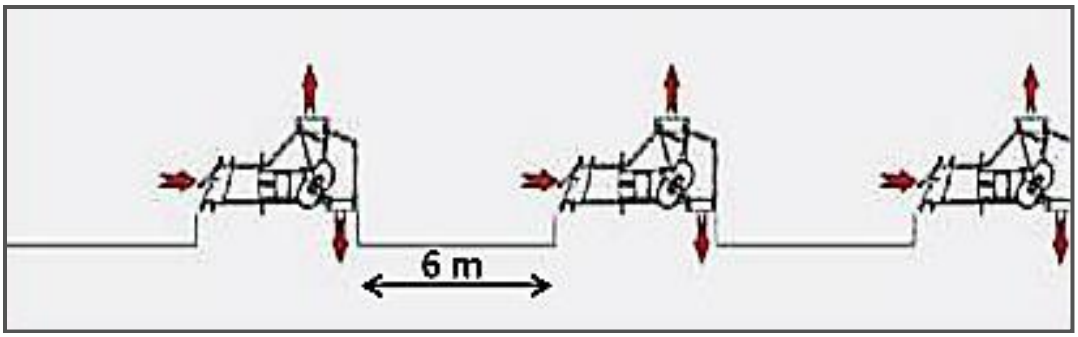


Figure 54 ESF configuration in isolated stations

The basic principle for this type of layout is the short circuit, which is to say that the sows have access to a station near their lying area and don't have far to travel for feeding. If there is enough space, producers should aim to have about 6 m (around 20 ft) between stations. In order to facilitate sow traffic, the ESF entrances and exits should face one another, so that a sow won't exit one station and enter the other immediately after.

8.4.4 Hospital pens

Producers can count on about 5% of the group's sows to require isolation during gestation for a variety of reasons: leg pain, illness, overly dominant behaviour, inactivity (not eating or drinking), etc.[33] The areas used to isolate the sows must be as close as possible to the pen; in fact, they should form an integral part of the pen (Figure 55).

Figure 55 Hospital pens integrated into ESP pen or isolated, but near the pen

8.4.5 Presence of Boars

With stable groups that have been together for more than 28 days, a boar's presence near the sows is less important because the sows are diagnosed as gestating before being placed in the group. But when they are grouped before the gestation test or if the group is dynamic, it is interesting to house a boar in a pen adjoining the sows' pen. If there is more than one group of sows, the boar's pen should be situated between the two pens. An antenna can be installed to detect the presence of sows interested in the boar (Figure 56).

Figure 56 Heat detector in ESF setups

This detector counts the number of visits and the time spent by the sows near the boar. According to the parameters entered in the computer system, the system will identify on-screen which sows are in heat and can even mark them on-site or sort them during their next turn in the ESF.

8.4.6 Sorting area

This area is used to isolate the animals in order to carry out specific operations (ultrasounds, vaccinations, move to farrowing, etc.). The sorting area is vital when a dynamic management approach is being used for the herd. Depending on how the feeding stations are configured, the passageway can be used as a sorting area (Figure 57). But it must be at least 1.5 m wide (5 ft) to allow the sows to turn around easily, it must have the required number of drinkers and it must be long enough to provide a surface measuring 1.3 m^2/sow (14 ft^2/sow) for all the sows in a group.

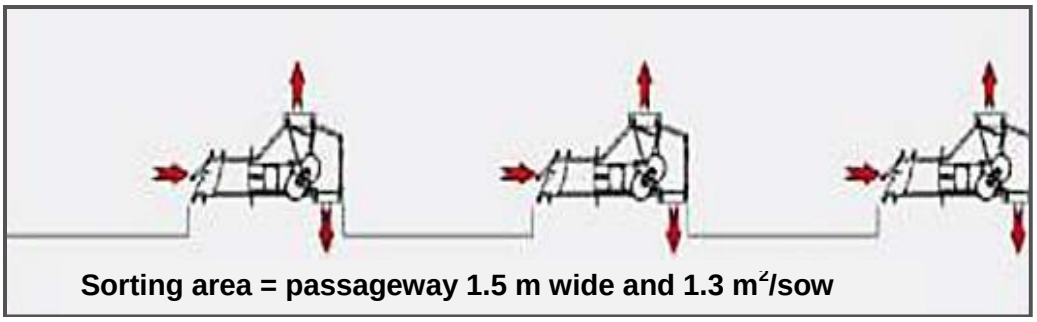


Figure 57 Passageways serving as sorting area

The other possible setup is to have a sorting area integrated into the pen (Figure 58). In this scenario, producers must allow 1.2 m^2/sow (about 13 ft^2/sow) and size this area so that an entire group of sows can be housed there. Drinkers must be available in this area.

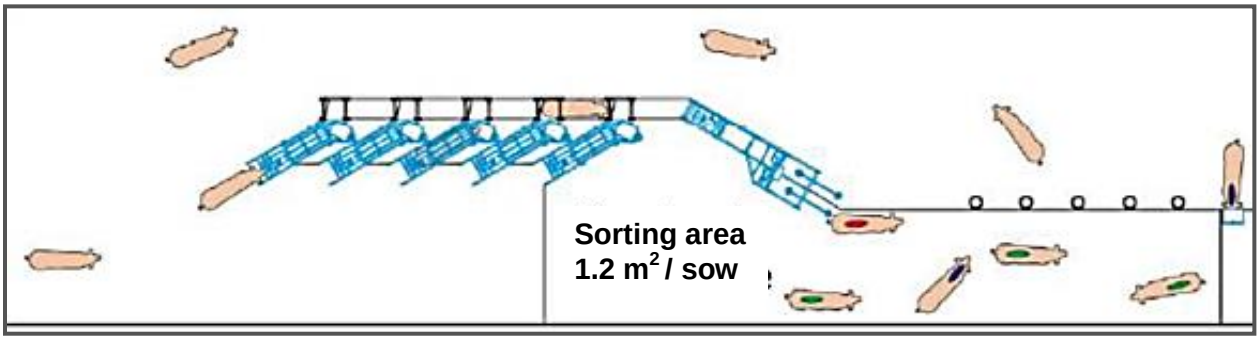


Figure 58 Sorting area integrated into pen

8.4.7 Pass-through gates

Pass-through gates allow the stockperson to enter and exit the pens without having to open and close any of the gates (Figure 59). This makes the work easier because in order to be able to properly manage grouped sows using ESFs, it is essential that the producer circulate about among the herd. This is an essential work tool, because it has been observed that sows are much calmer when the stockperson circulates regularly among them.

Figure 59 Examples of pass-through gates

8.5 Cost of system

The ESFs make it possible to optimize the use of the building's total area, as the entire pen space can be used by the sows and the groups typically consist of over 40 animals. The cost of a station ranges between $10,000 and $17,000, depending on the manufacturer and which options are chosen. This system is less advantageous when the ratio of sows to stations is not optimized (50 to 80 sows per ESF). Given the number of mechanical parts and system hardware, the cost of maintaining the ESFs should also be taken into account.

In the project carried out by the CDPQ in 2014[3], two farms that transitioned to group management of sows with an ESF feeding system were visited. The data is available in Table 15.

Table 15 Data from two farms that transitioned to group management of sows – ESF

	Farm 1	Farm 2
Before	Farrow-to-finish	Farrow
After	Farrow	Farrow
No. of sows	+ 175%	+ 140%
Changes in herd management	Batch every two weeks to batch every four weeks	No change
Change in building	Finishing transformed into group gestation	Construction of group gestation + farrowing rooms + quarantine
$/spot in the group*	532	$1,815/ sow in additional stock

*Cost of labour not included

9. Free access ESF

9.1 How the free access ESF works

In this system, each sow is identified with the help of an electronic ear tag. To eat, the sow has to enter the feeding station. Contrary to the standard ESF, sows have to enter and leave by the same gate.

Once inside the feeding station, the sow is identified by the system. If it hasn't eaten all of its daily ration, the feed is distributed. This is done in drops of about 150 grams every 30 to 60 seconds. These parameters can be modulated and must be adjusted to sync up with the sow's intake speed. To avoid feed waste and ensure that the feed dispensed has indeed been eaten by the sow in the station, the system regularly checks whether it is still reading the sow's electronic chip before giving it more feed. Contrary to the standard ESF system, water is not dispensed at the same time as the feed. Also, a clamp that prevents the sow from lying down is placed in the stations so that the sow doesn't stay there too long (Figure).

Figure 60 Clamp preventing the sow from lying down installed in free access ESF

The aim of both measures is to get the sow to exit the feeding station. The sow doesn't have any incentive to leave the stall with this system. This is different from the standard ESF where it is pushed out of the ESF by the next sow due to the entrance gate opening once the ration has been consumed in its entirety. Once its meal is finished, the sow has to back up to leave, since it always has to use the same gate.

This new feeding system, making it possible to individually feed sows in a group, is easily adaptable to both small- and large-sized farms. The ratio of sows to feeding system is about 15 to 20 per device, instead of 50 to 60 with the standard ESF. The main benefit of this system is that it allows several sows to eat at the same time: the number of sows varies by the number of stations there are. At the start of the feeding sequence, the sows most motivated to eat can access the stations at the same time, which cuts down on their waiting time. The total time needed to feed the entire group is lower than with a standard ESF.

Two free access ESFs are now available in Quebec to individually feed sows in groups. One is manufactured by Jyga Technologies inc. and the other by Industries et Équipements Laliberté Ltée (IEL). Each company uses the same feeding concept, i.e. a free-access stall that protects the sow while it is eating. The front of the free-access stall features a feeding system capable of individually identifying and feeding each of the sows in the group. The difference between the IEL and the Jyga Technologies inc. models lies in the free-access stall, since the mechanisms are different.

9.1.1 Gestal 3G free access ESF by Jyga Technologies inc.

The new free access ESF marketed by Jyga Technologies inc., the Gestal 3G station, was developed as part of a joint venture by the Centre de développement du porc du Québec inc. (CDPQ) and by Jyga Technologies inc. in 2013-2014[40] (Figure 61). This system consists of three known technologies, namely a free-access stall manufactured by the Danish company Vissing Agro; a Gestal Solo feeding system for lactating sows manufactured by Jyga Technologies inc. that has been adapted; and an antenna for reading the electronic chip in each sow's ear tag (Figure 62).

Figure 61 Gestal 3G free access ESF by Jyga Technologies inc.

Figure 62 Composition of free access ESF for gestating sows in groups sold by Jyga Technologies inc.

9.1.2 IEL's free access ESF

IEL's new free access ESF (Figure) consists of three known technologies, namely a free-access stall of their own design; an IEL "accu feed" feeding system for lactating sows that has been adapted; and an antenna for reading the electronic chip in each sow's ear tag (Figure 4).

Figure 63 Free access ESF by IEL

Figure 64 Composition of free access ESF marketed by IEL

9.1.3 Difference between the free access ESFs sold by IEL and Jyga Technologies inc.

The main difference between the two systems lies in the free-access stall mechanism. In both cases, the sow activates the mechanism that closes the gate behind it to protect itself from the other sows while it is feeding. The sows only need to back out to exit the feeding stations.

The operating principle for IEL's free-access stall is presented in Figure .

Sow can enter only if the stall is open

The sow must push the metal gate near the hopper

This causes both small “western” gates to close behind the sow

Figure 65 Operating principle for IEL’s free access ESF

The operating principle for the free-access stall manufactured by Jyga Technologies inc. is presented in Figure 66.

Entry possible only if stall is open

Sow must push on metal bar at back of stall

Which causes gate to close behind the sow

Gate locks automatically

Figure 66 Operating principle for the free-access stall manufactured by Jyga Technologies inc.

Based on the manufacturers’ recommendations and the study conducted by the CDPQ[40], the ratio of sows to a station ranges from 15 to 20 sows. Sows’ feeding behaviour is not the same when there are one or more feeding stations in the pen. The current recommendation is to lower the ratio to about 15 sows/station when there is just a lone feeding station in the pen, and to have a ratio of 20 sows/station when there is more than one station. Further research is necessary, however, to determine the optimal ratio by group size, number of stations and pen layout.

It should be pointed out that gilts consume their ration more slowly when learning how the system works; gilts also eat more slowly than multiparous sows and when it is learning how the system works. Where possible, gilts should be separated from sows to avoid hierarchical problems.

9.2 Feeding and watering

This system allows each sow to receive individualized feeding according to its body condition and physiological stage. In addition, some manufacturers will soon introduce a feature allowing more than one type of feed to be dispensed to the sow.

When a sow is in a free access ESF, it is completely safe from bullying and can therefore eat its feed ration worry free. On average, a sow takes 15 to 20 minutes a day to eat, with most consuming their ration in a single turn. However, since there is no incentive to get the sows to leave the stations, the average amount of time a sow stays in the feeding station per day is about 33 minutes. That is why the ratio of sows to a station is a lot lower than in the standard ESF system.

9.2.1 Parameters to be defined for free access ESFs

Producers must define the following basic parameters to make the necessary adjustments to ensure that their feeding stations are working well: feed intake curves, number of meals per day, feeding day switch-over times, size of feed rations (Gestal 3 G only) and interval between drops.

Feed intake curves

It is essential to have at least three feed intake curves: one for thin sows, another for those in good body condition and a final one for fatter sows (Figure 67).

Since both systems allow producers to create a large number of feed intake curves, it is recommended, for more extensive and precise management of sows' body condition, to have nine different curves: three for gilts (thin, good body condition and fat); three for sows with two parities; and three for multiparous sows. This is necessary because energy and protein needs are not the same for these three categories of sows. Also, all the systems make it possible to modulate the quantity of feed per sow. A very thin sow could receive, say, 120% of the indicated ration on the thin sow curve.

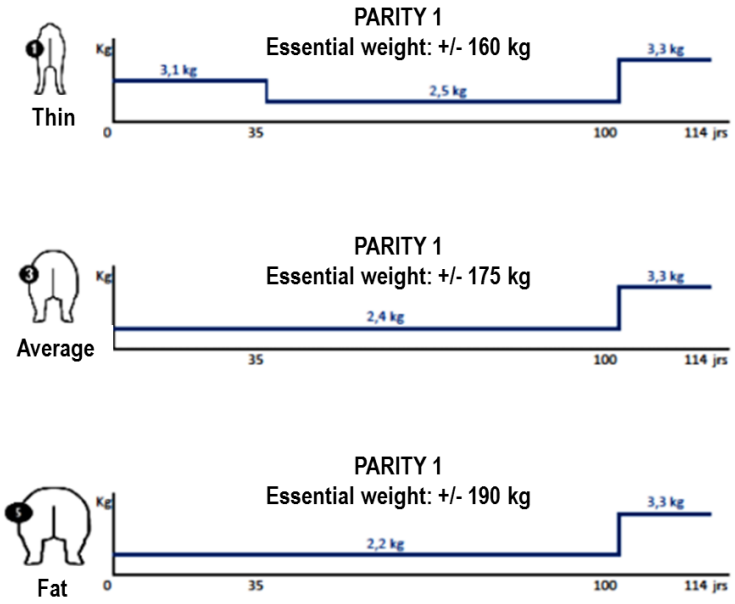


Figure 67 Sample feed intake curve for parity 1 sows proposed by Jyga Technologies inc.

In the near future it will be possible to dispense two different feeds or to even dispense a mixture of two different feeds directly from the free access ESF. This precision feeding technique for gestating sows, in addition to allowing producers to better meet each of the sows' real needs, could potentially (in theory) lower the feeding cost by some $12/sow/year.[35] The CDPQ is preparing a research project to test, in commercial conditions, the actual benefits in terms of performance, body condition and economic impact of precision feeding of gestating sows.

Number of meals per day

In order to lower stress levels inside the pen and reduce aggression among the sows waiting to get fed, it is advised to reduce the number of times sows enter the free access ESFs. Producers are therefore advised to allow the sow to eat all its meal in a single visit. According to the study by the CDPQ[40], once the sows are used to being fed with this system, the average number of visits to the station per sow per day was 1.12, which means that most of the sows eat only once a day and a few visit the stations two or more times a day.

Feeding day switch-over times for free access ESFs

To reduce aggression among sows waiting to eat, producers are urged to start a new feeding day in the evening or during the night, a period when the sows' normal activity is lower. This way, less dominant sows can go eat while most of the rest are sleeping. Also, switching over to a new feeding day during the evening allows producers to verify, late in the morning, which sows have not consumed their daily ration.

Size of feed drops

Feed portions weighing about 100-150 grams are recommended when feeding sows. Small portions allow the sow to consume a more precise quantity of feed. This is because if it leaves the free access ESF before having eating its last dispensed feed portion, only 100-150 grams will not have been eaten. This feed is not wasted, because the next sow will consume this quantity.

Both manufacturers of these free access ESFs calculate feed quantities by volumetric drop measurements. Therefore, the systems have to be calibrated regularly, since volumetric density varies by ingredients used.

Interval between drops

A 30-60-second or so drop interval is recommended. The feed should be dispensed at a slightly faster pace than the time it takes for the sow to consume the feed (so that it is not waiting for the feed to be dispensed), but not too fast or else large quantities of the feed will accumulate in the bottom of the hopper.

In addition, this interval between drops should be more spaced out for gilts, because their food intake is slower than sows'.

9.2.2 Water

Free access ESFs do not dispense water, in order to encourage the sows to leave quickly after they finish their meal.

It is crucial to have drinkers or nipple drinkers near the free access ESFs to meet the sows' hydration needs. The drinkers should be placed in the feeding or traffic area so that they do not disturb the sows' movement within the pen. Also, it is essential to place the watering points above a fully-slatted section of floor. Sows normally relieve themselves near watering points. There needs to be one drinker per 10 to 15 sows and at least two watering points per pen where possible. In addition, the recommended water flow is 3 litres a minute. [28]

9.2.3 Parameters to be defined for each of the sows

Once the basic parameters have been entered in the free access ESF computer system and everything is working fine, the producer won't have to worry about the above parameters anymore, unless there are problems.

However, the producer will have to enter the data for each of the sows, with each gestation cycle. When a new sow enters the herd, it will have to be fitted with an electronic chip in its ear and a personalized profile must be created that contains its work number, location on the farm, date of entry in the herd, date of its last event and its feed intake curve by body condition.

For a sow already in the herd, the producer need only choose the feed intake curve by body condition and determine its location. The information needed to be entered into the system may vary by manufacturer.

9.3 Herd management with free access ESFs

Working with sows in groups fed with this system bears no resemblance to working with individual gestation stalls, but is very similar to working with the standard ESF system. With free access ESFs, several sows can eat at the same time depending on the number of stations in the pen, while the other sows eat one after the other. This differs from competitive feeding systems or free-access stalls, where the sows eat all at once. Therefore, the feeding period cannot be used to observe the sows. Instead, producers have to walk around the pens. It is highly recommended to have the sows lifted at least once a day to check for lameness, body condition and vulva bites, the latters being indicators that something is not right within the group.

To ensure that all the sows have consumed their daily ration, the computer system must be programmed to produce a list of the sows that did not consume the entire ration. These sows must then be identified among the grouped gestating sows and a rapid intervention must be carried out, if applicable (to check their general condition: sickness, leg pain, loss of ear tag, sluggishness, etc.). The feeding history for these sows must also be checked to make sure that everything is correct.

To facilitate the management of sows with this feeding system, producers are urged to have a portable chip reader to locate sows in the pen. Also, a hand-held terminal can be used to modify, right in the pen, certain parameters for tracking sows individually (change in feed intake curve, location, etc.), making it easier to manage gestating sows in the group.

9.3.1 Training the sows and gilts with free access ESFs

A training period is essential for gilts and sows being fed by this system. Even if this system is new, it has been observed that it is much easier and quicker for the animals to learn this system than the standard ESF system. To make it easier for the sows to learn how to use free access ESFs, the training pen must contain a number of stations (ratio of 7 to 10 sows per station) (Figure 68). Pigs are gregarious animals and learn a lot through imitation. Therefore if there are several stations in the same pen, the chances that a station will be free are a lot greater.

Figure 68 Training pen with several free access ESFs

It only takes one sow to enter a free access ESF and to eat there for the other sows to imitate that sow and go eat there as well. That is how learning takes place. In general, the earlier the learning, the easier it will be. Producers are therefore advised to do this before proceeding with breeding so as to reduce the adverse impact of missed meals and of group- forming stress on sow performance.

Training should be done in quarantine if the number of sows is sufficient or, ideally - if space permits - in acclimatization. The benefit of doing it in acclimatization is that physical and health-related constraints are absent since this section is located in the main building.

During the training period, since the sows or gilts will not yet know how the system works, it is recommended to reduce the amount of food dispensed per sow and that the feed not accumulate in the bottom of the hoppers. The aim of this is to keep the sows hungry and to avoid wasting feed.

To facilitate the learning process, it is very important to refrain from distributing feed outside the free access ESFs. Producers are also advised to lower the ration the day before and not to feed the animals the day they are grouped so that the gilts and sows are hungry and looking for food.

In the study conducted by CDPQ[40] with this type of feeding station, a training pen containing 40 sows was set up with six feeding stations, generating a low ratio of sows per station. This is necessary to provide the sows with several opportunities to access the stations during the learning phase. Culled sows took part in these trials and even these sows successfully learned how to access the feeder without help from the farm staff. Of the nearly hundred sows that had passed through this section, only one needed human intervention during the learning process. Other data and observations must be collected to determine the success rate and the

percentage of sows and gilts that might have trouble learning how the system works, and also to develop the optimal training strategy. It is clear, however, that the training pen must contain at least two stations; if there are more, learning will be even easier.

9.3.2 Grouping with free access ESFs

It is preferable to group the sows at least 28 days after breeding (end of embryonic implantation period) and thus take advantage of this period when the sows are in stalls to get them back in good body condition and also proceed with the first gestation test. This also avoids grouping non-gestating sows.

It was also observed during grouping with this system that some sows use free access ESFs to protect themselves and hide from dominant sows during the fights that occur in the first hours. During this period, the sows are stressed and their attention is focused on determining the hierarchy within the group. Sows that take refuge in the free access ESFs remain inside them for hours. In such cases, even though their ration has been dispensed they do not eat, because their attention is on other things. These sows will continue to act this way for a few days and will occupy the free access ESFs for lengthy periods, not in order to eat but to keep safe.

So, to avoid this type of behaviour, even though other observations and trials are needed, producers are advised to deny the sows access to the free access ESFs during the first 3-4 hours to allow time for the hierarchy to become established through confrontations and fights.

9.4 Pen layout with free access ESF

Pen design and layout are extremely important to avoid confusion within the group. As is the case with the standard ESF system, the pen containing the free access ESFs must consist of three separate areas: a feeding area, a traffic area and a rest area (Figures 69 and Figure 70).

Figure 69 Pen layout with IEL free access ESFs

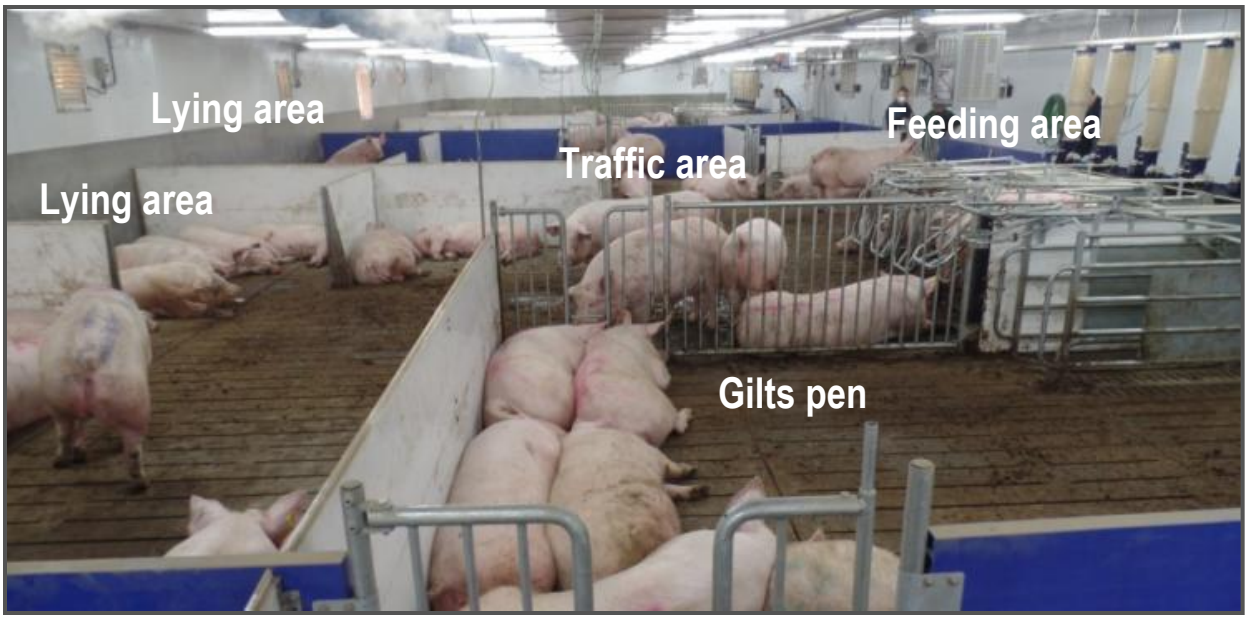


Figure 70 Pen layout with free access ESF by Jyga Technologies inc

The feeding area is where the free access ESFs are located. The floor in this area should ideally be slatted, or at least from the rear section of the feeding stations.

The traffic area, as its name indicates, allows the sows to easily move about the pen. This area should be at least eight feet wide, but ideally ten feet wide depending on the pen configuration. The floor in this area should ideally be slatted, because this is the area where the sows do their business. Also, this is where the watering points should be positioned, not far from the free access ESFs. Since the ESFs do not dispense water, the ratio of sows per bowl is about 10 to 15. Also, the recommended water flow is 3 litres per minute.[28]

Lastly, the rest area is where the sows lie down, so it must be designed with tranquility and comfort in mind. Small resting places of about 6 to 7 feet (1.83-2.13 m) deep by about 10 ft (3 m) long (Figure 71) are preferable to larger ones (10 x 20 ft) (3 X 6 m), because they allow the sows to get around easily within the pen without disturbing the other sows in the rest area. Also, since sows like to lie along a wall or a pen divider, small resting places are better suited than large ones. The floor in this area can be made of solid concrete or of slats, but sows prefer to lie on a solid surface.

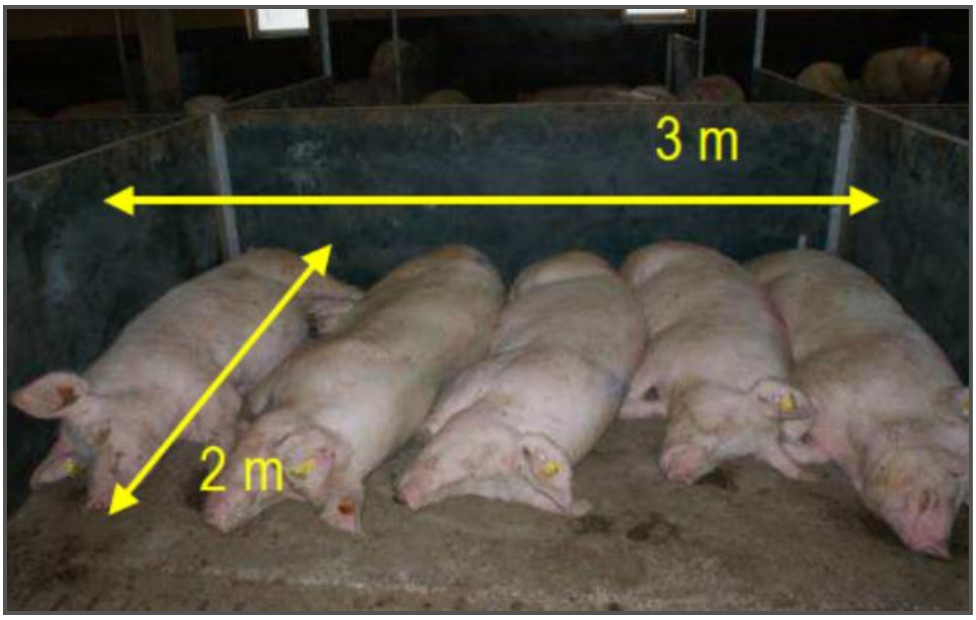


Figure 71 Recommended resting area dimensions

Also, ventilation must be designed in such a way as to avoid air blowing directly on the sows during the cold season but to direct air to this area in the summer.

If these areas are not set up properly, or if the pen is poorly configured, the sows will be confused about these various areas and will not use them for their intended purposes; they will relieve themselves anywhere in the pen.

9.4.1 Modifications to gestation stall units to house sows in groups with free access ESFs

The first step in the transformation was to take down all the equipment contained in this gestation room: gestation stalls, pen dividers, dispensers, feed drops and automatic feeders. The stainless steel troughs were then removed and the concrete underneath was redone in order to obtain a level surface.

The next step was to fill the fertilizer “holes” on the concrete gestation slats. This was done with the help of long metal plates and stainless steel rivets specially designed for concrete (Figure 72). The use of rivets instead of U bolts helps provide a far smoother floor surface and at the same time lowers the risk of leg injuries, since there is no bolt head jutting out over the metal plate.

Figure 72 Use of stainless steel rivets and long metal plates to fill the fertilizer “holes” on the gestation slats

Once the work on the floor was completed, the equipment (free access ESFs, clamps to prevent sows from lying down, automatic feeder and drinkers) and the pen dividers made of PVC could be installed. To ensure the solidity of the pen dividers between the resting places, the poles used to hold these up could be solidly anchored into the floor and also the ceiling (Figure 73-a). Another method to solidly anchor the dividers between the resting places is to add onto the end of the divider, a small partition perpendicular to it, to form a T structure (Figure 73-b).


a)

b)

Figure 73 PVC pen dividers with poles right up to the ceiling (a) and a T structure (b) to keep them solidly in place

9.4.2 Hospital pens

In the standard ESF systems, allowances must be made for the roughly 5% of the group's sows that will need to be isolated during gestation for a variety of reasons: leg pain, illness, overly dominant behaviour, etc.[33] Since the free access ESF works much the same as the standard ESF, in which the sows have to move to a location to get fed one after the other, it is safe to assume that about the same proportion of sows will need to be removed from the group for these same reasons. These areas that are used to isolate the sows should be as close to the pen as possible, and should even form an integral part of the pen where possible (Figure).

Figure 74 Hospital pen located in close proximity to sow group

9.4.3 Presence of boars

Because of the low ratio of sows to self-locking ESFs and the fact that the sows have to enter and exit by the same gate, this system calls for the static method of group handling. Also, if groups are formed after the diagnoses of gestation have been made, keeping the boar close to the sows is not necessary because only gestating sows are grouped. However, when grouping is done prior to the gestation test, it would be useful to house a boar in a pen adjacent to the one the sows are in. If there is more than one group of sows, the boar's pen should be located between the two sow pens.

9.4.4 Pass-through gates

Pass-through gates allow the stockperson to enter and exit the pens without having to open and close any of the gates (Figure 75). This makes the work easier because in order to be able to properly manage grouped sows using ESFs, it is essential that the producer circulate about among the herd. This is an essential work tool, because it has been observed that sows are much calmer when the stockperson circulates regularly among them.

Figure 75 Various types of pass-through gates

9.5 System costs

Self-locking ESFs make it possible to optimize the utilisation of the building's entire floor space because the sows can use all of the space within the pen. Also, this system works very well with 19 ft^2 per sow (1.77 m^2) and 15 ft^2 per gilt (1.39 m^2); these are the minimums recommended by the Canadian Code of Practice. The cost per station ranges between $2,500 and $3,500, depending on the options chosen and the manufacturer. The self-locking ESF is very accessible due to its lower cost. In fact, the purchase cost is 17 to 50% lower than for the standard ESF, again based on manufacturer and the options chosen, and varies based on the ratio of sows per feeding station.

As part of a project completed by the CDPQ in 2014[3], two farms that had transitioned to the group system using ESF feeders system were visited. The data gathered is shown in Table 16.

Table 16 Data obtained from two farms that transitioned to the group handling of sows – Self-locking ESFs

	Farm 1	Farm 2
Before	Farrow-to-finish	Farrow
After	Farrow	Farrow
No. of sows	+ 150%	+ 140%
Change in practices	None	None
Changes to building	Finishing converted to group gestation	Stall gestation converted to group gestation, with small addition
$/space (grouped)*	147	246

*Excluding labour

Comparison of costs for renovating various systems and converting to group housing of sows

The project carried out in 2012 by the CDPQ[2] revealed that major investments need to be planned when converting an existing farrowing house (Table 17).

Table 175 Renovation costs (labour and materials) to convert buildings with conventional stalls to a group-housing system for sows

	Individual Stalls	ESF	Shoulder stalls	Free-access stalls
	$/sow productive			
600 sows	539	839	820	1,117
250 sows	595	1,103	1,155	n/a

The costs shown in the table above are based on the assumption that major renovations are involved where, for all scenarios, all the equipment in the breeding area (gestation stalls, troughs, concrete slats, feeders, liners, plumbing and electrical) is replaced because it was beyond its useful life. The costs are also based on the assumption that the gestation section for grouped sows was completely redone (concrete broken up, new concrete slats installed, new equipment, plumbing and electrical and an addition for the group gestation area constructed). Also, the document's authors based themselves on the European ACA animal welfare standards since the standards in the Canadian Code of Practice were unknown at the time. An analysis of the document reveals that the conversion costs varied enormously, depending on the size of the herd and the group housing system used and that a major investment is required.

The 2014 study by the CDPQ[40] showed the renovation costs for the group gestation section only where parameters identical to those used in the previous study were taken into consideration. However, this study did include the costs of a self-locking ESF system and also showed the purchase cost of the equipment involved for each type of system, per productive sow (Table 16).

Table 16 **Cost comparison, per productive sow, for equipment and major renovations to the section used for the group housing of sows according to size of the herd and the housing system used**

	ESF[1]		Shoulder stalls[1]		Free-access stalls[1]		Self-locking ESFs[2]		Self-locking ESFs[2] (minor renovations)[4]	
Number of productive sows	**250**	**600**	**250**	**600**	**250**	**600**	**250**	**600**	**250**	**600**
Surface area used (ft^2/sow)	22	22	24.7	22	n/a	28.3	19	19	19	19
Cost of equipment alone[3] ($/productive sow)	150 - 250		90 - 105		180 - 200		125 - 166		150 - 250	
Cost of renovations ($/productive sow)	843	579	895	560	n/a	857	541	459	377	322

[1] European standard, adapted from Pouliot *et al.*[2]
[2] Canadian Code of Practice
[3] Data obtained in 2012 from equipment suppliers
[4] Retention of existing floor without breaking up concrete

10. Conclusion

In conclusion, it is important to reiterate that the success of a group-management operation rests with the quality of the relationship between the producer and his or her animals, a proper configuration of the pens and a well adapted herd management strategy.

The results seen from each housing system are tied directly to the way the producer manages a particular system. Each of the various types of systems is capable of yielding excellent performance results when it is properly run. A summary comparing the various housing and feeding systems is shown in Appendix 1.

Finally, the best group management system is the one where the producer feels comfortable!

11. References

[1] National Farm Animal Care Council (NFACC). 2014. Code of practice for the care and handling of pigs [Online]. Available at: https://www.nfacc.ca/pdfs/codes/pig_code_of_practice.pdf

[2] Pouliot, F., Turcotte, S., Lachance, M.P., Forest, J.F. and B. Turgeon. 2012. Évaluation de l'impact économique des exigences de bien-être animal sur les coûts de construction et de rénovation des bâtiments ainsi que sur la rentabilité des élevages porcins au Québec. Québec : CDPQ, 65 p.

[3] Turcotte, S. 2014. Les truies en groupe : l'expérience québécoise, Quebec, CDPQ, 89 p.

[4] Chambres d'agriculture de Bretagne. 2010. Truies en groupes: 3 systèmes de logement. [Online]. Available at: http://www.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/12356/$File/Truies+en+groupes+4pages.pdf?OpenElement

[5] Chambres d'agriculture de Bretagne; Chambre d'agriculture des Pays de la Loire; Institut technique du porc. 2006. Élever les truies gestantes en groupes: systèmes d'alimentation et de logement. Paris: IFIP, fiches techniques.

[6] Caille, M.E. 2012. Truies: en groupes toutes ! Les clés de la réussite [Online]. Available at: http://www.bretagne.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/16692/$File/Truies%20en%20groupes.pdf?OpenElement

[7] Ramonet, Y. and A. Tertre. 2014. Activité motrice des truies en groupes dans les différents systèmes de logement [Online]. Available at: http://www.bretagne.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/22061/$File/Activit%C3%A9%20motrice%20des%20truies%20en%20groupes%202014.pdf?OpenElement

[8] Ramonet, Y. and A. Tertre. 2014. De 50 à 500 mètres par jour : chaque truie a son rythme. TechPorc, January-February(15): 20-22.

[9] Courboulay, V. and P. Massabie. 2012. États des lieux des systèmes de logement en groupe en France et résultats techniques. IFIP, presentation, 17 p.

[10] Chambres d'agriculture de Bretagne. n.d. Évaluation du niveau d'activité des truies gestantes logées en groupes dans différents systèmes de logement. PowerPoint Presentation, 40 slides.

[11] Caille, M.E. 2012.État des pattes des truies en groupes à Guernevez et Crécom (2010-2011) [Online]. Available at: http://www.bretagne.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/18828/$File/12%20pages%20Etat%20des%20pattes%2009-2012.pdf?OpenElement

[12] Chambres d'agriculture de Bretagne, Ramonet, Y. and M.E. Caille. 2014. Truies en groupes : attention aux boiteries. Terra, May(430) : 27-34.

[13] Guyomarc'h, C., Hamoniaux, M., Pol, F. and C. Cador. 2014. Facteurs de risques des troubles locomoteurs des truies en groupes : pour retomber sur vos pieds. TechPorc, January-February(15): 16-19.

[14] Caille, M.E., Hamoniaux, M., Guyomarc'h, C. and D. Desson. 2014. Truies en groupes : lésions aux pattes et ambiance dans les bâtiments [Online]. Available at: http://www.bretagne.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/22604/$File/Pattes%20ventilation_8%20pages.pdf?OpenElement

[15] Poilvet, D. 2012. Contre les lésions aux pattes, gardez les caillebotis secs. Réussir Porc, December(199): 42-43.

[16] Caille, M.E., Guyomarc'h, C. and M. Hamoniaux. 2012. Facteurs de risque des lésions aux onglons des truies.

[17] Weber, R. and C. Schiess. 2006. Détention des truies en groupes pendant la période de saillie. Rapports ART, 658: 8 p.

[18] Ramonet, Y., Chopin, E. and M.E. Caille. n.d. Fréquence des combats à la suite du regroupement de truies gestantes logées au DAC. Chambres d'agriculture de Bretagne.

[19] Ramonet, Y., Caille, M.E., Dubois, A., Paboeuf, F., Calvar, C., Jegou, J.Y., Quillien, J.P. and H. Pellois. 2011. Les truies gestantes en groupes. Pratiques dans les élevages de l'Ouest de la France. Journées de la Recherche Porcine, 43: 161-170.

[20] Courboulay, V. 2011. Systèmes de logement et d'alimentation des truies en groupe. IFIP, 86 p.

[21] Spoolder, H.A.M., Geudeke, M.J., Van der Peet-Schwering, C.M.C. and N.M. Soede. 2009. Group housing of sows in early pregnancy: a review of success and risk factors. Livestock Science, 125(1): 1-14.

[22] Chambres d'agriculture de Bretagne. 2010. Truies: en groupes toutes. Deux jours pour faire les bons choix.

[23] Danish Pig Production. 2007. Use the hospital pen in time. August.

[24] Ramonet, Y., Caille, M.E., Dubois, A., Paboeuf, F., Calvar, C., Jegou, J.Y., Quillien, J.P. and H. Pellois. 2011. Les truies gestantes en groupes. Pratiques dans les élevages de l'Ouest de la France. Truies en groupes – Synthèse – JRP. PowerPoint presentation.

[25] Heugebaert, S. Caille, M.E. and C. Depoudent. 2014. Modifications du travail générées par la mise en groupes des truies. [Online]. Available at: http://www.bretagne.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/22875/$File/travail%20et%20TEG_%20version%20finale.pdf?OpenElement

[26] Courboulay, V. and B. Badouard. 2012. Aliment et travail: les premiers résultats des élevages en groupe. TechPorc, March-April(4): 8-9.

[27] Ontario Pork. 2012. Making the switch to group housing_part1 [Online]. Available at: https://www.youtube.com/watch?v=Z0TeFo-p31o

[28] Massabie, P. 2001. L'abreuvement des porcs. Paris: ITP.

[29] Prairie Swine Centre. 2013. National sow housing conversion project competitive feeding systems [Online]. Available at: http://www.prairieswine.com/wp-content/uploads/2014/01/Competitive-Feeding-English.pdf

[30] Caille, M.E. 2011. Truies en groupe. Aménagements à l'auge pour des repas calmes. Rapport d'étude. Chambres d'agriculture de Bretagne, 8 p. [Online]. Available at: http://www.synagri.com/ca1/PJ.nsf/TECHPJPARCLEF/14423/$File/BatsFlancs_derni%C3%A8re%20version-8%20pages_cd.pdf?OpenElement

[31] Ramonet, Y. 2012. Truies en groupe. Chambre d'agriculture de Bretagne, November 8, Guernevez.

[32] Gonyou, H.W. and F. Lang. 2013. Non-competitive feeding systems: gated stalls. Prairie Swine Centre. Science of Ethology, 1(3): 6 p.

[33] Ulrich Hansen, L. 2012. Danish experiences with group-housed sows. Denmark: Pig Research Centre, ppt, 62 p.

[34] Van Gansbeke, S. n.d. Logement en groupe des truies gestantes: présentation des systèmes.

[35] Grotenhuis, P. 2010. Phase feeding sows could save up to $5 per gestation. Pigs Pork & Progress: 20-21.

[36] Ramonet, Y., Chopin, E., Caille, M.E. and A. Dubois. 2010. Conduire un troupeau de truies au DAC : prendre en compte le comportement de l'animal. TechniPorc, 33(1) : 17-22.

[37] Ulrich, H.G. 2012. CallMatic 2 BFN: Electronic Sow Feeder for pregnant sows. Presentation, 55 p.

[38] Paboeuf, F., Gautier, M., Cariolet, R., Meunier-Salaun, M.C. and J.Y. Dourmad. 2010. Effets des modes de logement et d'alimentation des truies en gestation sur leurs performances zootechniques et leurs comportements. Journées de la Recherche Porcine, 42 : 1-8.

[39] Prairie Swine Centre. 2014. Projet national sur la transition vers un logement des truies en groupes. Distributeurs automatiques de concentrés [Online]. Available at: http://www.prairieswine.com/distributeurs-automatiques-de-concentres-projet-national-sur-la-transition-vers-un-logement-des-truies-en-groupes/

[40] Turcotte, S., Ricard, M.A., Lefebvre, A. and J. Brown. 2014. Développement d'un système d'alimentation novateur pour truies gestantes en groupe : rapport. Québec : CDPQ, 52. p.

Centre de développement du porc du Québec inc.
Place de la Cité, tour Belle Cour
2590, boulevard Laurier, bureau 450
Québec (Québec) G1V 4M6
☎ 418 650-2440 • 🖷 418 650-1626
cdpq@cdpq.ca • www.cdpq.ca
@cdpqinc