GROUP HOUSING OF SOWS – THE EUROPEAN EXPERIENCE

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ABSTRACT

Since January 1, 1999, it has been illegal to confine sows in stalls and tethers in the UK. The welfare lobby drove the requirement that producers group house sows. However, group-housing systems do not necessarily or inevitably improve welfare. Stereotypic behaviour, such as bar biting and sham chewing is not restricted to stall housed sows and is a reflection of inadequate nutrition rather than the sterile and unrewarding environment provided in sow stalls. Poorly designed and managed group housing systems can result in poor welfare. In particular, they can result in increased aggression and physical damage due to competition for food resources that do not result in satiety. Many of the problems created by group housing systems can be overcome by three factors. First, by increasing the fibre content of diets, feeding motivation can be reduced. This reduces competition for feed resources and increases the proportion of time sows spend resting. Secondly, the provision of bedding material that can be manipulated and eaten not only provides environmental enrichment, but also contributes to gut fill and satiety. Once again this reduces feeding motivation and improves the social environment. Thirdly, providing the sow with total protection whilst she is feeding ensures that she receives her complete ration and removes competition for feed, which is a major contributor to physical damage. Well designed and operated group housing systems using Electronic Sow Feeders (ESF's) provide the best environment for large groups of housed sows and can make a significant contribution both to improved sow welfare and sow feed management.

WELFARE LEGISLATION IN THE UK/EU

Consumer concern about the welfare of farm animals became an issue in the UK in the 1960's. This was largely a response to Ruth Harrison's book *Animal Machines* (Harrison 1964). Animal welfare organisations organised quickly, obtained extensive media coverage and became extremely effective lobbyists. In response, the UK government set up the Brambell Committee in 1964 with the remit:

'to examine the conditions in which livestock are kept under systems of intensive husbandry and to advise whether standards ought to be set in the interests of their welfare, and if so what they should be' (HMSO 1965).

An outcome of this committee was the establishment of the Farm Animal Welfare Committee, which was replaced in 1979 by the Farm Animal Welfare Council (FAWC). Using the principles implicit in the Brambell report, FAWC developed a basis for discussion and legislation on animal welfare that became know as the '*Five Freedoms'*. The Five Freedoms were later expanded with qualifying statements and these in turn formed the basis for the Code of Recommendations for the Welfare of Livestock: Pigs (Table 1).

Table 1. The Five Freedoms and their interpretation in the UK Pig Welfare Codes.

The Five Freedoms	Welfare Code provisions (1983)
1. FREEDOM FROM HUNGER AND THIRST - by ready access to fresh water and a diet to maintain full health and vigour. 2. FREEDOM FROM DISCOMFORT - by providing an appropriate environment including shelter and a comfortable resting area. 3. FREEDOM FROM PAIN, INJURY OR DISEASE - by prevention or rapid diagnosis and treatment. 4. FREEDOM TO EXPRESS NORMAL BEHAVIOUR - by providing sufficient space, proper facilities and company of the animal's own kind. 5. FREEDOM FROM FEAR AND DISTRESS - by ensuring conditions and treatment which avoid mental suffering.	• comfort and shelter; • readily accessible fresh water and a diet to maintain the animals in full health and vigour; • freedom of movement; • the company of other animals, particularly of like kind; • the opportunity to exercise most normal patterns of behaviour; • light during the hours of daylight, and lighting readily available to enable the animals to be inspected at any time; • flooring which neither harms the animals, nor causes undue strain; • the prevention, or rapid diagnosis and treatment, of vice, injury, parasitic infestation and disease; • the avoidance of unnecessary mutilation; and • emergency arrangements to cover outbreaks of fire, the breakdown of essential mechanical services and the disruption of supplies.

Despite this activity, Members of Parliament reported that they had more correspondence about animal welfare than any other issue. The construction of sow accommodation based on sow stalls and tethers was banned in October 1991, and the use of existing stall and tether systems was banned on 1 January 1999 (HMSO 1991). This unilateral decision of the British government was taken ahead of any planned EU legislation. This action was even more inexplicable given that at the time no more than 50% of UK sows were housed in stalls. The UK pig industry had never adopted stall housing to the same extent as other European countries or North America. The decision to ban stalls had far-reaching economic consequences for the British pig industry. Many producers lacked the confidence to reinvest in new housing, particularly as they were uncertain what other changes the welfare lobby (or the major food retailers) might demand. Many others simply lacked the resources to reinvest and left the industry. The remaining British pig producers are still feeling the repercussions of the stall ban, which has added significantly to their costs of production and has reduced their ability to compete with other European producers. Other EU producers will not face a complete ban on the stall housing sows until 2013, but still enjoy unrestricted access to the UK market.

It is an appropriate time to review the topic of group housing, as two new EU Directives (Directive 2001/88/EC & Directive 2001/93/EC) have just been enacted, which revise the European Welfare Regulations. In the UK, the provisions of these Directives have been enacted through an amendment to the Welfare of Farmed Animals Regulations (HMSO 2003) which came into force on 14 February 2003. The key paragraphs relating to the housing of non-lactating sows are summarized in Appendix 1. The complete document can be accessed on the Department of Environment, Food and Rural Affairs (DEFRA) website (DEFRA 2003).

In order to consolidate the provisions in this legislation DEFRA are also drafting a new Welfare Code for pigs, which can also be found on their website.

In addition to the legislative constraints, UK producers have also had to contend with the increasingly intrusive demands of the multiple retailers, who have added further constraints and restrictions through their Quality Assurance programmes. Although the retailers present the practices that they require as a reflection of the wishes of their consumers, there is little evidence that consumers have any understanding of many of the issues. Rather, the practices the retailers demand reflect the fierce competition in a retail sector dominated by 5 major retailers who between them account for more than 80% of meat sales. They promote specific values, such as a concern for animal welfare, as a part of their strategy of market differentiation and brand identification. In the UK, the retailer is the brand, not the product being sold. However, to the frustration of UK pig producers, the multiple retailers do not uniformly and consistently impose the same production standards on their overseas suppliers. Although market research surveys consistently indicate that consumers would be prepared to pay a premium for products derived from higher welfare systems of production the reality is that they have not been prepared to demand higher welfare, UK produced pig meat products. Price continues to be the most important factor affecting purchasing decisions.

GROUP HOUSING OF SOWS IN THE UK

The premature decision by the UK Government to ban sow stalls focussed the minds of British producers on the need to develop suitable systems for group housing the demanding, highly productive modern genotypes used on commercial units. In a survey, producers were asked what features they felt were important in group housing systems. Whilst most producers identified the capability to feed sows individually as being important (in order to prevent bullying and fighting), very few considered that having a system that permitted individual rationing of sows was important. The Pig Welfare Advisory Group (1993a; 1993b; 1993c; 1993d; 1993e; 1993f; 1993g; 1993h; 1993i) published a series of booklets outlining a range of options for the housing and management of group housed sows and included in their assessment the advantages and disadvantages of the different systems (N.B. these booklets can be accessed on the DEFRA website).

Of the various options that were available, the most widely adopted was outdoor sow housing. Given the mild climate in the UK, and on the right soil, some producers have been able to expand their herds rapidly and at a low capital cost by housing sows outdoors. In the early 1900's outdoor production was considered a low input, low output, system. Advances in husbandry have changed that view. The performance of modern outdoor units usually equals and can exceed that of indoor units (Table 2). For about 10 years, the multiple food retailers, who like their consumers perceived outdoor production as environmentally and welfare friendly, encouraged the move to outdoor production. For a time, circa 30% of UK sows were housed outside. However, lack of a market premium, and concern about disease transmission (particularly in the wake of foot and mouth disease) is resulting in outdoor units disbanding, or moving back indoors. Furthermore, it has been realised that outdoor sows can be extremely damaging to the structure of some soils and that the deposition of their excrement on defoliated land can pose a greater pollution threat than the controlled spreading of effluent from a confinement unit. There is no opportunity to individually feed sows on outdoor units. As a consequence, maintaining appropriate body condition can be problematic. Sows are almost invariably fed on the floor and a significant quantity of food can be wasted when weather conditions are unfavourable.

Table 2. Performance of indoor and outdoor sow herds (Meat and Livestock Commission 2001).

	Indoor herds	Outdoor herds
Average herd size	242	687
Annual replacement rate (%)	41.0	46.6
Litters per sow per year	2.26	2.25
Pigs born per litter	12.20	11.83
Litter reared per litter	9.76	9.84
Pigs reared per sow per year	22.10	22.20
Sow feed per year (tonne/sow)	1.23	1.41
Feed per pig reared (kg)	60	70
Feed cost per pig reared (£)	6.40	7.48

THE EFFECT OF HOUSING SYSTEM ON THE ABILITY TO RATION SOWS

This lack of recognition of the importance of individual rationing is a matter of serious concern to nutritionists. Modern sows start their breeding life with much lower body fat reserves than sows did twenty or even ten years ago, but at the same time they rear significantly more piglets. Moreover, the geneticists continue to increase both the lean content and the prolificacy of sows. If the sows we have today and the sows that we will have tomorrow are to stay productive, it is essential that we are capable of managing them in such a way that we can maintain their body fat reserves. This can only be achieved by treating them as individuals.

We can put this problem in perspective by looking at a couple of examples. The energy requirement of the pregnant sow increases from approximately 30 MJ DE/day at 120 kg live weight to approximately 40 MJ DE/day at 320 kg live weight. This represents a 33% increase in the feed requirement. If both sows were fed a 13.5 MJ/kg diet they would need respectively 2.2 and 2.9 kg feed per day. What appears to be a relatively small difference in daily intake amounts to over 80 kg feed during a 115-day pregnancy. Furthermore, the requirement of the sow increases by about 12% between mating and farrowing. Failure to satisfy the nutritional demands of the individual sow during pregnancy can result in excessive fat loss during lactation and this in turn leads to extended weaning to remating intervals and poorer litter performance. Depleted fat reserves also lead to breeding irregularities and to premature culling (Close and Cole 2000). Therefore, individual rationing is imperative if the productivity and the potential herd life of the sow is to be maintained.

Individual rationing is possible, but rarely practised, when sows are stall housed. It is equally possible in the rather old fashioned, but still very effective, yard and individual feeder systems (Pig Welfare Advisory Group 1993g). In Holland, a system that utilises voluntary stalls has also been developed. However, to provide effective rationing these systems require the daily identification of individual animals by the stockperson. This may be acceptable on the smaller, owner-operated unit where attention to detail has a high priority, but is not easily achieved on a large unit. A number of different housing and feeding systems have been adopted but there have been no systematic comparisons of the relative performance or operating costs of these different systems

Two systems that attracted some interest in the UK are Dump (or Spin) Feed (Pig Welfare Advisory Group 1993i) and Trickle Feed (also known as Biofix) systems (Pig Welfare Advisory Group 1993h). Dump feeders drop and Spin Feeders scatter the feed allowance for a group of sows into the straw-bedded lying area. One of the claims for this approach was that searching for food in the straw bedding would satisfy the behavioural need of the sows to forage. In reality, this is a poor attempt to justify a crude feeding system. At best, such an approach fails to provide any opportunity to control the intake of individual animals, at worst it causes considerable aggression and results in the entire bedded area being disrupted on a daily or twice-daily basis. There is no logic in providing a straw-bedded rest area and then making it the focus for intense feeding activity and aggression. As the sows still have to compete for feed the system cannot be regarded as 'welfare friendly'. Many producers who have tried such systems have abandoned them very quickly.

In the case of Trickle Feed (Biofix) systems, each sow has a feeding space (usually a shoulder length stall). The feed is made available in that feeding space slowly (hence Trickle Feed) and this is supposed to ensure that all sows receive their allocation. Trickle Feeders reduce, but cannot totally eliminate competition for feed. In addition, they force the sows to adopt an abnormal feeding pattern. The feeding rate of all the sows in the group is adjusted to the eating speed of the slowest animal in the group. Questions remain to be answered about the degree of frustration that is caused by such a feeding regime and the impact that this has on sow welfare. In addition, such systems are not totally effective in reducing aggressive encounters, as the faster eating sows still leave their feeding spaces and try to displace and steal the food of other sows that are still feeding.

The welfare and behaviour of sows has recently been compared in small cubicle pens housing groups of four sows and a split-yard housing system (similar to that in Figure 1) housing a large dynamic group (Durrell *et al.* 2002). The latter system appeared to offer the sows a more stimulating social and physical environment, but also led to higher levels of aggression and skin damage.

ELECTRONIC SOW FEEDERS OVERCOME RATIONING PROBLEMS

The Electronic Sow Feeder (ESF) system was first developed back in the 1980's (Lambert *et al.* 1984; Smith *et al.* 1986). They enable sows to be individually fed, in a feeding station where they are protected from other sows. The daily ration for the individual sow can be determined and is delivered when the sow enters the feed station and is identified by the computer controlling the system. Sows are individually identified by means of a transponder. In early versions, this was carried on a collar, but most modern systems now use a transponder carried in an ear tag. Tags used a decade ago were quite large and obtrusive, and led to some problems of chewing and ear trauma (Sherwin 1990). The tags used today are little larger or heavier than a conventional identification tag. Experiments have been undertaken using implanted transponders. Unfortunately, implants have a tendency to move from the initial implantations site. This has two important consequences. First, they may not be recognised by the receiver in the feed station. Secondly, they may not be detected and removed at slaughter. Because of the adverse impact that this could have on consumers, this approach has not been adopted commercially.

If a sow loses her transponder she will not be identified by the feed computer and will receive no food. Therefore, it is an essential element of daily management that any sows recorded as not having fed are checked to see whether they still have an active transponder in place or not.

Electronic Sow Feeders overcome the majority of problems intrinsic in other group housing systems and have some additional advantages, namely:

- They allow sows to be housed as a group but fed as individuals.
- They provide opportunities for the stockperson to exercise a very high degree of feed management (i.e. programming rations to meet the specific and changing requirements of individual sows).
- They allow sows to adopt an individual and flexible feeding pattern (within the constraints imposed by feeder use by the other sows in the group).
- They minimise aggressive encounters associated with feeding by removing competition for food.
- They allow sows living in a group to exercise a high degree of control over their thermal environment.
- They enable sows to enjoy a very rich and varied repertoire of behaviour, particularly if provided with bedding material.

Unfortunately, ESF systems got off to a bad start in Europe. Any researcher reviewing the literature up until 1995-6 could be forgiven for concluding that these systems presented more problems than solutions (Broom *et al.* 1995; Jensen *et al.* 1995; Kroneman *et al.* 1993; Olsson *et al.* 1992; Simmins 1993; Stamer *et al.* 1992; Taureg *et al.* 1991a; Taureg *et al.* 1991b). However, most of these reports in the literature are of little or no value today. The equipment used in the early studies had intrinsic design faults that only became apparent with the commercial adoption of the systems. In addition, many of the published studies involved housing designs and sow group sizes that have no relation, or relevance, to the systems that are now used on commercial units. Many of the initial ESF systems were sold onto farms before adequate research and development had taken place. As a result many of the 'early adopters' had to overcome teething problems with their systems. A lot of good, but less determined producers gave up. The remainder persevered with their ESF systems, often making numerous changes to the feeders and to building design until, by trial and error, they learnt how to construct and operate an effective system. It is a tribute to their efforts that there are now a number of variants that will produce excellent results. There are now producers in Europe, North America and Australia, who are convinced not only that ESF systems work but also that group housing using ESF is the only way of keeping sows.

It is always difficult to make comparisons of 'systems' as so many management variables can affect performance and bias results. However, as long ago as 1994 data generated from the Feed Recording Scheme run by the Meat and Livestock Commission in the UK demonstrated that systems based on ESF's could produce as good biological outputs as any other system (Tables 3 & 4).

Table 3. Performance of herds using Electronic Sow Feeders (ESF) compared with the average of all other forms of housing (Meat and Livestock Commission 1994).

	ESF herds	All herds average
Number of herds	23	305
Litters per sow per year	2.31	2.24
Non-productive days per year	30	38
Pigs reared per sow per year	21.7	21.4
Average number of pigs born	10.7	10.81
Average number reared per litter	9.41	9.54
Feed per sow per year (tonne)	1.21	1.31

Table 4. Comparison of performance of sows in herds using Electronic Sow Feeders, conventional yards and feeders or stalls and tethers (Meat and Livestock Commission 1994).

	ESF	Yards	Stall/Tether
Average number of pigs born	11.62	11.76	11.64
Average number reared per litter	9.41	9.51	9.51
Mortality of pigs born live	12.0	12.6	11.3
Pigs reared per sow per year	21.7	21.0	21.7

The University of Plymouth was an early adopter of the ESF system and the research team there spent several years remodelling and re-engineering both feeders and buildings before learning how to make a system that would work effectively. An analysis of the data from the system operated at the University of Plymouth for seven years between 1990 and 1997 (Table 5) indicated that performance was equal to, or exceeded that of the top third of producers recording with the MLC scheme during that period.

Table 5. Comparison of performance of the Seale-Hayne herd (using ESF) with average and top third herds recording with the Meat and Livestock Commission (1990-1997) (Hodgkiss 1998).

	Seale-Hayne	MLC average	MLC top third
Services: farrowings (%)	87.93	86.60	87.74
Pigs born live per litter	11.41	10.85	11.23
Pigs born dead per litter	1.25	0.80	0.82
Total pigs born per litter	12.94	11.76	12.17
Sow cullings and deaths (% per year)	36.71	41.11	41.06

A recent publication (Bates *et al.* 2003) confirms that sow perform as well in an ESF system as they do in stalls (Table 6).

Table 6. Performance of sows housed in stalls or in a group fed using ESF (Bates et al. 2003).

	ESF	Stalls
Farrowing rate (%)	94.3	89.4
Litter birth weight (kg)	17.7	16.7
Litter weaning weight (kg)	57.1	56.2

However, the design of the installation has a major effect on its operation. When ESF's were first introduced producers were led to believe that they could be installed in virtually any building design and they would work. This proved incorrect. The design of the equipment and the layout of the building are extremely important. ESF systems are normally operated with a large numbers of animals living together in a dynamic group (that is a group where some sows are relocated to the farrowing house each week and other sows rejoining the group following weaning or service). Because of this, the behaviour of the sows is of paramount importance. Some important lessons have been learned from early mistakes. Among these, the most important lesson is that relatively small differences in the feeding equipment and the layout of the building can have profound effects on the behaviour of individuals and the group. As a result of some of the lessons that have been learned, certain recommendations can be made for those planning new installations.

IMPORTANT DESIGN FEATURES FOR ESF INSTALLATIONS

Avoiding Damage To The Sow

Initial ESF designs failed to give the sow sufficient protection while eating. This had two main effects. First, some sows were reluctant to use the feed station, as they felt vulnerable to attack. Timid sows would also vacate the feeder, leaving feed behind and thereby not getting their complete ration. Secondly, some herds experienced significant problems with vulva biting (Gjein *et al.* 1995; Lembeck *et al.* 1995; Maton *et al.* 1990; Rizvi *et al.* 1998; Svendsen *et al.* 1992b). Some early designs required that the sow back out from the ESF, and sows waiting to enter frequently attacked sows exiting the feeder. Keeping a boar in with the group of sows was also implicated in vulva biting, particularly if he was fed in the ESF.

The following recommendations can be made.

1. Feeding stations must be 'walk through'. Rear exit systems lead to aggressive encounters and physical damage (fighting and vulva biting).
2. Feeding stations must operate in a way that ensures the total security of the sow while feeding and gives her some warning that the rear gate is going to be unlocked, thereby giving her an opportunity to vacate the feed station before another sow attempts to enter.
3. Boars should not be fed in the ESF. They are extremely competitive and contribute to damage. A boar fed outside the ESF will not allow his food to be stolen!

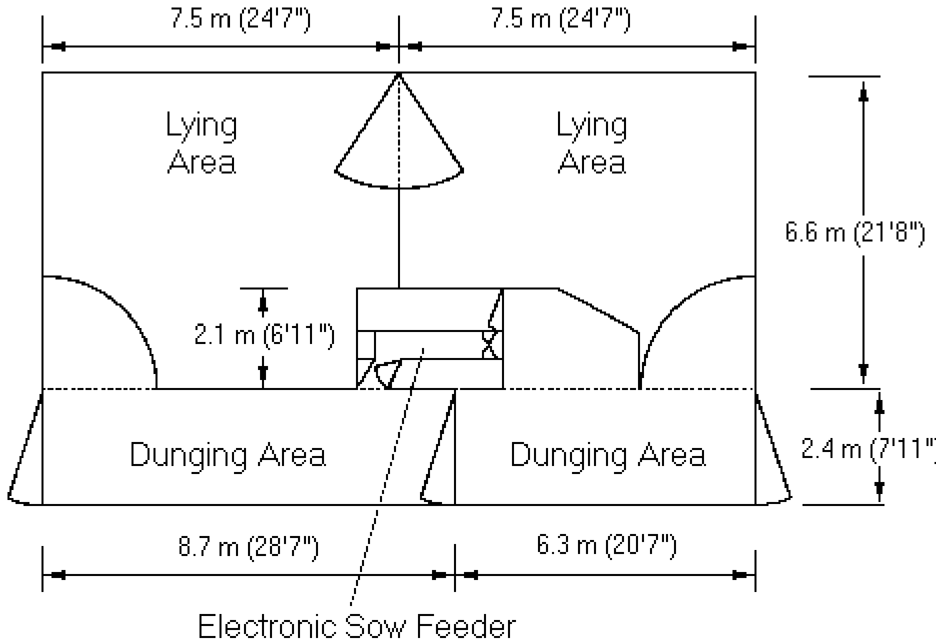
Reducing Non-Feeding Visits

Feed troughs should not be available to sows that have consumed their daily allowance. The better designs either swing the trough to one side or lower a shutter to make it unavailable.

Although this may appear to result in more complicated engineering, it is a great benefit as it reduces the number of non-feeding visits and allows more sows to be fed through one feeding station. In addition, it increases the life of the system. Designs in which feed left in a trough is available to a sow who has no feed balance remaining, or where by repeatedly banging the feeder the sow may dislodge feed from the delivery auger into the trough, encourage sows to make repeated returns to the feeder to try and gain additional feed. If they get any feed (reward) this behaviour is encouraged and consequently repeated time and again, with detrimental effects on the equipment. This can also lead to a herd being overactive and disturbed all the time. Systems in which the sows cannot get any feed reward for what should be non-feeding visits are notable for their peaceful atmosphere.

Some producers have attempted to solve this problem by designing units in which the sows are penned on one side of the feeder and enter a second pen having fed (Figure 1). The aim of this approach is that sows wishing to feed will not have to compete for access with sows making non-feeding visits. At the end of the feeding period it will be immediately obvious to the stockperson which sows have and have not fed. However, this design does impose on the sow the necessity to take all her feed at a single visit (unless the process is repeated more than once in each day).

Figure 1. **'Walk-through' layout. Sows pass from one lying area to the other via the Electronic Sow Feeder and are then returned as a group when all have fed.**



Sows should be permitted to take their entire daily ration at a single feed if they wish, but they should not be forced to take all their daily allowance at one feed. Studies undertaken at the University of Plymouth have shown that there is great variation between sows in the number of meals that they wish to take in a day (Eddison *et al.* 1995; Hodgkiss 1998). The number of meals taken each day and the feeding sequence of the group is not a constant and this must be accommodated by the equipment (Bressers *et al.* 1993; Lembeck *et al.* 1995).

It is better not to provide water in the feeding station. Sows will not remain in the station after feeding if there is no water. They will go out to drink. Some of the newer feed stations use liquid feed delivery, which can increase throughput and also has the advantage that a much wider range of feed materials can be utilised.

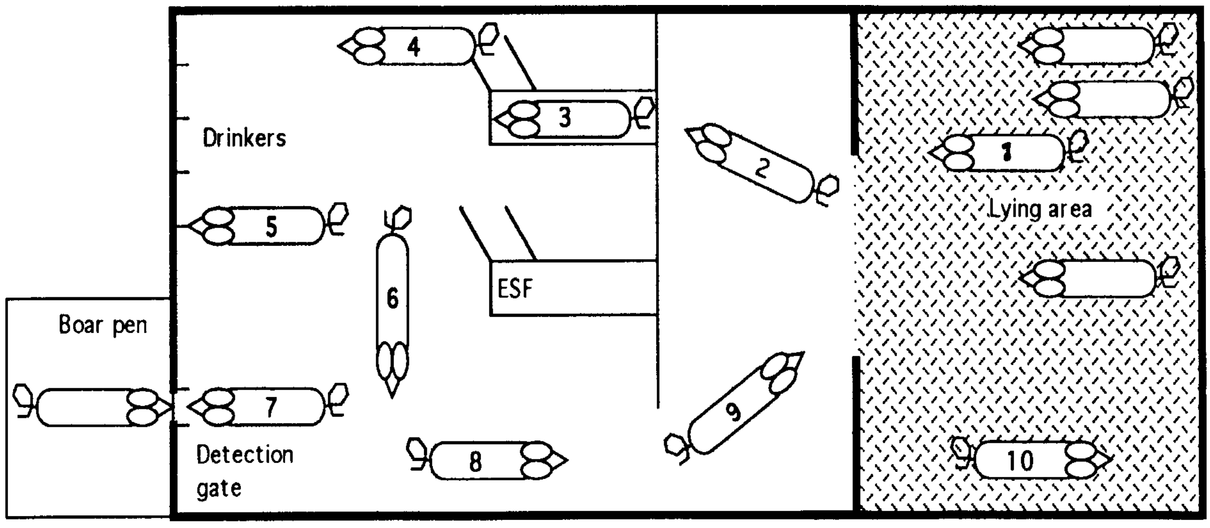
Where dry feed is used, pelleted feed is preferable to meal as it helps to avoid bridging in bins and feeders. If bridging occurs this can cause problems as the computer registers that the sow has eaten when she has not.

The bulk density of the feed must be checked regularly. Most systems deliver feed on a volumetric basis. As a consequence a failure to check and adjust for differences in bulk density of the diet being fed can result in a significant loss of accuracy in rationing sows.

The Building Layout

The layout should attempt to anticipate the natural sequence of sow activities and create a circuit that the sow will follow. This is shown schematically in Figure 2. Creating a natural circuit reduces confrontations and competition for resources. This can be achieved without the need for extended exit races.

Figure 2. Schematic indicating a layout that allows sows to perform behaviours in an appropriate order.



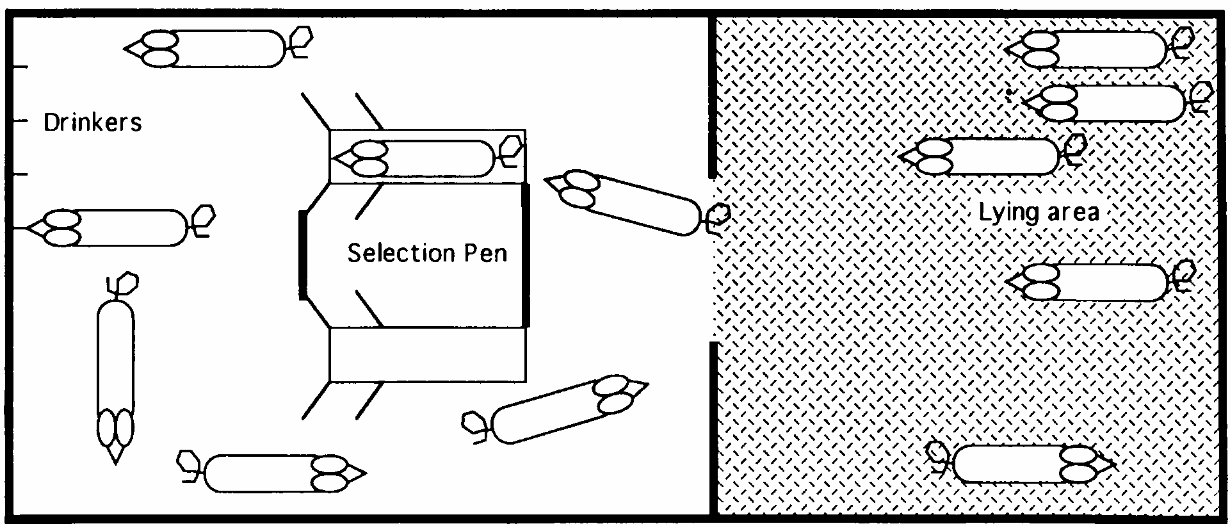
Explanation

1. Sows resting in lying area. Ideally they should have line of sight to the feeder. The next sow in the feeding queue may not be the one nearest to it!
2. Sows waiting to enter the feeder should neither obstruct nor be obstructed by sows returning from the dunging area. This minimises agonistic encounters.
3. Sow must be completely protected while feeding.
4. Sows must be able to exit the feeder with out fear of being attacked by other sows. Therefore, the exit gate must not allow any sow to enter the feeder from the wrong side.
5. Drinkers should be positioned away from the feeders in the dunging area so that sows are drawn away from the feeders once they have exited. In hot climates nose operated sprays can also be positioned in this area so that sows can cool themselves.
6. Sows will dung and urinate after eating/drinking.
7. If an oestrus detection gate is to be included in the design this should be positioned so that it draws sows away from the main thoroughfare. This will minimise agonistic encounters
8. Return route to the lying area should direct the sow away from the feed queue.
9. Returning sow should have a good view of the lying area and the access to it should be wide enough so that agonistic encounters are reduced.
10. Returning sow locates an appropriate resting place.

The use of a two-station module represents good risk management. If a mechanical breakdown occurs in a two-station pen the remaining station will cope, in the short term, until the second feeder can be repaired. If only one station is provided in a pen a mechanical breakdown can prove extremely difficult to manage. Sows that are not used to competing for food should never be floor fed. If the system has straw bedding, copious new bedding should be provided until the system can be repaired.

Most companies selling ESF's offer the option of a shedding gate that will allow sows to be diverted into a selection pen (Figure 3). This would appear to be a valuable management aid. However, experience on commercial units has shown this not to be the case. As any selected sow may be in this pen for quite long periods (e.g. overnight), the selection pen must provide a warm and comfortable environment and must be provided with its own water supply. This is an additional constraint on the design that is not always easy to provide. A more important factor is that sows will often resist exiting through an unfamiliar gate. This can result in sows attempting to back out of the unit and being damaged by other sows in the process. The preferred approach is to fit the feed station with one or more computer-operated spray markers that can mark selected sows as they go through the system. This prevents the normal routine of the sows being disrupted. In a well-managed unit the sows become very docile and finding and removing a marked sow from the group is extremely easy. Very large group sizes should be avoided, not because they don't work but because the observation, identification and removal of individuals becomes very time consuming. Multiples of 80-100 sows, on 2 stations or 120-150 sows, on 3 stations seem to work very well.

Figure 3. Two-feeder layout incorporating a selection pen.



A Training Pen For New Entrants Is Essential

The gilt / sow must be well trained before joining the main herd. It is beneficial to arrange the training pen so that the incoming animals can see, smell and touch the sows already in the main group before they join it. Ideally, they should be able to see experienced animals using the feed station. This enables them to become familiar with the system before they have to operate it and ensures that they have no fear of the feeder when they are first introduced to it.

When they are introduced to the system they should be allowed plenty of time to explore the feed station and should be encouraged to enter by scattering some food on the floor. They should never be pushed or forced into the pen. A good stockperson should have no problem training gilts to use the system. Never the less a very small number of animals may prove to be untrainable and have to be removed from the system. On large units, it is important that all the pens have a similar layout or that sows always return to the same pen. Failure to do this can increase the amount of retraining required.

Entries to and exits from the feeders should not involve the sows going up and down steps or steep slopes. Both tend to impede the flow of animals and also lead to a higher incidence of foot and leg damage. The areas immediately around feeder entries and exits should be as free of impediments as possible and barriers and corners which could leave a sow feeling trapped must be avoided.

Feed stations should not be placed directly against walls and the exit from feeding stations should be well away from the entrance to another in order to improve the flow of sows. (Figure 4 & 5). Such an arrangement gives only a 90° approach angle and tends to deter timid sows from approaching the feeder. Feeders should be placed in such a way that they provide a 180° approach angle to the feeder (as in Figure 2). In some installations, the feeders have been placed so that the sows can circulate all around them. Allowing access all around the feeder can be beneficial in small units as it allows sows to avoid confrontations where space is restricted around the feed stations.

Figure 4. Avoid positioning feeders such that the approach angle is reduced or the exit impeded by other sows.

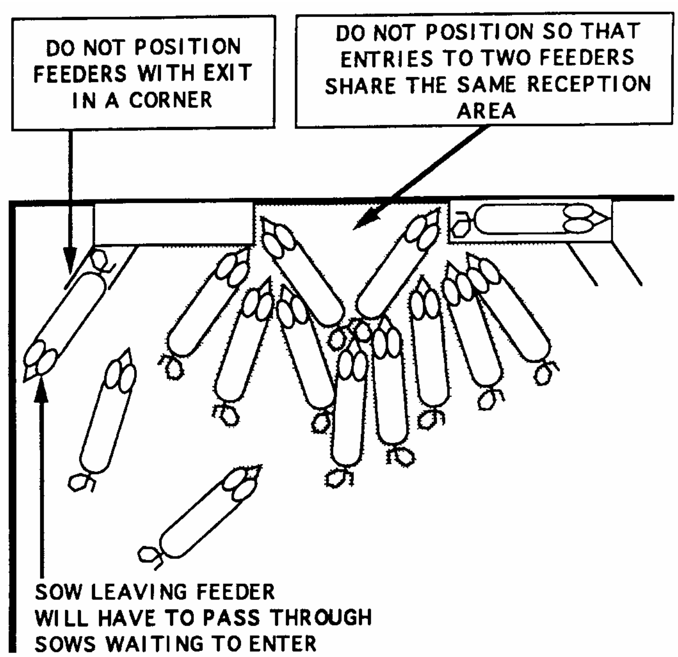
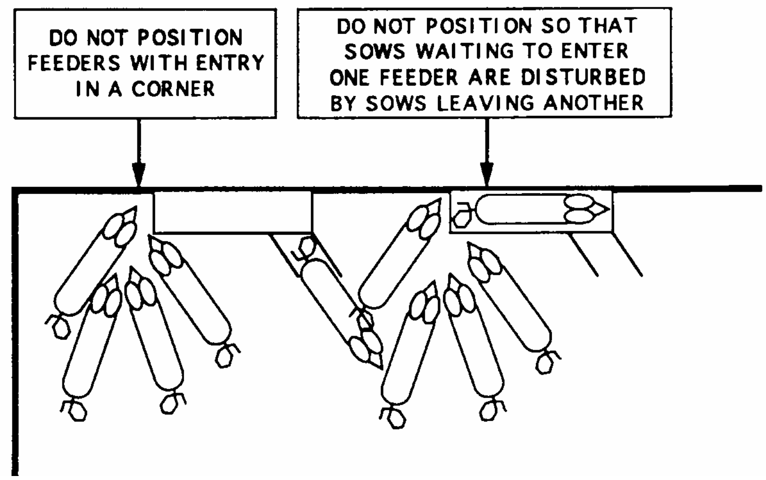
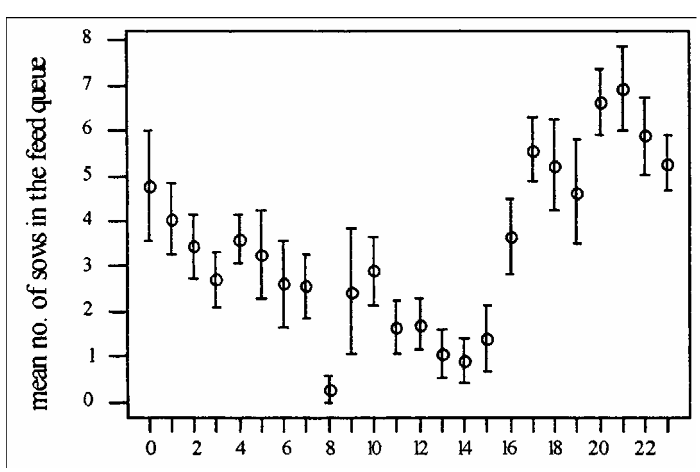


Figure 5. Avoid positioning feeders such that sows exiting from one feeder impede sows entering another.



Ideally, the building should be designed so that the feed stations can be seen from the lying area. This allows sows to keep an eye on the feed station while continuing to rest in the lying areas. Our observations suggest that sows are very like humans! Most of them do not like hanging about in queues. Consequently, they will stay in the lying area and only get up to feed when they judge the feeding queue to be short enough. If they can see easily who is waiting to feed, timid sows will avoid going up to feed when more dominant sows are waiting in the vicinity of the feed station. This allows the sows to avoid aggressive encounters and contributes to the peaceful atmosphere that characterizes successful installations. If the unit is laid out in the way suggested above there are rarely more than four or five sows in the area of each feeder even at busy times (Hodgkiss, 1998) (Figure 6). Finally, it is worth noting that the more dominant sows are not necessarily the first to eat in the daily feeding cycle. A dominant sow will demand access to the feeder when she wants to eat and this can be at any time in the twenty-four hours.

Figure 6. Number of sows in the feeding queue at different times of the day. (Two feed stations; 55-70 sows in the group; feed cycle starting at 1600h).



Opinions differ about the ideal time to start the feed cycle. A recent Dutch study found that changing the start of the feed cycle to late in the day reduced feeder occupation in the period following the start of the feeding cycle (Jensen *et al.,* 2000). The pig is by nature a twilight feeder, so starting the cycle late in the day would seem to fit in well with the natural instincts of the pig. A late afternoon start has a number of practical advantages namely:

- The busiest time at the feeders is at a time of day when the stock person has no need to be in the unit performing any tasks such as moving sows.
- The vast majority of sows will have fed by the time the stockperson starts work the following morning. This enables the stockperson to check the action list and identify any sow that has not fed.
- Sows being returned to the unit will be introduced when activity levels are lower thereby reducing aggression (N.B. sows should have been fed before being returned to the unit so that they are not motivated to use the feeders immediately on their return).
- The stockperson quickly gets to know sows that always chose to eat late in the feeding cycle and also to spot sows that they would have expected to have eaten by the time that they start work.
- Non-feeding sows can be checked for lost transponders, or ill health during the normal working day. In either case, they will need attention. However, feeding order is too unpredictable to be used to create action lists for attention (Bressers *et al.* 1993).

The Individuality Of The Sow

There is great variability in the way in which individual sows use the system. At Plymouth we found that the ESF system worked well with a dynamic group of sows; that is a group in which sows are continually removed to farrow and reintroduced following service. We monitored 65,000 feeder visits over an 18-month period (Eddison *et al.* 1995). This study has produced some interesting information, namely:

- That the number of visits made to the feeder in a day varied greatly from sow to sow (from 1-35).
- That sows vary in the amount of feed that they take in a single visit. Some sows always take all their allowance in a single feed. Others made several visits taking only small quantities of feed at each visit (range 1-14 visits per day).
- The visit duration and rate of eating varied considerably between sows. Some non-feeding visits last only seconds whilst one sow liked the feed station so much she went to sleep in it for 6 hours! Sows are not protected within the feeder for more than a couple of minutes after the last of their ration has been delivered, so had another sow wished to use the feeder she could have pushed out her sleeping pen mate.

In her detailed study of behaviour and welfare of sows in the Plymouth ESF unit, Nikki Hodgkiss made some other interesting findings (Hodgkiss 1998; Hodgkiss *et al.* 1998). Sows are very social animals and form relationships that can last for years even if they are separated for periods of time by lactation. Sows spent circa 25% of their time resting in association with other specific females either from the same service group or from the same gilt group (Table 7).

Table 7. The proportion of occasions on which sows were found resting in association with specific individuals (Hodgkiss 1998).

	Sow from the same service group	Sow from the same gilt group	Most frequent companion
Mean	0.26	0.27	0.22
SE mean	0.03	0.05	0.03

Feed Intake And Feeding Motivation

One of the Five Freedoms states that animals should have *'freedom from hunger and thirst - by ready access to fresh water and a diet to maintain full health and vigour'*. In the case of pregnant sow this is a contentious issue. A vast amount of research has been undertaken to determine the nutrient requirement of the sow and this has been used in the derivation of feeding recommendations (Close *et al.* 2000; National Research Council 1998). However, when sows are group housed not only their nutrient requirements but also their feeding motivation needs to be considered. A detailed discussion of feeding motivation in sows is beyond the scope of this paper but a few relevant points are worth reiterating.

We have been aware for many years that diets that meet the nutrient requirement of the sow do not satisfy her feeding motivation (i.e. the sow remained hungry and motivated to seek food). Workers in Edinburgh demonstrated that stereotypic behaviour in stall-housed sows resulted from hunger rather than boredom. In tethered gilts, stereotypic behaviour was almost totally eliminated when feed intake was increased from 1.25 to 4 kg per day (Appleby *et al.* 1987). Pigs fed 1.3 times maintenance were still unsatisfied in terms of their feeding motivation (Lawrence *et al.* 1989a; Lawrence *et al.* 1988; Lawrence *et al.* 1993). They also found that recommended feed intakes represented only 60% of the amount of feed that pigs would choose to eat if offered feed *ad lib.* As a consequence animals were motivated to feed for 19 hours of the day (Lawrence *et al.* 1989b). The feeding motivation is so strong that sows will work for feed to the extent that they sustain an energy deficit in order to gain more food (Hutson 1991). More recently, Hodgkiss (1998) investigated the feeding motivation of sows. She fed pregnant sows for 12 days either a conventional diet *ad libitum*, or 2.5 kg per day of a conventional diet (adequate to meet their nutrient requirements) followed by *ad libitum* access to soaked, unmolassed, sugar beet pulp (Figure 7).

Over the twelve-day period sows fed the conventional diet consumed 7.8±0.14 kg food per day. The sows offered a high fibre diet consumed 11.9±0.14 kg per day. Despite this they still had an energy intake around 50% of the sows on the conventional diet and well in excess of the supposed nutritional requirement.

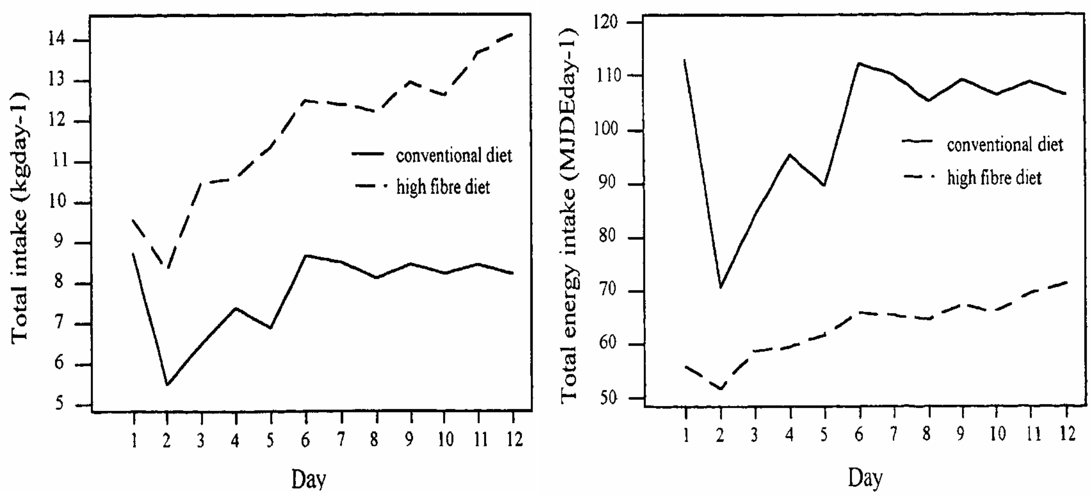
A number of studies have examined the effect of feeding lower density diets. These have recently been reviewed by Meunier-Salaun *et al.* (2001). They concluded that incorporation of fibre in diets to increase bulk, without changing the daily dietary energy supply, resulted in:

- At least a doubling of eating time,
- A 20% reduction in feeding rate,

- A 30% reduction in operant response in feed motivation tests,
- A reduction of 7-50% in stereotypic behaviour,
- A decrease in general restlessness and aggression.

Many fibre sources cannot be used effectively as they are either too bulky to handle or make the diet too expensive. However, where if it is available at an acceptable cost, the incorporation of unmolassed sugar beet pulp into diets appears to be beneficial (Hoy *et al.* 2001; Meyer *et al.* 2001; Tabeling *et al.* 2002; Whittaker *et al.* 2000; Whittaker *et al.* 1999; Whittaker *et al.* 1998). Commercial producers in the UK have used sugar beet pulp very effectively to reduce excessive non-feeding visits and to reduce activity levels in their units.

Figure 7. Feed and energy intake of pregnant sows fed a conventional diet ad lib. or 2.5 kg of a conventional diet plus ad lib. soaked, unmolassed, sugar beet pulp (Hodgkiss 1998).



STRAW BEDDING PREFERRED

There is no doubt that ESF systems work best in conjunction with bedded lying areas. Given ample bedding the sows are able to adjust their thermal environment. In some Northern European countries sows are housed in relatively low cost buildings with little environmental control (Svendsen *et al.* 1992a). In such circumstances straw bedding is essential in order to maintain an acceptable environment. The provision of straw bedding may also reduce the nutritional requirement of the sow (Simmins *et al.* 1994). This is less likely to be through a contribution to energy supply but through a reduction in energy loss. Ideally, the housing system should provide a variety of opportunities for the sow to modify her thermal environment. Straw bedding is of great benefit in this respect. Operators with straw bedded systems will point out that the size of the area that the sows designate for sleeping varies greatly with the time of the year and the thermal environment. In cold weather a relatively small surface area is utilised and the sows huddle together for warmth. A good depth of straw is advisable under such conditions so that the sows can bury themselves in it when very cold or form it into nests. This reduces ground level air movement and dramatically reduces the heat loss of the sow. In hot conditions the sows only need sufficient straw to make the floor surface comfortable. Sows in such straw bedded systems are very much less prone to developing the pressure sores, which are found on sows which are permanently housed on bare concrete.

However, this does not mean that the sows need to be maintained in an area, which is completely covered with straw. On the contrary, this actually reduces the sow's capability to control her temperature. In our system, we have observed that sows will often chose to lie on bare concrete when the ambient temperature is high in order to increase body heat loss. To deny them this opportunity would reduce their freedom to choose an appropriate temperature. In our system, the sows also have the use of a small paddock when the weather is good. Naturally, like sows kept outdoors all the year round such sows can suffer from sunburn if not provided with a wallow. The wallow not only affords them some protection from sunburn but also it provides the sows with another opportunity to adjust their body temperature. Sows that are not allowed to go out and wallow could become overheated in hot weather. Behaviourally, they attempt to overcome this problem by wallowing in the dunging area. This is not desirable from a health point of view. This problem can be overcome by incorporating a sow-operated shower into the design of an ESF system to provide a clean cooling system for the sows, which doesn't adversely affect the rest of the environment.

Activities related to the straw enrich the environment of the sow and provide them with the opportunity to perform a wide range of behavioural activities. The new EU welfare regulation has accepted that pigs are intelligent and investigative animals and that their housing frequently provides no outlet for these behavioural needs. Consequently, they have included in the regulations a requirement that:

> *To enable proper investigation and manipulation activities, all pigs must have permanent access to a sufficient quantity of material such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such which does not adversely affect the health of the animals.*

The 2003, UK, Pig Welfare Code adds that:

> *Environmental enrichment provides pigs with the opportunity to root, investigate, chew and play. Straw is an excellent material for environmental enrichment as it can satisfy many of the pigs' behavioural and physical needs. It provides a fibrous material which the pig can eat; the pig is able to root in and play with long straw; and, when used as bedding, straw can provide the pig with physical and thermal comfort.*
>
> *Objects such as footballs and chains can satisfy some of the pigs' behavioural needs, but can quickly lose their novelty factor. The long-term use of such items is not, therefore, recommended unless they are used in conjunction with materials such as those listed above, or are changed on a weekly basis.*

SYSTEMS WITHOUT STRAW

There is no doubt that ESF systems work best when combined with straw bedding. However, will they work without straw? In the author's view they can, but they do not work as well and can severely compromise the sow's welfare. Commercial systems that operate well without straw all have one common feature, namely, the sows have access to some bulk material, or feed, on a regular basis. Providing straw for consumption and / or entertainment from a hayrack, rather than bedding the sows on it, seems to be quite effective. On other units sows have been given grass or maize silage in addition to their compound diet. As indicated above, operating a group housing system with conventional diets, in a barren environment will not satisfy either the feeding or investigative behaviour of the sow.

CONCLUSIONS

Changing sows from confinement to group housing of sows poses many problems for the producer. Containment in stalls has allowed us to impose unacceptable constraints on the sow's activity and behaviour and to ignore the fact that we are denying her a number of the Five Freedoms. Group housing does not in itself solve all the problems of animal welfare. Indeed, if the housing and feed management of the sow is inadequate, welfare may be compromised every bit as much in a group housing system. However, this should not be used as an excuse for retaining stall housing. Group housing can work extremely effectively.

The greatest challenge for the industry is to identify, train and retain stockpersons who can operate and manage loose housing systems effectively. Those working with group-housed sows need a detailed understanding of animal behaviour, highly developed perceptual skills, initiative and an empathy with their animals. The industry needs a new generation of stockpersons who are proud to be practitioners of good 'husbandry', although they may now see themselves as practitioners of 'applied animal ethology'!

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APPENDIX 1

Council Directive 2001/88/EC and Commission Directive 2001/93/EC, which were adopted in October 2001 amend Directive 91/630/EC, which lays down minimum standards for the welfare of pigs. The Directives came into effect in all Member States on 1 January 2003. They have been implemented in England through the Welfare of Farmed Animals (England) (Amendment) Regulations 2003 (S.I. 2003 No. 299) which came into force on 14 February 2003.

Relevant Sections Of The Welfare Of Farmed Animals (England) (Amendment) Regulations 2003

Tethering

4. No person shall tether or cause to be tethered any pig except while it is undergoing any examination, test, treatment or operation carried out for any veterinary purpose.

Accommodation

6(1) A pig shall be free to turn round without difficulty at all times.

6(2) The accommodation used for pigs shall be constructed in such a way as to allow each pig to -

- (a) stand up, lie down and rest without difficulty;
- (b) have a clean, comfortable and adequately drained place in which it can rest;
- (c) see other pigs, unless the pig is isolated for veterinary reasons;
- (d) maintain a comfortable temperature; and
- (e) have enough space to allow all the animals to lie down at the same time.

7(1) The dimension of any stall or pen used for holding individual pigs in accordance with these regulations shall be such that the internal area is not less than the square of the length of the pig, and no internal side is less than 75% of the length of the pig, the length of the pig in each case being measured from the tip of its snout to the base of its tail while it is standing with its back straight.

7(2) Paragraph 7(1) shall not apply to a female pig for the period between seven days before the predicted day of her farrowing and the day on which the weaning of her piglets (including any piglets fostered by her) is complete.

Artificially lit buildings

8. Where pigs are kept in an artificially lit building then lighting with an intensity of at least 40 lux shall be provided for a minimum period of 8 hours per day subject to paragraph 16 of Schedule 1 to these Regulations.

Bedding

11. Where bedding is provided, this must be clean, dry and not harmful to the pigs.

Floors

12. Where pigs are kept in a building, floors shall -

- (a) be smooth but not slippery so as to prevent injury to the pigs;
- (b) be so designed, constructed and maintained as not to cause injury or suffering to pigs standing or lying on them;

(c) be suitable for the size and weight of the pigs; and
(d) where no litter is provided, form a rigid, even and stable surface.

13. When concrete slatted floors are used for pigs kept in groups the maximum width of the openings must be….
(d) 20 mm for gilts after service and sows.

Feeding

14. (1) All pigs must be fed at least once a day.
(2) Where pigs are housed in a group and do not have continuous access to feed, or are not fed by an automatic feeding system feeding the animals individually, each pig must have access to the food at the same time as the others in the feeding group.

Drinking water

15. All pigs over two weeks of age must have permanent access to a sufficient quantity of fresh drinking water.

Environmental enrichment

16. To enable proper investigation and manipulation activities, all pigs must have permanent access to a sufficient quantity of material such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such which does not adversely affect the health of the animals.

Noise levels

18. Pigs shall not be exposed to constant or sudden noise. Noise levels above 85 dBA shall be avoided in that part of any building where pigs are kept.

Group housing

36. Sows and gilts shall be kept in groups except during the period between seven days before the predicted day of farrowing and the day on which the weaning of piglets (including any piglets fostered) is complete.
37. The pen where the group is kept must have sides greater than 2.8 m in length, except when there are less than 6 individuals in the group, when the sides of the pen must be no less than 2.4 m in length.
38. The total unobstructed floor area available to each gilt after service and to each sow when gilts and/or sows are kept in groups must be at least 1.64 m^2 and 2.25 m^2 respectively. When these animals are kept in groups of less than 6 individuals the unobstructed floor area must be increased by 10%. When these animals are kept in groups of 40 or more individuals the unobstructed floor area may be decreased by 10%.
39. For gilts after service and pregnant sows a part of the area required in paragraph 38 equal to at least 0.95 m^2 per gilt and at least 1.3 m^2 per sow must be of continuous solid floor of which a maximum of 15% is reserved for drainage openings.
40. Sows and gilts kept on holdings of fewer than 10 sows may be kept individually provided that their accommodation complies with the requirements of paragraphs 6 & 7.
41. In addition to the requirements of paragraph 14, sows and gilts must be fed using a system which ensures that each individual can obtain sufficient food even when competitors for the food are present.
42. All dry pregnant sows and gilts must be given a sufficient quantity of bulky or high fibre food as well as high energy food to satisfy their hunger and need to chew.